

# Agriculture Development Towards Sustainability

## Editors

**Riswan M,  
Dr. Prasanna Srinivas.R,  
Rajesh KR., Abhay,  
Santosh P. Mane**



**Jyotikiran Publication, Pune**  
For the Success Choose the Best

**Jyotikiran Publications, Pune**  
**International Publication**

<b>Title</b>	: Agriculture Development Towards Sustainability
<b>Editor Name</b>	: Riswan M, Dr. Prasanna Srinivas.R, Rajesh KR. Abhay, Santosh P. Mane
<b>Publishing Agency</b>	: Jyotikiran Publication, Pune
<b>Publisher Address</b>	:Santosh Pandurang Mane Sr. No. 204, Sahajeevan Society, Bhekrinagar, Hadpsar, Pune-8 Mob- 8888454089 Email- <a href="mailto:jyotikiranpublicationpune@gmail.com">jyotikiranpublicationpune@gmail.com</a>
<b>Printed By</b>	:Amitsons Digital Copier 106, Paras Chamber, 1st Floor, Above Bank Of India, Near Laxminarayan Theatre, Swargate, Pune- 411009
<b>Edition Details</b>	:I <sup>st</sup>
<b>ISBN</b>	: 978-93-94819-16-0
<b>Copyright</b>	: © Santosh P Mane
<b>Publication Date</b>	: 30/11/2022

## Editors

Editor	
<b>RISWAN M</b> Senior Lecturer, Department of Sociology, South Eastern University of Sri Lanka, Sri Lanka	
<b>Dr. PRASANNA SRINIVAS.R</b> Assistant Professor, Department of Microbiology M.S.Ramaiah College of Arts, Science and Commerce, M S R Nagar, Bengaluru, Karnataka, India	<b>RAJESH KR. ABHAY</b> Assistant Professor Department of Geography, Dyal Singh College, University of Delhi, New Delhi 110 003 (India) Alternate
<b>SANTOSH P. MANE</b> Assistant Professor, IQAC Coordinator & Head Department of Geography, Sameer Gandhi Kala Mahavidyalaya (Commerce & Science College) Malshiras, Solapur, Maharashtra-713107, India	

### Co-Editors –

- ❖ **Dr. K. C. Ramotra**, Professor, Former Head Department of Geography, Shivaji University, Kolhapur, Maharashtra, India
- ❖ **Dr. sunanda I.Kittali**, Department of Geography, Rani Parvati Devi College of Arts and Commerce, Belagavi, Karnataka
- ❖ **Dr. Hari Om Bhardwaj**, Principal, Syadwad Institute of Higher Education and Research, River Park, Saharanpur - Delhi
- ❖ **Dr. Sachin Kantilal Pise**, H.O.D., Department of Geography, Annasaheb Vartak College, Vasai Road West, Palghar
- ❖ **Prof. Dipak Kolu Valvi**, H.O.D, Department of History, Annasaheb Vartak College, Vasai Road West, Palghar

### Advisory Board –

- ❖ **Dr. N. V. Pashankar**, Assistant Professor, Dept. of Commerce, Maharashtra Mahavidyalaya, Nilanga, Maharashtra Mahavidyalaya, Nilanga Dist-Latur, Maharashtra
- ❖ **Dr. Dattatray S. Dhawale**, Scientist, Qatar Environment and Energy Research Institute, Hamad Bin Khalifa University, Qatar
- ❖ **Neeshi Heeroo-Luximon**, Lecturer in Marathi, Mahatma Gandhi Institute, Marathi Department, School of Indian Studies, Mauritius
- ❖ **Dr. Sunil Madhukar Gawade**, National Petroleum Construction Company, Abu Dhabi Hydrographic Data Processor
- ❖ **Dr. M. Maksudur Rahman**, Professor, Department of Geography & Environment, Faculty of Earth and Environmental Sciences, Bangladesh

### Review Committee –

- ❖ **Dr. Asit Panda**, HOD & Assistant Professor, Dept. of English (UG & PG), Belda College, Vidyasagar University, West Bengal
- ❖ **Dr. Caroline David**, HoD of Economics & FC Department, DTSS College of Commerce, Malad East.

### Published by –

**Jyotikiran Publication, Pune,**

**Publisher**, Santosh Pandurang Mane, Sr. No. 204, Sahajeevan Society, Bhekrinagar, Hadpsar, Pune-8, Mob-8888454089

Email- [jyotikiranpublicationpune@gmail.com](mailto:jyotikiranpublicationpune@gmail.com)

Web- <http://jkpublications.com/>

**CONTENTS**

<b>Sr No</b>	<b>Paper Title</b>	<b>Page No.</b>
1	Agricultural Marketing In India <b>Dr.Maneesh.B</b>	1-3
2	Role of Women and Employment In Agriculture Sector <b>Dr. Ulhas Ramji Rathod</b>	4-6
3	Green Revolution and Its Impact on Indian Agriculture <b>Dr.Mogalappa</b>	7-9
4	Changes in crude fiber in mutants of Cluster bean (Cyamopsis tetragonoloba L. (Taub.) induced by chemical and physical mutagens. <b>Sunita Bhosle</b>	10-15
5	Ethnobotanical Survey Of Medicinal Plants Used To Cure Skin Diseases <b>Priyanka Ingle, Madhuri Pawar</b>	16-17
6	Diseases of chili and their management <b>Rahul singh Raghuvanshi, Dr. Subhash Chandra</b>	18-23
7	Review on Effects of different fertilizer treatments on growth and yield of various crops <b>Mangesh M. Vedpathak, and Balbhim L. Chavan</b>	24-32
8	Challenges and Strategies for Sustainable Agriculture in India. <b>Dr. Sucheta Y. Naik</b>	33-36
9	Organic Farming: Best Alternative Towards Sustainability <b>Dr. Manisha A. Mahatale, Dr. Ashish K. Mahatale</b>	37-42
10	Agricultural Laws in India: An Analysis <b>Dr. Asha R. Tiwari</b>	43-45
11	Challenge to Indian Agriculture : Land Fragmentation – Causes, Its Implications and Remedies <b>Prof. Yuvraj Pandharinath Jadhav</b>	46-49
12	Use of non-conventional methods for the extraction of value-added products from citrus waste <b>Mr. Ghadge Amit Babasaheb</b>	50-54
13	Agriculture of India: A SWOT Analysis <b>Dr. Nitinkumar M. Patil, Ranjana Mhalgi</b>	55-58
14	Agro-Based Industries: The Backbone of Rural Development <b>Dr.Gayatri S, Tiwari</b>	59-62
15	Issues, Challenges and Prospects of Indian Agriculture <b>Mrs. Arpita Laddha</b>	63-66
16	Road To Revival Of Agro-Tourism Sector In India: Post Covid-19 Pandemic <b>Dr. Susan Alex</b>	67-72
17	Online-to-offline mode shifting of Agricultural Products: E-commerce becoming New Retail for Agri-Products. <b>Rachna Ashish Rathi</b>	73-77
18	Nanotechnology a tool for Sustainable Agriculture against stress: An assessment <b>Indra Jeet Chaudhary, and Mangesh M. Vedpathak</b>	78-87
19	Significance of Legal Framework for Sustainable Agriculture in India <b>Arafatali Saiyed, Akil ali Saiyed</b>	88-91
20	Organic Farming: A Way of Sustainable Agriculture in India <b>Dr. S. H. Kadekar</b>	92-94
21	Agricultural development is the backbone of the economy! <b>Dr. Prakash Laxmanrao Dompale</b>	95-99
22	Impact of Technology on Agriculture: A Brief Study <b>Dr. Vanmala R. Tadvi</b>	100-102
23	Aquaculture and Apiculture <b>Dr. Vaishali S. Panchwate ( Tinkhede )</b>	103-110
24	Health Conditions Of Elderly People: A Sociological Study <b>Rajnikant Chandrappa, Dr. Shanta B. Astige</b>	111-117
25	देशाच्या आर्थिक विकासात कृषी व्यवसायाची भूमिका <b>प्रा. डॉ. जे. एस. सवाईथूल</b>	118-123



# *Agriculture Development towards Sustainability*

ISBN: 978-93-94819-16-0

Pub. Date: 30 Nov. 2022

Volume: I

26	The Role Of Water Resource Management In Agriculture Sustainability <b>Dr.Nagde Daivashala Shivaji</b>	124-125
27	शेती व्यवसाय समोरील प्रमुख समस्या व उपाय योजना:- <b>डॉ. अंभुरे एस. डी.</b>	126-128
28	Environmental Friendly Impact Of Jute And Related Problems With Jute Retting Process In Nadia District , West Bengal <b>Dr. Ranjita Roy Sarkar</b>	129-132
29	Significance of Legal Framework for Sustainable Agriculture in India <b>Arafatali Saiyed and Akil ali Saiyed</b>	133-136
30	Sustainable Agricultural Growth in India -Issues and Challenges <b>Dr Beenu Singh</b>	137-145
31	जागतिकीकरणाचा भारताच्या शाश्वत शेती विकासावर प्रतिकूल परिणाम - एक भौगोलिक अभ्यास” <b>प्रा. डॉ. गायकवाड सुभाष माणिकराव</b>	146-149
32	Challenges of Agricultural Development in India <b>Dr. Nitinkumar M. Patil and Dr. Babasaheb K. Wani</b>	150-154

**Agricultural Marketing In India**

**Dr.Maneesh.B**

Assistant Professor Department of Economics MMNSS College, Kottiyam, Kollam

**Corresponding Author- Dr.Maneesh.B**

Email- [manbpillai@gmail.com](mailto:manbpillai@gmail.com)

DOI- 10.5281/zenodo.7476088

**Abstract:**

One of the chief causes of the poverty of Indian cultivator is defective organization for the marketing of his produce. The cultivator does not get the full value for even the little produce that he is able to raise. This is because of several defects, such as lack of transport and storage facilities, inadequacy of regulated markets, malpractice in the 'mandis', lack of market information, indifferent quality of produce offered for sale, inadequate grading facilities, etc. so long as these defects are not removed, it will not be possible to improve the economic condition of our agricultural masses. This article suggests measures for better agricultural marketing. Briefly, this research article sheds lights on the flaws in Indian agricultural marketing and the solutions to them.

**Key words: Agricultural marketing – regulated market- 'mandis'**

**Introduction**

The term agricultural marketing is composed of two words- Agriculture and Marketing. Agriculture, in the broadest sense, means growing or raising crops and livestock. Marketing connotes a series of activities involved in moving the goods from the point of production to the point of consumption. It includes all the activities involved in the creation of time, place, form and possession utility. The study of agriculture marketing comprises all the operations, and the agencies conducting them, involved in the movement of farm produced foods, raw-materials and their derivatives. In India, there are several government organizations, who are involved in agricultural marketing like, Commission for Agricultural Costs and Prices, Food Corporation of India, Cotton Corporation of India, Jute Corporation of India etc.

**The Major problems and challenges in Indian Agricultural Marketing:**

**1. Large number of Intermediaries:**

This is one of the biggest flaws in Indian agricultural marketing. This type of marketing of food grains or vegetables has a large number of intermediaries. Due to this intermediary, the farmer grower is not getting a fair price but on the other hand he is being exploited financially as he is being charged more by the consumer. In the true sense of the word, a farmer works hard in the field, so he must get a fair price for his produce. Not only that, but the large number of such intermediaries should be eliminated

to stop the financial exploitation of the consumer. For this, a government intermediary should be appointed in the agricultural marketing system and through him the task of buying and selling should be completed.

**2. Faulty weight loss:**

Faulty weights and scales are also considered a major flaw in agricultural marketing. Even today, traditional weight scales exist in the rural areas. In some places, bricks are used as weight. This type of weight does not give the exact weight of the crop. As a result, it is clear that fraud is taking place. Some merchants even set aside weights to buy and sell and cheat out of it. Even though there is a policy at the government level to control the faulty weight scales, it is still evident that the government has not had full success in this regard.

**3. Inadequate facilities of Transport and Communication:**

The means of transport and communication are inadequately developed and defective. The country is very backward in respect of both roads and railways. Thousands of villages lie at a considerable distance from the main roads. The villages are connected with the 'mandis' by roads, most of which are tracks, become unusable during the rains.

**4. Lack of storage facilities in the village:**

The farmer does not possess good storage facilities. The only storage available in the village is earthen vessels or the kaccha rooms of the villagers. The indigenous method of

## ***Agriculture Development towards Sustainability***

storage expose the produce to white ants, rats, dampness, etc. and results in considerable loss. The cultivator is thus obliged to sell the produce immediately after harvesting. He gets a much lower price on account of selling in a market which is already glutted.

### **5. Lack of financial resources:**

Agricultural marketing also includes financial resources. The scarcity of capital makes it difficult for farmers to produce agricultural produce. From sowing in the field to taking it to the market, timely and sufficient capital is required. However, even today, many farmers are unable to produce in the field due to insufficient and timely availability of capital. Therefore, the government should pay full attention to the timely and adequate availability of capital to the farmers.

### **6. Lack of Standardization and Grading:**

In order to get good prices for agricultural commodities in the market, it is necessary to standardize and grade those commodities. At the same time, due to lack of proper standardization and grading, consumers face many difficulties in purchasing the product. Even today many farmers in India are illiterate and even educated farmers do not know how to do proper standardization and grading. For this, if the government appoints a working group and imparts practical knowledge about it to all the farmers at home, then in a short time a quality work will be completed. This will give a big impetus to the farmers to produce agricultural produce.

### **7. Lack of organization:**

There are small and big farmers in India. Such farmers lack collective organization. Marketable goods are brought to the market by small farmers for sale. But unless the farmers themselves learn the method of marketing or co-operate for it, they can never make a good deal with the buyers of their produce. Of course, farmers need to unite because farmers are not getting good prices for their produce.

### **Measures to Improve Agricultural Marketing in India**

#### **1. Establishment of Regulated Markets:**

To remove the disabilities of the farmers

in the 'mandi', it is necessary to have regulated markets all over the country. A regulated market ensures the removal of serious malpractices which obtain in the 'mandi' and contribute a lot in enabling the farmers to get reasonable price for their produce. These markets are generally characterized by a system of competitive buying which is beneficial to the farmer who can sell at the maximum available price. Such markets are managed by market committees on which nominees of growers, traders, local bodies and the State Government are represented.

#### **2. Grading and Standardization:**

Grading of agricultural produce facilitates its marketing. In order to secure the grading of agricultural products, the Government passed the Agricultural Produce Grading and Marketing Act in 1937. By now grading standards have been laid for over 163 agricultural and allied commodities under this Act.

#### **3. Storage Facilities:**

An extension of storage facilities at the farm land and warehousing corporation with a view to constructing and managing a whole network of warehouses in all towns and 'mandis'. The cooperative societies get necessary financial and technical assistance from the government for promoting warehouses in villages.

#### **4. Credit:**

Steps may be taken to provide cheap credit to farmers, especially from institutional sources like commercial banks and cooperative credit societies to farmers with a view to improving their economic conditions and protecting them from the exploitative practices of village money lenders and for helping them to get reasonable prices for their produce.

#### **5. Transport Facilities:**

Expansion of transport facilities between the village and 'mandis' seem to be the need of the hour. Rural transport has been five year plans and quite some progress has been made in this direction.

#### **6. Cooperative Marketing:**

To eliminate the vicious circle of middlemen, a direct link must be established between agriculturists and consumers. The object can be achieved through the establishment of co-

operative basis. This society arranges to sell the product of the members only on a nominal commission. Such a society is of great advantage to the cultivators. It substitutes collective bargaining for individual bargaining and thus assures the cultivators a fair price. It can also build warehouses, advance loans to its members against their crops and arrange efficient and cheap transport. Co-operative marketing societies thus remove many of the defects from which marketing of agricultural produce suffers. They reduce the number of middlemen. They offer expert advice and provide finance to small producers. The consumer is also benefitted by these societies.

**Conclusion:**

Improving agricultural marketing in India is a matter of urgency. Although government has taken strategic steps to improve the situation, the existence of intermediaries or brokers in the sale and purchase of agricultural commodities is still widespread. At present, agricultural marketing markets exist only at the taluk level, i.e., in urban areas. Such markets are rare in rural areas. Therefore, if the government takes immediate action on the situation, the marketing issues that have arisen will quickly disappear. The government should check its policies and rules to strengthen the marketing network.

**References:**

1. Agrawal A.N., Indian Economy Problems of Development and Planning, New Age International Publishers, New Delhi.
2. Acharya S.S. Agarwal N.L. (2010), Agriculture Marketing in India, New Delhi, Oxford and IBH Publishing Co.Pvt Ltd.
3. Datt and Sundaram, Indian Economy, S.Chand Publication, New Delhi.
4. Puri V.K and S K Mishra (2021), Indian Economy, 39<sup>th</sup> Revised Edition.

**Role of Women and Employment in Agriculture Sector**

**Dr. Ulhas Ramji Rathod**

Narayanarao Kale Smruti Model College Karanja(Gha.), Dist. Wardha

Corresponding Author- **Dr. Ulhas Ramji Rathod**

Email- [dr.ulhas\\_rathod@rediffmail.com](mailto:dr.ulhas_rathod@rediffmail.com)

DOI-10.5281/zenodo.7476097

---

**Introduction**

In India, 48.53% of the total population is female and 51.47% is male, while in Maharashtra, 48.17% of the total population is female and 51.83% is male. If we consider the agricultural laborers, 1.72 crore agricultural laborers in 1901, 2.40 crore agricultural laborers in 1911, 1.96 crore agricultural laborers in 1921, 2.21 crore agricultural laborers in 1931, 2.75 crore agricultural laborers in 1951, 3.15 crore agricultural laborers in 1971, 4.75 crore agricultural laborers in 1981. , there were 7.50 crore farm laborers in 1991, 8.30 crore farm laborers in 2001, 11.43 crore farm laborers in 2011. A review of the farm labor force over 110 years shows that the number of farm laborers has continued to increase, only to see a decline in 1921, as epidemics and disease decimated the population during that decade. In 2013-14, share of agriculture sector was 17% in Lakh, while employment was nearly 50%. The share of agricultural exports in total exports was 18.5% in 1990-91 and 14.2% in 2014-15. As the mainstay of rural economy is mainly agriculture, rural development is dependent on agricultural development. Agriculture sector needs to be developed for sustainable village development. Also, just as rural development is dependent on agricultural development; agricultural development is also dependent on many factors. The main factor in this is labor. The contribution of agricultural workers, especially women workers, in agricultural development is significant. Women's participation in agriculture is evident since ancient times, the place of women in the rural agrarian economy is very important. Women in the rural areas are the mainstay of agriculture and without their cooperation the agriculture sector cannot be completed. Basically, women have invented the agricultural business and since ancient times, the proportion of women in the agricultural business is high. They work as farmers and farm laborers in agriculture, and also do domestic work, which means that women in rural areas work almost 16 hours a day. Women in rural areas do household work such as sowing, harvesting, threshing etc. in agricultural work.

India is a developing country. Rural economy is very important in this country. As the livelihood of nearly 70 % of the people is agriculture and allied industries, agriculture plays an important role in India's economic development. The share of agriculture sector in 1950-51 was 56.5%, in 1960-61 the share of agriculture sector was 52.13%, in 1970-71 the share of agriculture sector was 45.77%, in 1980-81 the share of agriculture sector was 39.6%, in 1990-91 the share of agriculture sector was 32.91%, The share of agricultural sector in 2000-01 was 26.1%, in 1910-11 the share of agricultural sector was 14.2%, in 1911-12 the share of agricultural sector was 18.3%, in 1912-13 the share of agricultural sector was 16.3%, in 1914-15 the share of agricultural sector was 15.08%, was Although the share of agriculture sector in national income is decreasing, the rate of growth of national income is dependent on the rate of growth of agricultural income. According to the 2011 census, 68.9% of the

total population in India lives in rural areas, 54.8% of the population in Maharashtra lives in rural areas.

**Research Methodology-**

Secondary materials were used. In this, economic survey of Maharashtra, economic review, census report, human development index report, reference books, newspapers, magazines, internet were used and on that basis this research essay is being presented through descriptive method.

**Objectives-**

A study of employment trends, nature of work and remuneration of women in agriculture sector.

To study the problems of women in agriculture.

Finding solutions to solve the problems of women in agriculture.

**Assumption-**

The proportion of women is more than men in agriculture



The remuneration of work is low and there is inequality.

Women face many problems.

## **Nature of his work-**

Cleaning cowsheds, milking, feeding animals, weeding, planting, sowing, weeding, harvesting etc. are all done by women. Also, the participation rate of women is high in businesses that are complementary to agriculture. E.g. Women are also seen to be involved in dairying, sericulture, poultry farming, fisheries, goat rearing, sheep rearing. A large number of women workers are also seen in agricultural marketing and small scale industries.

Agricultural marketing and small scale industries also see a majority of women workers. Also, in some places, it is seen that women are active in financial planning with the help of self-help groups. It can be seen that agriculture was basically invented through women. Also, this business is mostly based on women's labor. While clarifying the contribution of women in agriculture, the survey report of the International Labor Organization shows that 50 percent of women are involved in food grain production and 100% of women are involved in the agricultural production process. At the same time, the participation of women in the dairy business as a supplementary business is seen to be very large. In modern times, there has been a change in the nature of agriculture business, and due to increase in production due to technology and green revolution, the stress of agricultural work on women is seen to be reduced and thereby saving a lot of their time.

## **Contribution of women in agriculture sector-**

In India, the agriculture sector is considered as the backbone of the economy. Agricultural business is generally done in rural areas and although the use of technology has increased in modern times, the importance of women in agriculture does not decrease. According to Census 2011 in India, 12.78% of agricultural land is owned by women, and as they do not have special rights in the decision-making process, their role remains as a supporter to men in this field. 65% of agricultural work is dependent

on women. According to a report by the World Food and Agriculture Organization, women contribute 32% to agriculture, while women contribute 48% to agricultural employment. Also, contribution of women is more than men in North Eastern region, Pahadi region, and Kerala state. In rural areas, the percentage of women dependent on agriculture is 84%, of which 33% are female farmers and 47% are female agricultural laborers. According to the Economic Survey Report 2018, the agricultural sector is becoming a women's field due to the migration of men to urban areas. According to the 2011 census report, 55% of the total women are agricultural laborers and 24% are female farmers. About 7.5 crore women are engaged in poultry and animal husbandry. Women account for 20 to 30% of agricultural production. According to India Census Report 2011 the total number of women laborers was 149.8 lakhs. Out of a total of 149.8 lakh women workers, 35.9 lakh women are in cultivation sector while 61.5 lakh are agricultural laborers, 8.5 lakh are women in domestic industry and 43.7 lakh are classified as other workers. Regarding the employment of women in Maharashtra, according to the census of 2011, the total number of women workers was 1 crore 68 lakh 11 thousand, of which 49 lakh 77 thousand were farmers, 67 lakh 11 thousand were agricultural laborers, 53 lakh 5 thousand were working in the domestic sector, and 45 lakh were working in other service sectors. 68 thousand women participated. Out of the total number of female workers in agriculture, the proportion of female agricultural workers is higher. Women are constantly involved in all the activities from tillage of the farm land to the handing of the product. At the same time, women also play an important role in household work.

## **Characteristics of women agricultural workers-**

1. Lack of education among agricultural women in India.
2. Precarity of work.
3. Women working in the agricultural sector are unorganized, because the agricultural sector is also unorganized.

4. Remuneration of women in agriculture sector is less than other sectors.

5. Lack of artistic quality is seen in women in agricultural sector.

Problems of women in agriculture sector-

Due to the male dominated culture, it is seen that women in the agricultural sector have less importance in economic, social and political work.

Women in this field are not particularly visible in the mainstream.

Women are paid almost 30 to 50% less wages than men and that too only in cash wages.

Women in this sector do not seem to have any ownership rights.

It is observed that women in this sector are identified as agricultural workers.

As it is a male dominated culture, the attitude towards women in this area is seen as childish and childlike.

Women do not seem to be participating in the mainstream.

Although many empowerment and empowerment schemes have been implemented for women, it is seen that women in remote areas are still deprived of their benefits.

Solution-

The status of entrepreneurs should be given to women in Purak business.

Ownership of land should be given to women and for that, if the land owner is a woman, she should be provided with more facilities and concessions.

Special emphasis should be given on gender equality.

Active activities should be implemented for the overall development of women, so that their economic, social and political status can be improved.

Separate schemes and policies for women should be designed and implemented efficiently in remote areas.

Employment opportunities should be created by creating women labor intensive lughu and cottage industries.

Women education should be promoted.

Emphasis should be placed on the development of agriculture sector.

A Fair Wages Act should be enacted to eliminate the disparity between the wages of female agricultural workers and male agricultural workers.

### **Conclusion-**

If women are given equal status, the number of women can be increased by increasing the production in the agricultural sector and the problems like hunger and malnutrition can be controlled. A second green revolution will happen if women are given priority in various schemes implemented by the government like organic farming, self-employment, Prime Minister's Skill Development Scheme etc. The contribution of women in development is unique. Therefore, the condition of women needs to be improved. In particular, the condition of women agricultural workers needs to be improved. For that, efforts should be made not only at the government level, but at the social level.

### **Reference List-**

1. PL Bhandarkar - Research Methods and Techniques
2. Dr. Sheikh Shabbir - Social Problems in India
3. Dr. Vijay Kavimandan - Agricultural Economics
4. Prof. B. L. Tongue, Dr. Sudhakar Shastri - Indian Economy
5. Dr. Sudhakar Shastri, Dr. Nitin Kawadkar - Indian Economy
6. Dr. G. N. Zamre - Indian Economics
7. Financial Review 2015-16
8. Financial Survey of Maharashtra 2017-18
9. Current letters
10. Internet usage

**Green Revolution and Its Impact on Indian Agriculture**

**Dr.Mogalappa**

Assistant professor Department of Economics Government Degree College,  
Yadagiri - Karnataka (India)

Corresponding Author- **Dr.Mogalappa**

Email- [dr.mogalappa@gmail.com](mailto:dr.mogalappa@gmail.com)

DOI-10.5281/zenodo.7476103

---

**Introduction**

The Green Revolution was an endeavour initiated by Norman Borlaug in the 1960s. He is known as the 'Father of Green Revolution' in world. It led to him winning the Nobel Peace Prize in 1970 for his work in developing High Yielding Varieties (HYVs) of wheat. In India, the Green Revolution was mainly led by M.S. Swaminathan. The Green Revolution resulted in a great increase in production of food grains (especially wheat and rice) due to the introduction into developing countries of new, high-yielding variety seeds, beginning in the mid-20th century. Its early dramatic successes were in Mexico and the Indian subcontinent. The Green Revolution, spreading over the period from 1967-68 to 1977-78, changed India's status from a food-deficient country to one of the world's leading agricultural nations. The state of Punjab led India's Green Revolution and earned the distinction of being the "bread basket of India" [1] [2]

M.S. Swaminathan, the main architect or the Father of the Green Revolution in India [3]

The main development was higher-yielding Varieties of wheat. [4]

Dilbagh Singh Athwal, is called the Father of wheat Revolution. [5]

The Green Revolution in India was first introduced in Punjab in the late 1966-67 as part of a development program issued by international donor agencies and the Government of India. [6]

---

**I. Objectives of Green Revolution:**

**Short Term:** The revolution was launched to address India's hunger crisis during the second Five Year Plan.

**Long Term:** The long term objectives included overall agriculture modernization based on rural development, industrial development; infrastructure, raw material etc.

**Employment:** To provide employment to both agricultural and industrial workers.

**Scientific Studies:** Producing stronger plants which could withstand extreme climates and diseases.

**Globalization of the Agricultural World:** By spreading technology to non-industrialized nations and setting up many corporations in major agricultural areas.

**II. Basic Elements of the Green Revolution:**

**Expansion of Farming Areas :** Although the area of land under cultivation was being increased from 1947 itself, this was not enough to meet the rising demand.

The Green Revolution provided assistance in this quantitative expansion of farmlands.

**Double-cropping System:** Double cropping was a primary feature of the Green

Revolution. The decision was made to have two crop seasons per year instead of just one. The one-season-per-year practice was based on the fact that there is only one rainy season annually. Water for the second phase now came from huge irrigation projects. Dams were built and other simple irrigation techniques were also adopted.

**Using seeds with improved genetics:** Using seeds with superior genetics was the scientific aspect of the Green Revolution.

The Indian Council for Agricultural Research developed new strains of high yield variety seeds, mainly wheat and rice, millet and corn.

**Important Crops in the Revolution:**

Main crops were Wheat, Rice, Jowar, bajra and Maize. Non-food grains were excluded from the ambit of the new strategy.

Wheat remained the mainstay of the Green Revolution for years.

**IV. Background of Green Revolution in India:**

In 1943, India suffered from the world's worst recorded food crisis; the Bengal Famine, which led to the death of approximately 4 million people in eastern India due to hunger. Even after independence in 1947, until 1967 the government largely



concentrated on expanding the farming areas. But the population was growing at a much faster rate than food production.

This called for an immediate and drastic action to increase yield. The action came in the form of the Green Revolution.

The green revolution in India refers to a period when Indian Agriculture was converted into an industrial system due to the adoption of modern methods and technology such as the use of HYV seeds, tractors, irrigation facilities, pesticides and fertilizers. It was funded by the US and the Indian Government and the Ford and Rockefeller Foundation.

The Green Revolution in India is largely the Wheat Revolution as the Wheat production increased by more than three times between 1967-68 and 2003-04, while the Overall increase in the production of cereals was only two times.

#### **V. (A) Positive Impacts of Green Revolution:**

**Tremendous Increase in Crop Produce:** It resulted in a grain output of 131 million tonnes in the year 1978-79 and established India as one of the world's biggest agricultural producers. The crop area under high yielding varieties of wheat and rice grew considerably during the Green Revolution.

**Reduced Import of Food-Grains:** India became self-sufficient in food-grains and had sufficient stock in the central pool, even, at times, India was in a position to export food-grains. The per capita net availability of food-grains has also increased.

**Benefits to the Farmers:** The introduction of the Green Revolution helped the farmers in raising their level of income.

Formers ploughed back their surplus income for improving agricultural productivity.

The big farmers with more than 10 hectares of land were particularly benefited by this revolution by investing large amounts of money in various inputs like HYV seeds, fertilizers, machines, etc. It also promoted capitalist farming.

**Industrial Growth:** The Revolution brought about large scale farm mechanization which created demand for different types of machines like tractors, harvesters, threshers, combines, diesel engines, electric motors, pumping sets, etc.

Besides, demand for chemical fertilizers, pesticides, insecticides, weedicides, etc. also increased considerably. Several agricultural products were also used as raw materials in various industries known as agro based industries.

**Rural Employment:** There was an appreciable increase in the demand for labour force due to multiple cropping and use of fertilizers.

The Green Revolution created plenty of jobs not only for agricultural workers but also industrial workers by creating related facilities such as factories and hydroelectric power stations.

#### **(B) Negative Impacts of Green Revolution**

**Non-Food Grains Left Out :** Although all food-grains including wheat, rice, jowar, bajra and maize have gained from the revolution, other crops such as coarse cereals, pulses and oilseeds were left out of the ambit of the revolution.

Major commercial crops like cotton, jute, tea and sugarcane were also left almost untouched by the Green Revolution.

**Limited Coverage of HYVP :** High Yielding Variety Programme (HYVP) was restricted to only five crops : Wheat, Rice, Jowar, Bajra Maize. Therefore, non-food grains were excluded from the ambit of the new strategy. The HYV seeds in the non-food crops were either not developed so far or they were not good enough for farmers to risk their adoption.

#### **Regional Disparities :**

Green Revolution technology has given birth to growing disparities in economic development at interregional and intra regional levels. It has so far affected only 40 percent of the total cropped area and 60 percent is still untouched by it. The most affected areas are Punjab, Haryana and western Uttar Pradesh in the north and Andhra Pradesh and Tamil Nadu in the south. It has hardly touched the Eastern region, including Assam, Bihar, West Bengal and Orissa and arid and semi-arid areas of Western and Southern India. The Green Revolution affected only those areas which were already better placed from an agricultural point of view. Thus the problem of regional disparities has further aggravated as a result of the Green Revolution.

**Excessive Usage of Chemicals :** The Green Revolution resulted in a large-scale use of pesticides and synthetic nitrogen fertilisers for improved irrigation projects and crop varieties.

However, little or no efforts were made to educate farmers about the high risk associated with the intensive use of pesticides. Pesticides were sprayed on crops usually by untrained farm labourers without following instructions or precautions.

This causes more harm than good to crops and also becomes a cause for environment and soil pollution.

**Water Consumption :** The crops introduced during the green revolution were water-intensive crops.

Most of these crops being cereals, required almost 50% of dietary water footprint.

Canal systems were introduced, and irrigation pumps also sucked out the groundwater to supply the water-intensive crops, such as sugarcane and rice, thus depleting the groundwater levels.

Punjab is a major wheat- and rice-cultivating area, and hence it is one of the highest water depleted regions in India.

**Impacts on Soil and Crop Production :** Repeated crop cycle in order to ensure increased crop production depleted the soil's nutrients.

To meet the needs of new kinds of seeds, farmers increased fertilizer usage.

The pH level of the soil increased due to the usage of these alkaline chemicals.

Toxic chemicals in the soil destroyed beneficial pathogens, which further led to the decline in the yield.

**Unemployment :** Except in Punjab, and to some extent in Haryana, farm mechanization under the Green Revolution created widespread unemployment among agricultural labourers in the rural areas.

The worst affected were the poor and the landless labourers.

**Health Hazards :** The large-scale use of chemical fertilizers and pesticides such as Phosphamidon, Methomyl, Phorate, Triazophos and Monocrotophos resulted in a number of critical health illnesses including cancer, renal failure, stillborn babies and birth defects.

## **VI. Conclusion:**

Overall, the Green Revolution was a major achievement for many developing countries, specially India and gave them an unprecedented level of national food security. It represented the successful adaptation and transfer of the same scientific revolution in agriculture that the industrial countries had already appropriated for themselves.

However, lesser heed was paid to factors other than ensuring food security such as environment, the poor farmers and their education about the know-how of such chemicals. As a way forward, the policymakers must target the poor more precisely to ensure that they receive greater direct benefits from new technologies and those technologies will also need to be more environmentally sustainable.

Also, taking lessons from the past, it must be ensured that such initiatives include all of the beneficiaries covering all the regions rather than sticking to a limited field.

## **References:**

1. Kumar, Manoj and Williams. 2009 January 29 " Punjab, bread basket of India, hungers for change" Reuters (Reuters Means Landon basic information Institution)
2. The Government of Punjab (2004). Human Development Report 2004, Punjab (PDF) (Report) . Archived 09 August 2011 . Section " The Green Revolution" , pp. 17-20.
3. Rudolf, John Collins (19 January 2010) " Father of India's Green Revolution says Nation is Threatened by Global warming" The New York Times. ISSN 0362-4331 Retrieved 3 December 2021.
4. About I A R I. (Indian Agricultural Research Institute) Retrieved. 11 June 2015.
5. " 'Father of wheat Revolution' DS Athwal passes away" Hindustan Times , 15 May 2017. Retrieved 3 December 2021.
6. Dutt, Swarup ( June 2012) . " Green Revolution Revisited:. The contemporary Agrarian Situation in Punjab, India" . Social change. 42(2): 229-247.
7. Website Source.

**Changes in crude fiber in mutants of Cluster bean {*Cyamopsis tetragonoloba* L. (Taub.) induced by chemical and physical mutagens.****Sunita Bhosle**

Balbhim College, Beed, Maharashtra

Corresponding Author- **Sunita Bhosle****Email-**[sunita.bhosle25@gmail.com](mailto:sunita.bhosle25@gmail.com)**DOI- 10.5281/zenodo.7476112****Abstract**

In the present study two varieties of Cluster bean, namely, Golden Early – 36 (GE-36) and Harit Rani (HR) were used to induce genetic variability. For present study physical mutagen like Gamma rays (5kR, 10kR and 15kR) and two chemical mutagens, namely, ethyl methanesulphonate (EMS) of different concentrations such as 0.05%, 0.10% and 0.15% and sodium azide (SA) of concentrations such as 0.01%, 0.02% and 0.03% were tried. Seeds from each treatment were sown in field following randomized block design (RBD) with three replications along with control as the M1 generation. Further two consequent generations were taken, M2 and M3 generations respectively. Different mutants were screened from both the varieties and they were further biochemically estimated. Crude fiber was estimated by Maynard (1970) method in all the eight mutants of two varieties. In variety GE-36, the highest value (61.31%) for crude fiber content was observed in large leaf, and the lowest value (58.00 %) for crude fiber content could be seen in the high yielding mutant. In variety HR, the highest value (70.20%) for the same parameter could be noted in long pod mutant and the lowest value (52.31%) has been observed in the dwarf mutant, which shows gradual difference in the content of fiber in both the control varieties ie in GE.36 it is 59.21% and in Harit Rani is 58.31%. Harit Rani mutant showed most promising result in increase in crude fiber content. It can be concluded that mutation breeding is one of important tool for enriching the biochemical properties.

**Key words:** Mutation breeding, Cluster breeding, Mutants, Crude fiber, Ethyl methyl sulphonate and sodium azide.

**Introduction**

The **guar** or **Lond bean**, with the botanical name *Cyamopsis tetragonoloba*, is an annual legume and the source of guar gum. It is also known as gavar, guwar, or guvar bean. The origin of *Cyamopsis tetragonoloba* is unknown, since it has never been found in the wild (Whistler R.L. and Hymowitz T. 1979). It is assumed to have developed from the African species *Cyamopsis senegalensis*. It was further domesticated in India and Pakistan, where it has been cultivated for centuries (Undersander D.J. et al 2012). Guar grows well in semiarid areas, but frequent rainfall is necessary. This legume is a valuable plant in a crop rotation cycle, as it lives in symbiosis with nitrogen-fixing bacteria (Undersander D.J. et al 2012). Agriculturists in semi-arid regions of Rajasthan follow crop-rotation and use guar to replenish the soil with essential fertilizers and nitrogen fixation, before the next crop. Guar has many functions for human and animal nutrition, but the gelling agent in its seeds (guar gum) are the most important

use (Mudgil D. et al. 2011). Demand is rising due to the use of guar gum in hydraulic fracturing (oil shale gas) (Mudgil D. et al. 2011). About 80% of world production occurs in India and Pakistan, but due to strong demand, the plant is being introduced elsewhere. Guar is grown principally in north-western India and Pakistan (Guar gum online 4) with smaller crops grown in the semiarid areas of the high plains of Texas in the US (Guar Production 2006). Australia and Africa. The most important growing area centres on Jodhpur in Rajasthan, India where demand for guar for fractionation produced an agricultural boom as in 2012. (Gardiner Harris July 16, 2012). Currently, India and Pakistan are the main producers of cluster bean, accounting for 80% production of the world's total, while Thar, Punjab Dry Areas in Pakistan and Rajasthan, Gujarat, Kutch region occupies the largest area (82.1%) under guar cultivation in India. In addition to its cultivation in India and Pakistan, the crop is also grown as a cash crop in other parts of the world. (Pathak, R. et al. 2010). Several commercial growers have

converted their crops to guar production to support the increasing demand for guar and other organic crops (Pathak R. 2011) in the United States.

Mutation breeding is built on mutation induction and mutation detection. Mutation induction coupled with selection remains the "cleanest" and most inexpensive way to create varieties by changing single characters without affecting the overall phenotype. Mutation induction involves the treatment of plant propagules with mutagens (chemical or physical). This is followed by selection for desirable changes in the resulting mutants. Breeders use mutation induction to broaden the genetic base of germplasm, and use the mutant lines directly as new varieties or as sources of new variation in breeding programs. Mutation breeding has many comparative advantages. It is cost effective, quick, proven and robust. In addition, mutation breeding is transferrable, ubiquitously applicable, non-hazardous and environmentally friendly. There are more than 3200 mutant varieties officially released for commercial use in more than 210 plant species from more than 70 countries, as referenced in the Mutant Varieties Database. The vast majority of released mutant varieties consist of cereals, followed by flowers and legumes.

#### **Dietary Fiber**

As indigestible complex carbohydrates, dietary fibers perform important biological functions, though they supply no calories or nutrients and are resistant to digestive enzymes. Dietary fiber comes from the walls of plant cells and includes cellulose, hemicellulose, lignin, pectin, mucilage and gum. Many food products list total fiber content in grams, which includes both soluble and insoluble fiber.

#### **Crude Fiber**

Crude fiber refers to one type of dietary fiber, the type that remains as residue after food receives a standardized laboratory treatment with dilute acid and alkali. The treatment dissolves all the soluble fiber and some of the insoluble fiber in a food. The residue or crude fiber is primarily composed of cellulose and lignin. Crude fiber is a nutritionally obsolete term, according to the National Research Council's Commission on Life Sciences.

Crude fiber measurements, the result of lab analysis, may underestimate the actual dietary fiber in a food item by 50 percent or more.

#### **Materials and methods**

The seed material of two varieties of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) namely, Golden Early 36 and Harit Rani obtained from Golden Seeds Pvt. Ltd, Bangalore, Karnataka and Navalakha Seeds Pvt. Ltd, Pune have been used in the present study.

#### **Mutagens Used:**

The chemical mutagens namely ethyl methane sulphonate (EMS) and sodium azide (SA) and physical mutagen Gamma rays were used in the present study.

#### **Details of Mutagenic Treatments:-**

To begin with the pilot experiments were conducted for determining the suitable concentrations/doses for further studies.

#### **Preparation of mutagenic solution:-**

The chemical mutagenic treatments were prepared at room temperature of  $25 \pm 2^\circ\text{C}$ . The fresh aqueous solutions of the mutagens were prepared prior to treatment.

#### **Treatment:**

Prior to chemical mutagenic treatments, seeds were immersed in distilled water for 6hrs. The presoaking enhances the rate of uptake of the mutagen through increase in cell permeability and also initiates metabolism in the seeds. Such presoaked seeds were later immersed in the mutagenic solution for 6hrs with regular shaking. Seeds soaked in distilled water for 6hrs served as control.

Three consequent generations were taken and observed M1, M2 and M3. Also during these three generations different morphological characters and biochemical parameters were observed and studied.

#### **Estimation of crude fibre:-**

The crude fibre estimation was carried out by the method given by Maynard (1970).

#### **Extraction of pod fibre:-**

Fine powder of oven dried pods was made and used as sample. 2g of dried sample was boiled with 200ml of 1.25%  $\text{H}_2\text{SO}_4$  for 3minutes. After boiling the solution was filtered through Whatman filter paper and washed with 200ml of 2.5% NaOH for 30

minutes. Again it was filtered through preweighed Whatman filter paper by washing the residue. It was again boiled with 100ml distilled water for 30minutes. The residue was filtered with preweighed Whatman filter paper with several washings with distilled water and lastly with 70% ethyl

### Results

The crude fibre content was estimated in the mutants of cluster bean varieties GE-36 and HR. In control of variety GE-36, the crude fibre content was 59.21% while in variety HR it was 58.31%. In GE-36, crude fibre content

alcohol. At last the residue was dried overnight at 100°C in oven. Crude fibre content was calculated by formula.

$$\% \text{ Crude fibre content} = \frac{\text{On ignition (gm)}}{\text{Weight of sample (gm)}} \times 100.$$

was increased in the large leaf mutant (61.39%) and dropped (56.5%) in small pod mutant. In variety HR the highest crude fibre content (70.20%) was demonstrated by the long pod mutant and the least (52.41%) by the dwarf mutant.

**Table 1: Crude fibre content in mutants of M3 generation in cluster bean variety GE-36.**

Sr, No.	Mutants	Crude fibre %
1	GE-36(Control)	59.21
2	Tall	59.25
3	Dwarf	60.25
4	Long pod	60.32
5	Small pod	56.5
6	Branched	61.28
7	Large leaf	61.39
8	Early flowering	58.06
9	High yielding	58.00

**Statistical analysis:**

Mean : 59.37

S.E: 0.53

S.D: 1.610

CD at 0.05= 1.22

CD at 0.01= 1.72

**Table 2: Crude fibre content in mutants of M3 generation in cluster bean variety HR.**

Sr, No.	Mutants	Crude fibre %
1	HR(Control)	58.31
2	Tall	54.23
3	Dwarf	52.41
4	Long pod	70.20



5	Small pod	64.31
6	Branched	69.33
7	Large leaf	62.20
8	Early flowering	58.31
9	High yielding	56.21

**Statistical analysis:**

Mean : 60.61

S.E: 20.5

S.D: 61.6

CD at 0.05= 22.8

CD at 0.01= 0.01

**Discussion and Conclusion**

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) (2n=14) is a drought tolerant annual multipurpose legume that was introduced for feed, green fodder, vegetable, green manuring and grain purposes. The endosperm of cluster bean contains galactomannan gum, which has several diversified industrial uses. India earns huge amount as foreign exchange from the export of its gum and its derivatives. Cluster bean left after the extraction of the gum contains about 45% proteins and forms a valuable proteinaceous raw material (Subramanian and Parpia, 1975).

Mutation breeding is an important tool for enriching variation in a crop like cluster bean where exploitable and useful genetic variability is very meager. The creation of genetic variability in this crop through the recombination of genes by hybridization is very difficult and cumbersome owing to small, delicate flower structures resulting in low percentage of crossed seed setting in the manually hybridized bud. Due to these reasons, not much desirable and usable genetic variability has been generated through conventional breeding approaches in cluster bean. Looking at the above limitation, efforts have been made during the present work to create more and purposeful variability in cluster bean by induced mutations.

The survey of related literature indicated that very little attention has been paid by the scientists of our country in regard to creation of useful variability through the

established method of induced mutation in cluster bean.

In the present study two varieties of cluster bean namely Golden Early – 36 (GE-36) and Harit Rani (HR) were used to induce genetic variability. For this study physical mutagen like Gamma rays (5kR, 10kR and 15kR doses) and two chemical mutagens, namely, ethyl methanesulphonate (EMS) of different concentrations such as 0.05%, 0.10% and 0.15% and sodium azide (SA) of concentrations such as 0.01%, 0.02% and 0.03% were tried. The chemical mutagenic treatments were given at room temperature  $25\pm 2^{\circ}\text{C}$ . Immediately after the completion of treatment, the seeds were washed thoroughly under tap water. Later on seeds with chemical mutagenic treatment were kept for post soaking in distilled water. The seeds which were given physical mutagenic treatment were sown in field immediately. For each treatment a batch of 300 presoaked seeds was used. 50 seeds from each treatment were dried between the folds of filter paper and germinated in petridishes to record germination percentage. The remaining 250 seeds from each treatment were sown in field following randomized block design (RBD) with three replications along with control as the M1 generation. The seeds were sown at a distance of 40cm between the plants and 60cm between the rows. Studies pertaining to mutation breeding of cluster bean were spread over three generations.

**Discussion****Mutagenic Studies:**

Mutation breeding has been employed as a tool to induce mutations at loci controlling economically important traits or for eliminating undesirable genes from the elite breeding lines (Lippert et al., 1964). In present investigation both physical and chemical mutagens were used to induce mutation. Observations recorded in present study revealed induction of broad genetic variability in case of cluster bean. Many crops with improved economic value have been obtained by using induced mutation (Broetjes 1988, BEAS 1995 and IAEA 1995). Besides the economic benefits, some mutants have also played important role in the study of genetics and plant development (Vanden et al., 1990 and Bretagne-Sgnard et al., 1996).

#### **Biochemical Studies:**

A relatively new aspect in applied mutagenesis has been the quantitative and qualitative alteration of seed storage substances like proteins, carbohydrates, fibers and other specific substances deposited in various parts of plants.

#### **Crude fiber content:**

In present study viable mutants have shown variation in content of crude fibre in both the varieties of cluster bean. The highest crude fiber was recorded in large leaf (61.39%) and long pod mutant (70.20 %) in the two varieties of cluster bean. Significant variation in TDF (Total dietary fibre) and SDF (Soluble dietary fibre) in cluster bean seeds indicated the possibility of genetic manipulation for these components. Although galactomannans, the predominant form of the soluble fibre in cluster bean, have most of the beneficial health effects in humans as the  $\beta$ -glucan soluble fibre found in oats and barley (Okubo et al., 1994, Golay et al., 1995, Anderson and Hanna 1999, Brown et al., 1999, Chandalia et al., 2000, Battilana et al., 2001, Meyer and Tunland 2001), the oats and barley generally contain less than 25% total fiber (da Silva and Ciocca 2005). Thus, cluster bean has a distinct advantage over cereal crops as a source of TDF and SDF due to the large amount of such factors present in its seeds. Significant variability in TDF and SDF content among *C tetragonoloba* accessions has been observed earlier. The magnitude of variability indicates the

possibility of improving the pertinent traits through plant breeding approaches (Kays et al., 2006).

#### **References**

1. **Whistler R.L. and Hymowitz T. 1979.** Guar: agronomy, production, industrial use and nutrition. Purdue University Press, West Lafayette.
2. **Mudgil, D.; Barak, S.; Khatkar, B. S. (2011).** "Guar gum: Processing, properties and food applications—A Review". Journal of Food Science and Technology. **51**: 409–18. doi:10.1007/s13197-011-0522-x. PMC 3931889. PMID 24587515.
3. **Undersander D.J., Putnam D.H., Kaminski A.R., Doll J.D., Oblinger E.S. and Gunsolus J.L. 1991.** Guar. University of Wisconsin-Madison, University of Minnesota [1] Accessed November 8, 2012.
4. **Guar Gum, Midwest Herbs**
5. **Vernon Agricultural Research & Extension Center, Texas A&M Univ. 2006.**
6. **Gardiner Harris (July 16, 2012).** "[In Tiny Bean, India's Dirt-Poor Farmers Strike Gas-Drilling Gold](#)". The New York Times. Retrieved July 17, 2012.
7. **Pathak, R.; Singh, S. K.; Singh, M.; Henry, A. (2010).** "Molecular assessment of genetic diversity in cluster bean (*Cyamopsis tetragonoloba*) genotypes". Journal of Genetics. **89** (2): 243–246. doi:10.1007/s12041-010-0033-y. PMID 20861578.
8. **Pathak, R.; Singh, M.; Henry, A. (2011).** "Genetic diversity and interrelationship among clusterbean (*Cyamopsis tetragonoloba*) for qualitative traits". Indian Journal of Agricultural Sciences. **81** (5): 402–406
9. **Subramanian N. and Parpia H. A. B. (1975):** Protein Calorie Advisory group Compendium. D. pp 215.
10. **Lippert L.F., Bergh B.O. and Cook A.A. (1964):** Three variegated seedling mutants in the pepper. J Hered., **55**:78-93.
11. **Broetjes C. and Van Harten A. M. (1988):** Applied mutation breeding for vegetatively propagated crops. Elsevier, New York: pp.1-345.

***Agriculture Development towards Sustainability***

12. **Vanden Bulk R. W., Loffer H. J. M. and Lindhout W. H. (1990):** Somaclonal variation in tomato: Effect of explant source and a comparison with chemical mutagenesis. *Theor. Appl. Genet.* 80: 817-825.
13. **Bretagne Sgnard B., Fouillox G. and Chupeav Y. (1996):** Induced albina mutations as a tool for genetic analysis and cell biology in flax (*Linum usitatissimum*). *J. Exp Bot* 47:189-194.
14. **Okubo T., Ishihara N., Takahashi H., Fujisawa T., Kim M., Yamamoto T. and Mitsuoka T. T. (1994):** Effects of partially hydrolyzed guar gum intake on human intestinal microflora and its metabolism. *Biosci. Biotechnol Biochem.* 58, 1364-1369.
15. **Golay A., Schneder H., Bloise D., Vadas L. and Assal J. (1995):** The effect of a liquid supplement containing guar gum and fructose on glucose tolerance in non-insulin-dependent diabetic patients. *Nutr. Metab. Cardiovasc. Dis.* 5, 141-148.
16. **Anderson J. W. and Hanna T. J. (1999):** Impact of non digestible carbohydrates on serum for lipoproteins and risk for cardiovascular disease. *J. Nutr.* 129,1457S-1466S.
17. **Brown L., Rosner B., Willet W.W. and Sacks F. M. (1999):** Cholesterol lowering effects of dietary fibre: A meta analysis. *Am. J. Clin. Nutr.* 69, 30-42.
18. **Chandalia M., Abhimanyu G., Lutjohan D., Von Bergmann K., Grundy S.M. and Brinkley L.J. (2000):** Beneficial effects of high dietary fibre intake in patients with type 2 diabetes mellitus. *New Engl. J. Med.* 342, 1392-1398.
19. **Battilana P., Ornstein K., Minehira K. and Schwartz J.M. L. (2001):** Mechanisms of action of beta-glucan in post prandial glucose metabolism in healthy men. *Eur. J. Clin. Nutr.* 55, 327-333.
20. **Meyer D. and Tungland B. (2001):** Non digestible oligosaccharides: Their physiological effects and health implications. In *Advanced Dietary Fiber Technology* (B.V. Mcleary and L. Prosky, Ed) pp. 455-470, Blackwell Science Ltd., Oxford, U.K.
21. **Da silva L. P. and Ciocca M. L. S. (2005):** Total, insoluble and soluble dietary fibre values measured by enzymatic-gravimetric methods in cereal grains. *J. Food Compos. Anl.* 18,113-120.
22. **Kays S.E., Morris J. B. and Kim Y. (2006):** Total and soluble dietary fibre variation in (*Cyamopsis tetragonoloba* (L.) Taub.) (guar) genotypes. *Journal of Food Quality.* 29(4):383-391.



**Ethnobotanical Survey Of Medicinal Plants Used To Cure Skin Diseases**

**Priyanka Ingle<sup>1</sup> Madhuri Pawar<sup>2</sup>**

<sup>1,2</sup>Botanical Survey of India, Western Regional Centre, Pune 411 001.

Corresponding Author- **Priyanka Ingle**

Email: [priyaingalkar@gmail.com](mailto:priyaingalkar@gmail.com)

DOI- 10.5281/zenodo.7476126

**Abstract**

The Wan Wildlife Sanctuary is situated in Akot Wildlife Division, Akot of Akola district, Maharashtra which contributes 211 sq. km area of Melghat Tiger Reserve. An area of 205.86 sq km is actual forest area and 5.14 sq km area is of cultivation and 'Gaathan' area of seven ex-forest villages called as 'Madow'. Present survey work has been undertaken during 2016 – 2018. During the survey period the only village present in the wildlife sanctuary area was 'Talai'. During this survey work ethno-botanical data of 13 medicinal plants used to cure skin disease have been collected which belongs to 10 families. This data have been collected from 'Rathi' & 'Korku' communities which are the major communities residing, either working as Forest Department staff in Wildlife Sanctuary area during the survey period.

**Key words:** Melghat Tiger Reserve, Wan Wildlife Sanctuary, Medicinal plants, Ethnobotany, Rathi, Korku, Skin diseases.

**Introduction:**

The Wan Wildlife Sanctuary is situated in Akot Wildlife Division, Akot of Akola district, Maharashtra which contributes 211 sq. km area of Melghat Tiger Reserve. An area of 205.86 sq km is actual forest area and 5.14 sq km area is of cultivation and 'Gaathan' area of seven ex-forest villages called as 'Madow'. Present survey work has been undertaken during 2016 – 2018. During survey period only village present in the wildlife sanctuary area was 'Talai'. In survey work ethno-botanical data of 13 medicinal plants which is used to cure skin disease have been collected which belongs to 10 families. This data have been collected in five survey and field visits from 'Rathi' & 'Korku' communities which are the major communities residing, either working as Forest Department staff in wildlife sanctuary area. After survey period the village 'Talai' has been rehabilitated at outskirts area of wildlife sanctuary and named as 'Navi Talai'.

**Enumeration:**

- 1) *Andrographis paniculata* (Burm.f.)  
Nees

Family – Acanthaceae

Parts used – Leaves

Uses - Leaf powder mixed in coconut oil and applied on the infected areas of skin for two days to cure lesions.

- 2) *Eranthemum roseum* (Vahl) R.Br.

Family – Acanthaceae

Parts used – Leaf

Uses - Leaf pest is externally applied on the infected areas of skin to cure skin diseases.

- 3) *Achyranthes aspera* L.

Family – Amaranthaceae

Parts used – Root

Uses - The root powder is sprinkled over the lesion twice in a day in skin diseases.

- 4) *Lannea coromandelica* (Houtt.) Merr.

Family – Anacardiaceae

Parts used - Gum

Uses – Gum mixed with coconut oil used for topical application on infected area twice in a day to cure skin diseases.

- 5) *Buchanania cochinchinensis* (Lour.)  
M.R. Almeida

Family – Anacardiaceae

Parts used – Leaves

Uses – Topical application of leaf paste on infected area twice in a day to cure skin diseases.

- 6) *Wrightia tinctoria* R.Br.

Family – Apocynaceae

Parts used - Leaves

Uses – Hot water mixed with leaf powder used to take bath to cure skin infections.

- 7) *Mallotus philippensis* (Lam.) Müll.  
Arg.

Family – Euphorbiaceae

Parts used – Fruit

Uses – The power obtain from pericarp of the fruit is applied externally to treat parasitic infections of the skin.

- 8) *Ricinus cummunis* L.

Family – Euphorbiaceae

Parts used - Leaves

Uses – The leaves are heated and applied on infected areas of skin to cure a contagious skin diseases.

9) *Lavandula bipinnata* (Roth) Kuntze

Family – Lamiaceae

Parts used – Leaves

Uses – Leaf pest applied on infected areas of skin to cure skin infections.

10) *Piper betel* L.

Family – Piperaceae

Parts used – Leaves

Uses – Leaf pest along with salt and oil applied on infected areas thrice in a day to cure Shingles.

11) *Azadirachta indica* A. Juss.

Family – Meliaceae

Parts used – Leaves

Uses – Hot water mixed with leaf powder used to take bath to cure skin infections.

12) *Haldina cordifolia* (Roxb.) Ridsdale

Family – Rubiaceae

Parts used – Leaves

Uses – Leaves crushed in water and applied on infected areas twice a day to cure skin infections.

13) *Balanites aegyptiaca* (L.) Delile

Family – Zygophyllaceae

Parts used – Fruit

Uses – Topical application of fruit pulp on infected areas of skin twice a day to cure skin diseases.

**References:**

1. Anonymous. (1968). Maharashtra State Gazetteers (Government of Maharashtra) Amravati District (Revsd. Ed.) Directorate of Government Printing Stationery and Publications, Maharashtra.
2. Dhore, M.A. and Joshi, P.A. (1988). Flora of Melghat Tiger Reserve. Directorate, Project Tiger, Melghat, Paratwada, Dist. Amravati, Maharashtra.
3. Patel, R.I. (1968). Forest Flora of Melghat. Prabhat Press, Meerut.
4. Singh BD, Karthikeyan S. and Singh N.P. (2000). Flora of Maharashtra State-Dicotyledons, Botanical Survey of India, Calcutta.

## **Diseases of chili and their management**

**Rahul singh Raghuvanshi<sup>1</sup>, Dr. Subhash Chandra<sup>2</sup>**

<sup>1</sup>Research Scholar Department of Plant Pathology  
Acharya Narendra Deva University of Agriculture & Technology,  
Kumarganj, Ayodhya

<sup>2</sup>Associate Professor Department of Plant Pathology  
Acharya Narendra Deva University of Agriculture & Technology,  
Kumarganj, Ayodhya

Corresponding Author- **Rahul singh Raghuvanshi**

Email – [raghuvanshir22@gmail.com](mailto:raghuvanshir22@gmail.com)

**DOI- 10.5281/zenodo.7476136**



---

### **Introduction**

Chilli was introduced to India by Portuguese traders but now it is the most cultivated crop across the country. Having cultivated mostly in open agricultural fields, the crop has been invaded by several diseases. In this blog let us understand the strategies for managing major diseases of the crop.

Chilli (*Capsicum annuum* L., family Solanaceae) is an important spice and vegetable crops on the basis of its high consumption, nutritional and cash value to the farmers and consumers in the tropical and sub-tropical area. Chilli fruits are consumed as fresh, dried or processed products, table purpose, spice and condiments. Moreover, the green fruit of chilli is one of the richest sources of vitamin C and A (Howard, 2000). Chilli is infected by several fungal, bacterial and viral diseases which incite severe economic losses. Among the diseases anthracnose/die back or ripe fruit rot caused by *Colletotrichum capsici*. At the present time the disease is mostly managed by using chemical fungicides. The continuous and indiscriminate use of chemicals resulting accumulation of harmful residues in the soil, water and grains which break down the ecological balance by killing the beneficial and/or antagonistic microorganisms.

---

### **1. Anthracnose/Fruit Rot/Die-back of Chilli**

**Causal organism:** *Colletotrichum capsici*.

**Epidemiology:** The pathogen survives on infected seed and plant debris. High humidity and moderate temperature favour disease development.

#### **Symptoms**

The disease occur in two forms; Dieback and Ripe fruit rot.

#### **Die-back**

1. The disease causes necrosis of tender twigs from the tip to backward. The entire branch or the entire top of the plant may wither away.

2. Numerous black dots (acervuli of fungus) are found scattered all over the necrotic surface of the affected twigs.

3. Only the top or few side branches may be killed or in severe attacks the entire plant is withered. Partially affected plants bear fruit which are few and low quality.

#### **Ripe fruit rot**

1. Although red ripe fruits are frequently affected, anthracnose symptoms appear even on well-developed green fruits.

2. Small black circular spots are appeared on the skin of the fruit and spread along the long axis of the fruit and thus becoming more or less elliptical.

3. The spots are usually sunken with black margin. Badly diseased fruit turn straw colour from normal color. Sunken spots are covered with pinkish mass of fungal spores.

4. The fruits with many spots drop off prematurely, resulting heavy loss in yield. Seeds are also infected by this fungus.



**Symptoms of Anthracnose/Fruit Rot/Die-back of Chilli**

**Favorable condition**

High temperature (28 C).

High relative humidity (92% or above).

Heavy and prolong dew deposition after rainy season.

**Management/Control Measure**

**A. Cultural control**

Seeds should be collected from spotless fruits.

Disease crop debris should be collected and burnt.

**B. Chemical control**

Seed treatment with Vitavax-200, Brassical @ 2g/kg of seed.

spraying with Dithane-M 45 or Bavistin @ 0.2% solution, 3-4 times after 15 days interval when fruit begin to ripe.

**2. Mosaic of Chilli**

**Causal organism:** Tobacco mosaic virus.

**Vector:** Aphid (*Aphis gossypii*).

Epidemiology: The disease spreads by mechanical contact and also through seed and insect-vector aphids (*Aphis gossypii*, *A. craccivora*, *Myzus persicae*).

**Symptoms**

1. The most characteristics symptom appearance of dark green and light green areas on the leaf surface.

2. Leaves are greatly in size and filamentous like.

3. The diseased plant produces less flower and fruits. The fruits are usually deformed and rough in texture.



**Symptoms of Mosaic of Chilli**

**Transmission**

The virus is sap transmissible. It is also transmitted by aphid.

**Management/Control Measure**

Field sanitation.

Roughing and cultural practices.

Use of optimum doses of nitrogenous fertilizer in the field.

Destruction of lateral alternate host.

Spraying with Malathion/Metasistox/Diazinon/Sumithion @ 0.1% solution at 10 days interval, starting from early stage of plant growth and stopped at least 20 days before plucking of fruits.

**3. Leaf Curl disease of Chilli**

**Causal organism:** Leaf curl virus.

**Vector:** White fly (*Bemisia tabaci*).

Epidemiology: Field-spread occurs through whitefly, an insect vector (*Bemisia tabaci*). This disease increases with increases in temperature and relative humidity. The virus mainly perpetuates on weed hosts. Warm and dry weather favors disease-spread. In southern India, disease epidemics are more common during March-June, whereas under north Indian conditions, epidemics occur from June to October.

**Symptoms**

1. The leaf curl is characterized by severe stunting of the plants with downward rolling and wrinkling of leaves.

2. Leaves become small in size; Internodes are shortened, giving the plant as witches broom appearance.

3. Leaves are pale yellow colored.

4. Fruiting is stopped or fruits that formed are small and deformed. Alternate Hosts Tobacco, Tomato, Papaya etc.





**Symptoms of Leaf Curl disease of Chili**

**Transmission**

The virus is not sap transmissible or not seed borne. It is transmitted by white fly.

**Management/Control Measure**

Field sanitation.

Roughing and cultural practices.

Use of optimum doses of nitrogenous fertilizer in the field.

Destruction of lateral alternate host.

Apply Carbofuran 3G @ 4-5 Kg/acre in the mainfield to control sucking complex and insect vectors selectively.

If it is not possible spray the crop with systemic insecticides. Dimethoate 2 ml or Acephate 1g per litre of water.

Collect and destroy infected virus plants as soon as they are noticed.

**4. DAMPING-OFF OF SEEDLINGS (*Pythium*)**



**Symptoms:** Infection occurs on stem at soil level. Initial symptoms are water soaked lesions on the soft stem tissue. The lesions expand leading to the collapse of seedlings. Generally the disease spreads through infected planting material, soil and water.

**Management:** Soil-drench with Captaf (0.2%) or copper oxychloride (0.3%).

**5. POWDERY MILDEW (*Leveillula taurica*)**



**Symptoms:** The disease first appears as tiny white spots on the under surface of the leaves and later turn into large irregular spots. Subsequently, the white powdery growth covers entire leaf on the undersurface. Yellowish spots appear on the corresponding infected portions on the dorsal surface of the leaves. Affected leaves tend to drop off prematurely.

**Epidemiology:** Alternating low and high temperature coupled with high humidity favours the disease spread.

**Management :** Spray Wettable sulphur (0.3%) or Tridemorph (0.1 %) or Hexaconazole (0.05%) or Dinocap (0.1 %) or Flusilazole (0.03 %) or Myclobutanil (0.1 %) at 10 -15 day intervals (2-3 sprays).

**6. PHYTOPHTHORA BLIGHT (*Phytophthora capsici*)**



**Symptoms:** Initial symptoms are water soaked small dark green spots that enlarge and become bleached, as though scalded. Infected fruits initially develop dark, water-soaked patches that become coated with white mold and spores of the fungus. Fruits wither but remain attached to the plant. Seeds will be shriveled and infested by the fungus.

**Epidemiology:** Prolonged wet weather favours the disease spread.

**Management:**

1. Practice crop rotation with crops other than tomato, eggplant and cucurbits, for at least 3 years.
2. Avoid poorly drained fields for growing these crops
3. Plant the crop on ridges, or on raised dome-shaped beds to provide better soil drainage.
4. Foliar application of Mancozeb (0.2%) or Copper oxychloride (0.3%), Copper hydroxide(0.2%) or

Fosetyl-AI (0.2%) or Pre-packed mixture of Metalaxyl - Mancozeb (0.2%) or combination of Dimethomorph (0.1%) – Metiram (0.2%), Azoxystrobin (0.2%), Pyraclostrobin + metiram (0.2%), Fenamidone - Mancozeb(0.3%), Famoxadone - cymoxanil (0.1%), which gives good control.

**7. LEAF SPOT (*Cercospora capsici*)**



**Symptoms:** Oval or oblong spots with light grey centres on leaves, stalks and stem. Infected leaves drop off prematurely.

**Epidemiology:** The pathogen survives on infected seed and infected plant debris. Cool, humid conditions and moderate temperature favour the disease.

**Management:**

1. Seed treatment with Thiram (0.3%) and Captan (0.3%).
2. Foliar spray of Carbendazim (0.1 %) or Mancozeb(0.2%) or Carbendazim-Mancozeb (0.2%).

**8. BACTERIAL WILT (*Ralstonia solanacearum*)**



**Symptom:** The pathogen is soil-borne in nature and mostly affects solanaceous crops. Initial symptoms of wilt occur in the younger leaves and slight yellowing occurs in older leaves. Wilted leaves maintain their green color and do not fall-off as the disease progresses. Under conditions favorable to

the disease, complete wilt occurs. Wilting and death is accompanied by dark-brown internal discoloration of vascular elements.

**Management:**

1. Seed-treatment with *Pseudomonas fluorescens* before sowing.
2. Seedling-root dip with *P. fluorescens* and planting in green manure (sun hemp) amended soil.
3. Foliar application of antibiotics (Streptocycline 300 to 500 ppm).
4. Crop rotation with maize-sorghum-ragi or maize-onion or garlic and paddy.
9. **CHILLI LEAF - CURL DISEASE** (Chilli leaf curl virus, Begomovirus genus of Geminiviridae)



**Symptoms:** Symptoms consist of upward and downward curling of leaves. Leaf margins develop pale-green to yellow color, which extends into the interveinal areas. Nodes and internodes are significantly reduced in size. Infected plants assume a bushy appearance, with severely stunted growth, look pale and produce more lateral branches. Fruits from infected plants are small and deformed. It is a single-stranded DNA virus.

**Epidemiology:** Field-spread occurs through whitefly, an insect vector (*Bemisia tabaci*). This disease increases with increases in temperature and relative humidity. The virus mainly perpetuates on weed-hosts. Warm and dry weather favors disease-spread. In southern India, disease epidemics are more common during March-June, whereas under north Indian conditions, epidemics occur from June to October.

**Management:**

**Cultural control**

1. Growing the nursery under nylon-net cover (50 mesh)
2. Eradication of early-infected plants and weed-hosts from the field
3. Two rows of border-crop pings with maize, jowar, or bajra reduce disease-spread

**Chemical control**



1. Soil-application of Furadon @ 1.5 Kg ai/ha at the time of sowing.
2. Spray seedlings with Acephate (0.15%) or Monocrotophos (0.1 %) prior to transplanting.
3. Spray insecticides like Monocrotophos (0.15%), Acephate (0.15%) or Hostothion (0.1 %) at fortnight intervals after transplanting, until the flowering stage.
4. Chemical spray, followed by neem seed kernel extract (2%), is also effective in rotation with insecticides.

**10. CHILLI MOSAIC AND LEAF DISTORTION DISEASE** (Cucumber mosaic virus)



**Symptoms:** Symptoms are extremely variable depending on the variety/ hybrid and on weather conditions. Common symptoms are: initial chlorotic lesions, followed by light- and dark-green areas appearing as mosaic. At later stages, newly emerging leaves distort or transform into filiform or thin, elongated leaves. In severe cases, plants get stunted and produce less number of fruits. Fruits from infected plants are hard and brittle, full of seeds. Yellow streaks may also appear on fruits. The virus is an isometric particle of 28 nm size, has a genome of single-stranded multipartite RNA and belongs to the Cucumovirus group.

**Epidemiology:** The disease spreads by mechanical contact and also through seed and insect-vector aphids (*Aphis gossypii*, *A. craccivora*, *Myzus persicae*).

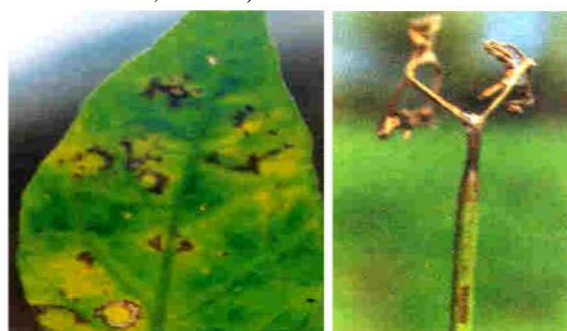
**Management:**

**Nursery stage**

1. Growing the nursery under nylon-net cover (40–50 mesh).
2. Soil application of systemic insecticides like Furadon @ 1.0 Kg ai / ha at the time of sowing seeds in the nursery bed.
3. Prior to transplantation, seedlings should be sprayed with Acephate (0.15%) or Monocrotophos @ (0.15 %) or Dimethoate (0.2 %).

**Main field**

1. Sowing border crops like maize/ bajra/jowar, 15 days before transplanting the main crop.
  2. Removal of early-infected plants from the field.
  3. Spraying Acephate (0.15 %) or Hostothion (0.1 %) or Imdacloprid (0.05%); these chemicals should be used alternatively and should not be repeated continuously.
  4. Spraying neem seed kernel extract (2 %) + sticker, 15 days after transplanting until fruit formation, at 10 days intervals.
  5. Mulching with silver or black colored polythene mulch-sheet.
  6. Growing virus tolerant varieties.
- 11. CHILLI NECROSIS DISEASE** (Groundnut bud necrosis virus, GBNV)



**Symptoms:** This disease is characterized by bronzing of young leaves, chlorosis, followed by necrotic ring spots. Necrotic spots appear under the growing tips and the entire twig dies back. In some cases, this leads to severe stunting and cessation of growth. Early-infected plants bear deformed, unevenly ripe fruits, while, fruits formed after late-infection show concentric rings. Sometimes, side-shoots proliferate and do not bear fruit. The pathogen is a tripartite, negative-stranded and single-stranded RNA virus.

**Epidemiology:** GBNV is transmitted by thrips insect vector (*Thrips palmi*) and also mechanically. The virus is not seed-transmitted. This virus infects many legumes and solanaceous crops in addition to several weed species. Weed-hosts such as Emilia, Cassia, and Acanthospermum also serve as reservoir-hosts for both the virus and the vector.

**Management**

**Cultural practices**

1. Raising seedlings under nylon nets (50 mesh).
  2. Rouging out infected plants and weed-hosts.
  3. Growing two rows of the border crop with maize/jowar/bajra 15 days before transplanting chili.
- 12. Chilli Mild Mottle And Mosaic Disease** (Pepper Mild Mottle Virus And Tobacco Mosaic virus)



**Symptom:** The disease is characterized by mild mottling with light green areas, interveinal chlorosis, mosaic and distortion of fruits, in some varieties/ hybrids the half portion of leaf will be pale yellow color. The disease generally does not affect the growth of the plant. This virus belongs to tobamovirus group, which are having a rod shaped particles measuring 670 to 710 nm in length with 18 nm diameter. They have single stranded RNA genome.

**Epidemiology:** These viruses are externally seed borne and spread in the field mainly due to contact and injury to the crop during cultural operations in the crop. The virus mainly survives in the outer seed coat and seldom in the endosperm.

#### **Management**

1. The main preventive measure to protect the viruses is to use virus free seed.
2. Seed borne infection can be prevented by soaking seeds in Calcium hypochlorite (5 %) for 15 Minutes or Trisodium phosphate (10%) solution for 20-30 min and drying.
3. Raising seedlings under nylon nets (50 mesh).
4. Roguing out infected plants and weed-hosts.
5. Growing two rows of the border crop with maize /jowar/ bajra 15 days before transplanting chilli.

#### **Conclusions:**

The cultivated chilli suffers from number of fungal, bacterial and viral disease. Among the fungal diseases damping off and anthracnose are the major devastating diseases causing considerable yield loss. Environmental play an effective role for development of these diseases. Disease perpetuate through plant debris in soil, special fruiting body, volunteer host and weeds year to year. The disease can be managed effectively and eco-friendly by cultural practices and applying economic chemicals.

#### **References:**

1. Howard, L.R. 2000. Changes on phytochemical antioxidant activity of selected pepper species as influenced by maturity. *J. Agric. Food Chem.* 48: 1713-20.

2. Ullasa, B.A., R.D. Rawal, H.S. Soshi, D.P. Singh and M.C. Joshi. 1981. Reaction to sweet pepper genotype to anthracnose, *Cercospora* leaf spot and powdery mildew. *Plant Dis.* 65: 600-601.
3. Rahman, M.S., Akhter, M.S., Maya, M.A., A.H.M.A. Rahman and A.M. Akanda. 2011. Field Resistance of Chilli Cultivars against Anthracnose Disease Caused by *Colletotrichum capsici*. *Thai Journal of Agricultural Science* 2011, 44(4): 243-250



**Review on Effects of different fertilizer treatments on growth and yield of various crops**

**Mangesh M. Vedpathak<sup>1</sup> Balbhim L. Chavan<sup>2</sup>**

<sup>1</sup>. Shriram shikshan Sanstha, Paniv, Tal- Malshiras, Dist- Solapur, MS, India.

<sup>2</sup>. Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431001, MS, India

Corresponding Author- **Mangesh M. Vedpathak**

Email- [mvedpathak512@gmail.com](mailto:mvedpathak512@gmail.com)

DOI- 10.5281/zenodo.7476140

**Abstract:** The organic fertilizers are good soil conditioner for better improvement of growth and yield of agricultural crop and therefore are utilized as nutrient source to crop system. Composting is one of the best methods of recycling the solid waste to improve soil fertility and reduce the environmental pollution. Composting is one of the ecofriendly and suitable methods for organic fertilizer production by solid waste management practices. Present research paper covers major aspects of scientific information in relevance of the research work was carried out in the field. There are many methods of composting to convert biodegradable solid waste in to nutrient rich organic fertilizers, which is used for healthy and sustainable agricultural practices.

The present research paper describes the review on scientific aspects of comparative suitability of fertilizers for the growth and yield of different crops which were studied in the field.

**Key words:** Agriculture, composting, growth, fertilizer, yield.

**Introduction:**

Fertilizers play very important role in agricultural production sector. Fertilizers have played a major role to overcome the problems of food shortages and malnutrition in many regions of the world. The importance of chemical fertilizers and organic fertilizers has been underlined in recent years, which has been reflected in the vast scientific literature. The scientific literature survey reveals that there are many adverse impacts of chemical fertilizers due to unwise and haphazard use in agriculture. On the other hand, the problem of solid waste and related environmental issues is also increasing day by day. The efforts are being made to make the use of organic solid waste fertilizer to recycle their nutrient contents after suitable treatment processes and reduce the impacts of chemical fertilizers.

**Solid waste and environmental problems:**

Increasing solid waste quantities and their indiscriminate disposals are posing a threat to the environment and ultimately to the human health in different forms through various routes and means. This problem is creating the worst situations in many cities, especially in underdeveloped and developing countries. Careful treatment and disposal of solid waste has become necessary for healthy and ecofriendly environment. According to Nguyen and his co-workers (2011) many

cities in developing countries are facing the problem of serious environmental degradation and health risks to the human society due to the weakly developed municipal solid waste management systems. The increasing consumption of resources and their wastages are generating huge amounts of solid wastes from industrial and domestic activities and posing significant threats to human health (Frosch, 1996; Sankoh, 2013). Several scientific studies have been conducted to examine the health impacts and environmental effects arising from improper solid waste dumping and unwise disposals (Aatamila et al., 2010; Giusti, 2009; Nwanta and Ezenduka, 2010; Xiao et al., 2007). These studies have showed the relevance that exists between these two, the solid waste disposal and human health. The conclusions from these studies have related the solid waste problems to the environmental pollution as well as its effects on the plants and animals. The environmental and health implications of solid waste disposal to people living in close proximity of waste dumpsites has been studied and the results are supported by many others (Boardiand Kuitunen, 2005; Gouveia and Prado, 2009; Nabegu, 2010). However, the ills of inappropriately disposed municipal solid wastes are quite numerous. Disease spread like such as malaria, epidemic incidences like diarrhoea and cholera, Health problems like chest pain,

***Agriculture Development towards Sustainability***

health deterioration, accidents, flood occurrences, and environmental pressures are just a few of the negative effects beside the general problems like emission of greenhouse gases, air pollution, water and groundwater contamination, eutrophication of water bodies and many more (Sood, 2004; UNEPA, 2006; Rushton, 2003; WB, 2005; Marshal, 1995; Medina, 2002). The agricultural soil with such fertilizer supports the crop growth better, if the growing crops are supplied with adequate quantity of such fertilizers, especially for the growth of all vegetable crops.

**Composting technology:**

Composting is biological process in which recycling of organic matter take place. It is simple, reliable, suitable and widely adopted technique for the management of solid waste. Processing of organic solid waste material through controlled bio-oxidation processes reduces the environmental risk by converting organic part of solid waste into a safer and stable product which is suitable for application to soil (Lazcano et al., 2008). Compost is prepared by biological degradation of plant and animal residues under controlled aerobic condition (Eghball et al., 1997). Compost is known to be product rich in microorganisms that helps plants to mobilize and acquire nutrients (Postma et al., 2003). Biodegradable waste were used in crop production without process and restore soil fertility as they have large nutrient value (Krogman et al., 1997; Benton and Wester, 1998).

The decomposed fertilizer from compost pit produced from organic waste mainly provides macro and micro nutrients in organic form. Plants absorb these nutrients through their bio-geo-chemical processes in an inorganic form. Therefore, nutrients from organic fertilizers need to undergo biological decomposition and subsequent bio-geo-chemical conversion in the soil before they are made available to crops for uptake of nutrients (Wiederholt et al., 2005). A lot of research has been done for describing the benefits of organic amendments in improving physical, chemical and biological characteristics of soil, but depend on quantity and composition (Badalucco et al., 2010; Tandon, 2011;

Mylavarapu and Zinati, 2009; Dudhat et al., 1997 and Wani and Lee, 1992). Composting process is improved and the process is named as NADEF method which is a simple method to process and operates on the principle of favorable conditions and rapid decomposition. It is nuisance free, environmental friendly and socially acceptable as the end product has good fertilizer value (Katre, 2012). There is need to investigate most suitable method of composting for agricultural solid waste management for agricultural use.

**Vermicomposting- a novel technology:**

The solid waste can be converted in to nutrient rich organic fertilizers with the vermin-composting technique for sustainable agriculture and land restoration problems. Use of chemical fertilizers can cause several environmental problems (Savci, 2012). Vermicomposting is biological process that is described and suggested for bio oxidation and stabilization of organic material comprising the combined action of earthworms and mesophilic microorganisms (Aira et al., 2002). It is simple a biological process in which certain species of earthworms are used to convert organic biodegradable solid wastes into a nutrient-rich end product and applied in agriculture as a soil conditioner for crop improvement. It is one of the novel methods of decomposing the organic matters and producing organic manure which is the best in all aspect including nutrient level (Fathima and Sekar, 2014). The nutrient rich end product is very effective natural fertilizer with no environmental hazards (Mehta and Karnwal, 2013).

Vermicomposting is the best method for managing organic solid waste. Vermicompost from organic fertilizers have large amount of total and available nitrogen, phosphorous, potassium and micronutrients (Parthasarathiet al., 2008; Talageri and Narayana, 2013). The application of vermicompost to agricultural soil improves the physical and chemical structure of the soil. Compost and vermicompost both are used in agriculture and have beneficial effect on soil structure and biota (Carpenter et al., 2000; Subler et al., 1998). These are the recycling technologies to improve the quality of products (Jayasankar, 1994; Selvi, 1996).

In vermicomposting process of degradation of organic solid waste by earthworms takes place in presence of moisture content and air. The organic solid waste matter can be degraded with help of different commercial species of earthworms. The earthworms consume the organic matter. This degradation activity result in the formation of soil fertilizer by earthworm droppings. The biodegradable wastes should be used for preparing compost by adding to it. The application of vermicompost has been shown to have several positive impacts on plant growth and health (Chavan, 2014). Vermicompost recovers more nutrient contents than the organic fertilizers produced using other methods such as pit composting, heap manure and NADEP method of composting. The growth media are attributed to the increase its plant growth by the application of vermicompost (Srivastava and Beohar, 2004). Vermicomposting, pit method of composting and NADEP method of composting are appropriate methods for biodegradable agricultural solid waste management (Chavan et al., 2014).

#### **Effects of chemical fertilizers on growth and yield of various crops:**

Vedpathak and Chavan (2016) conducted a field experiments with application of different fertilizer treatments for growing Fenugreek vegetable. In their field experiment study, they noticed that the crops grown with application of chemical fertilizer found significantly higher growth and yield of Fenugreek vegetable as compared to other fertilizer treatments. Abundant use of chemical fertilizers and pesticides in agriculture has resulted in poor soil fertility and health of consumers (Sonmez, 2007). The nitrogenous fertilizers and pesticide residues have created the problem of water pollution, leading to carcinogenic effect on human body and have caused damage to the important organs. Applications of chemical fertilizers have led to the loss of soil fertility due to imbalanced use of fertilizers, which have adversely affected agricultural productivity and caused soil degradation (Wani and Lee, 1992).

The interaction of chemical fertilizers with the agricultural soils is considerable, but it is less favorable to soil environment in

comparison with the organic sources of nutrients. The application of organic manure along with inorganic fertilizers in to soil results in the increased crop productivity of soil system and also helps to sustain the soil health for longer period (Singh, 2015). Excessive uses of chemical fertilizers adversely affect the quality of soil and decrease the food production due to loss of soil organic matter (Singh et al., 2007; Melero et al., 2008). Constant use of chemical fertilizers reduces all essential soil nutrients and minerals that are naturally found in fertile soil and reduce the soil-nutrient balance (Baloch et al., 2014).

The field trials were conducted by Godara and his co-workers (2012) and have reported that there was increase in grain yield of Fenugreek (*Trigoneliafoenum-graeum*L.) with application of recommended dose of nutrients in the forms of mixed chemical fertilizer over organic manures as vermicompost and poultry manure. Another field experiment was conducted by Godara and his associate researchers (2014) with Coriander (*Coriandrum sativum* L.) and found that application of 100% recommended dose of fertilizers through chemical fertilizers gave highest yield of coriander.

Joshi and his research colleagues (2013) studied the impacts with various doses of vermicompost organic fertilizers and of NPK fertilizers on the growth, yield and quality of Wheat. Experimental result showed that growth, yield and quality of Wheat were increased in NPK treatment. Vermicompost treatment was found to be cost effective. Sharma and his co-workers (2014) conducted research work on growth parameters such as germination percentage, viability percentage, root and shoot length, fresh and dry weights, vigour index and chlorophyll content in Wheat in laboratory with chemical fertilizer alone and their different combinations. Their results revealed that chemical fertilizers in suitable combinations increase seedling growth and chlorophyll contents in seedling of Wheat. Banjare and his research students (2015) conducted field experiments on Onion at Indira Gandhi KrishiVishwavidyalaya, Raipur, Chhattisgarh and tested the application of 100 % recommended doses of

***Agriculture Development towards Sustainability***

fertilizers (RDF) can produce maximum bulb yield in Onion. They noticed that mixture of two nutrient sources helped to increase growth parameters and yield contributing characters resulting in good bulb yield in Onion. Sadaria and co-workers (1997) also reported that the yield of Onion was found highest using 100 kg nitrogen/ha.

**Effects of organic fertilizers on growth and yield of various crops:**

In field trials conducted by Vedpathak and Chavan (2016) reported that application of vermicompost increases fresh and dry biomass of Coriander crop as compared to other organic and chemical fertilizers. Application of organic fertilizers provide nutrients to agricultural crop. There are several organic fertilizers having different forms like compost, vermicompost, digested slurry from anaerobic digesters or biogas plants, farmyard manure and press mud and coir pith compost. These are applied to the agricultural crops for nutrient cycling and producing phenomenal increase in crop yield and quality (Fathima and Sekar, 2014). It helps to sustain fertility and moisture of soil. Use of organic manures with the inorganic fertilizer is the best method to increase the production of crop in field. The important macro nutrients such as nitrogen, phosphorous, potassium, sulphur, zinc, and boron used for the growth and yield of various crops by the application of organic fertilizers (Sultana et al, 2014). For example, Onion crop shows progressive response with the use of organic and inorganic fertilizers. The practice of organic manure application in agricultural field is the alternate source of the nitrogen that would give better result in plant growth and yield (Nasreen and Hossain, 2000).

Addition of organic and inorganic sources, balanced carbon and nitrogen ratio, higher organic matter built up in soil, efficient soil microbial activity, synergistic interaction between organic manures, vermicompost and bio-fertilizers result in better growth and yield of Lady's crop (Chattoo et al., 2011). Rostami et al., (2012) observed that the addition of enriched MSW compost improved the yield in Soybean crop due to macro- and micronutrients uptake (Rostami et al., 2012). Farm yard manure,

poultry manure, green manure and compost are organic sources of organic matter and also benefited to increase fertility of soil and result in higher crop yields (Mohammadi et al., 2011).

Naikwade et al., (2012) observed that the utilization of organic manure increases the crop growth, crop yield and nutrient quality of Maize. Organic fertilizers were prepared from Vermicompost using bin method and NADEP composting method as these are appropriate technologies to convert organic waste in to biodegradable organic fertilizer. They gave good results both, in terms of quality and quantity. It is noticeable that organic fertilizers improve the water holding capacity of agricultural soil and provide growth nutrients for soil microorganisms which help to increase the activities of microbes in soil.

The management of soil organic matter require active inputs of diverse crop residues and organic amendments to supplement the losses through decomposer activities in soil and the uptake of nutrients by crop. The accumulation of soil organic matter under organic amendment load can often lead to enhance soil fertility through the sequestration of plant nutrients, especially Nitrogen and ultimately increase the soil productivity in terms of crop yield (Thakare and Wake, 2015).

Vaithiyanathan and Sundaramoorthy (2016) noted that the effect of organic manure and inorganic fertilizers on seed germination of Green gram (*Vignaradiata*L.). Farm yard manure, vermicompost and composted coir pith and inorganic fertilizers (Nitrogen, phosphorus and potassium) were used as treatments in their studies. Vermicompost applied soil increases seedling growth and photosynthetic pigments of the plants, compared to the other organic and inorganic fertilizer applications.

Ankaram (2013) studied the impact of vermicomposting on water hyacinth production and concluded that the application of vermicompost produced from water hyacinth with cow dung had improved activity from all growth activity characteristics. Bioconversion of waste in to vermicompost and applying in the farm influences the total growth and yield of Chilli



## Agriculture Development towards Sustainability

crop. This is the best practical method in converting municipal solid waste and apply in the form of aquatic weed water hyacinth and convert to fertilizer to get valuable profitable product.

The application of vermicompost resulted in higher germination, growth and yield of Mung bean (*Vigna radiate* L.) as compared to the control treatment (Nagavallema et al., 2004).

Noreen and Noreen (2014) stated that the combined use of farmyard manure, chemical fertilizer and biofertilizer has beneficial effect on crops. The uses of organic fertilizers are beneficial for the crop growth and they do not pollute the environment. On the other hand, the uses of chemical fertilizers pollute our environment and kill the beneficial soil microorganisms.

Maman and Mason (2013) reported the observations on yield of Pearl millet (*Pennisetum glaucum* L.). The results of experiments conducted on research farm reveal that poultry manure is important organic nutrient source used to increase Pearl millet (*Pennisetum glaucum* L.) grain and total yields. It indicated that 2 t/ha of poultry manure increased the Pearl millet (*Pennisetum glaucum* L.) grain and Stover yields and addition of 40 Kg of 15-15-15 fertilizer further increased crop yields but not the tangible cost to value ratio. Nasaband his co-workers (2015) was conducted field experiments on yield and quality of some Maize varieties at the Mirjaveh (Iran). The experiments included treatments of levels of vermicompost (0, 4, 8, and 12 t/ha) in field experiment. Application of vermicompost at the rate of 12 t/ha resulted in higher seed and biological yield, compared to the control.

Sharma and Agarwal (2014) conducted pot experiments with organic fertilizers. In their pot experiment study, they noticed that the crops grown with supplement of organic fertilizers, such a crops found significantly higher and superior in terms of nutritional content along with growth and yield as compared to the chemically grown crops. Similar observation were recorded by Badarand his coworkers (2015). They conducted pot culture experiment on the growth of Cowpea crop. Organic amendment was used for

enhancement of crop growth sustainably in agriculture production. Outcomes of their study indicated that all the organic amendments result in well plant growth and nutrient acceptance as compared to chemical fertilizers and control.

The pot experiment was conducted by Adhikary and Gantayet (2012) on growth and biomolecular contents of Chilli (*Capsicum Annus* L.). Among the different organic fertilizers studied, vermicompost showed higher vegetative growth and chlorophyll, carbohydrate and protein contents. The pot experiment studies suggest the possibility of using vermicompost as source for crop growth enhancement and higher yields.

Ghafoor and his coworkers (2015) studied the impacts of fertilizers on the growth and yield of wheat with various organic amendments such as sheep manure (20 t/ha), cow manure (20t/ha) and poultry manure (20t/ha). They observed that poultry manure is best one compared to sheep and cow manure.

The table and pot experiment was conducted by Vedpathak and Chavan (2018) with aiming to determine impacts of different doses of vermicompost on germination and morphological characteristics of Cluster bean (*Cyamopsis tetragonolobus* L) seedlings growth. The output of this table and pot scale experiment shows that significant increase in germination percentage, Seedling growth (cm/seedlings), fresh and dry weight (g/seedling) and morphological parameters in plants treated by 100gm of vermicompost, followed by 200gm vermicompost fertilizers as compared with control in pot and table scale experiment.

Yield of Potato (*Solanumtuberosum*L.), Spinach (*Spinaciaoleracea*L.) and Turnip (*Brassica campestris* L.) were estimated with application of vermicompost. Initial soil quality was assessed before and after the application of vermicompost. Treatment consist of 4, 5 and 6t/ha dose of vermicompost. At the end of experiment the vermicompost at 6t/ha gave maximum productivity of vegetable crops with improvement of soil quality (Ansari, 2008).

**Effects of combined application of organic fertilizer with chemical**

## Agriculture Development towards Sustainability

### fertilizers on growth and yield of various crops:

Composting is simple and an effective way to manage the degradable organic portion of solid waste. Vermicompost can be an efficient plant growth media for sustainable crop growth for agricultural production, if it is applied with suitable combinations of NPK fertilisers (Subbulakshmi and Thiruneelakandan, 2011). Yousefi and Sadeghi(2014) conducted field experiments to study the effect of vermicompost and urea-chemical fertilizers on the yield and yield components of Wheat (*Triticum aestivum*L.) in the field condition. The results indicate that the combined application of urea fertilizer and vermicompost had significant effects on grain yield. Addition of vermicompost increased the growth characteristics of wheat crop. But the combination of urea fertilizer with vermicompost were much improved the growth performance and yield components of wheat. Application of vermicompost with N fertilizer gave higher dry mater and grain yield of Wheat. Similar result also found in field crops such as Sorghum and Sunflower (Devi and Agarwal, 1998; Devi et al., 1998; Patil and Sheelavantar, 2000).

Alam and his research colleagues (2007) studied the effect of vermicompost and NPKS fertilizers with their applications on growth and yield of red amaranth. They put forward that vermicompost along with 50% NPK is more favorable for higher production of red amaranth. They also pointed it as useful for the conservation of soil environment. Meenakumari and Shekhar (2012) recoded that the yield of Tomato crop (*Lycopersicumesculentum*L.) was significantly increased by the application of vermicompost when it was combined with chemical fertilizers. Treatment inputs were control, chemical fertilizer, farmyard manure, vermicompost, 50% farm yard manure mixed with 50% chemical fertilizer, 50% vermicompost mixed with 50% chemical fertilizers used in these field trial experiments. It has been reported that NPK of organic manure require more time for utilizing by plants due to slow release of NPK.

Ullah and other co-owrkers (2008) conducted field trials with five treatments of organic, inorganic fertilizers as the combined sources of nutrients on the growth and yield of Brinjal crop. The results revealed that the combined treatments of 60% organic with 40% inorganic fertilizers were found to be best for the growth performance of Brinjal crop as compared to the chemical fertilizers. Available soil N, P, K, S along with organic matter present in soil the counts were higher with application of organic manure. Gandhi and Sundari (2012) conducted pot experiment with four treatment viz. control, vermicompost of cow dung, *Azola* and *Eichhornia* respectively to study the effects of vermicompost on Eggplant growth and yield. The results showed that the *Azola* vermicompost application was resulted in higher growth parameters in Eggplant followed by *Eichhornia* vermicompost and cow dung vermicompost. Oad and co-workers (2004) conducted field experiments to investigate the effects of organic and inorganic fertilizer applications on Maize fodder production. Treatment inputs consisting different nitrogen levels (0, 60, 90, 120 and 150 Kg/ha) and fresh organic FYM levels (1500, 3000 and 4500 Kg/ha) were used. The observation shows that by the application of 120 Kg N/ha in combination with 3000 Kg of FYM to Maize (*Zea mays* L.) recorded highest Maize fodder yield.

Talageri and Narayana (2013) conducted field experiments with four replications with Randomized Complete Block Design consisting of five inputs. Their observation shows that by the application of vermicompost (75%) in combination with 25% farm yard manure had higher values for growth and yield of Okra crop. The lowest growth and yield was observed when supplied only farm yard manure. Umesha and co-workers (2014) concluded field experiment and concluded that recommended dose of NPK with *Azotobactor chroococcum*, *Bacillus megaterium*, *Pseudomonas fluorescense* and enriched compost have highest plant height, total dry matter and yield parameters of Maize. Another study by the application of 100% recommended K through K ash, maximum Okra yield, fruit weight and fruit length in experiment was

**Agriculture Development towards Sustainability**

noticed (Pushpavalli et al., 2014). Shilpikashyap and others (2014) observed that the addition of 25% recommended dose of fertilizer with 75% neem cake in research farm gives better vegetative growth, yield and quality of fruit of Brinjal.

**Conclusion:**

Therefore, referred literature suggests to collect, treat and convert the organic fraction of solid waste into nutrient rich fertilizer and recycle so as the biodegradable waste gets managed and the impacts are reduced. Using a suitable technique and simple technology like composting of solid waste that can convert it to a potential plant nutrient enriched fertilizer which can be utilized for maintaining fertility of agricultural soil.

**References:**

- 1) Aatamila M., Verkasalo P., Korhonen M., Viluksela M., Pasanen K., Tittanen P. and Nevalainen A., (2010), Odor annoyance near waste treatment centers: A population based study in Finland, *Journal of Air and Waste Management Association*, 60(4):412-418.
- 2) Aira M., Monoy M., Dominguez F. and Mato S., (2002), How earthworms density affects microbial biomass and activity in pig manure, *European Journal of Soil Biology*, 38:7-10.
- 3) Badalucco L., Rao M., Colombo C., Palumbo G., Laudicina V. and Gianfreda L., (2010), Reversing agriculture from intensive to sustainable improves soil quality in a semiarid South Italian soil, *Biology and Fertility of Soil*, 46:481-489.
- 4) Baloch P., Rajparand I., Talpur U., (2014), Effect of integrated management on nut production of Coconut (*Cocosnucifera* L.) and soil environment - a review, *Science, Technology and Development*, 33(1):14-21.
- 5) Banjare C., Shukla N., Sharma P., Patanwar M. and Chandravanshi D., (2015), Effect of organic substances on yield and quality of Onion (*Allium cepa* L.), *International Journal of Farm Sciences*, 5(1):30-35.
- 6) Benton M. and Wester D., (1998), Bio solids effects on Toboso grass and alkali sacaton in a chihuahuan desert grassland, *Journal of Environmental Quality*, 27:199-208.
- 7) Boardi K. and Kuitunen M., (2005), Environmental and health impacts of household solid waste handling and disposal practices in the third world cities: The case of Accra metropolitan Area, Ghana, *Journal of Environmental Health*, 68(4):34-36.
- 8) Dudhat M., Malvia M., Muthukia and K., (1997), Effect of nutrient management through organic and inorganic source on growth, yield, quality and nutrient uptake by Wheat, *Indian Journal of Agronomy*, 43:455-458.
- 9) Eghball B., Power F. J., Gilley E. J. and Doran W. J., (1997), Nutrient, Carbon and mass loss during composting of beef cattle feedlot manure, *Journal of Environmental Quality*, 26 (1):189-193.
- 10) Fathima M. and Sekar M. (2014), Studied on growth promoting effects of vermiwash on germination of vegetable crop, *International Journal of Current Microbiology and Applied Science*, 3(6):564-570.
- 11) Frosch R., (1996), Towards the end of waste: Reflections on a new ecology for industry, *Daedalus*, 125(3):199-212.
- 12) Giusti L., (2009), A review of waste management practices and their impact on human health, *Waste Management*, 29(8):2227-2239.
- 13) Godara A., Gupta U., Lal G. and Singh R., (2014), Influence of organic and inorganic source of fertilizers on growth, yield and economics of Coriander (*Coriandrum sativum* L.), *International Journal of Seed Spices*, 4(2):77-80.
- 14) Godara, U. Gupta, R. Singh and Mehta R., (2012), Effects of different combinations of organic and inorganic nutrient sources on productivity and profitability of Fenugreek (*Trigonella-foenium-graecum* L.), *International Journal of Seed Spices*, (2)2:34-37.
- 15) Gouveia N. and Prado R., (2009), Health risks in areas close to urban solid waste landfill Sites, *Revista De Saude Publication*, 44(5):1-8.
- 16) Joshi R., Vig A. and Singh J., (2013), Vermicompost as soil supplement to enhance growth, yield and quality of *Triticumaestivum* L.: a field study,

- International Journal of Recycling of Organic Waste in Agriculture*, 2 (16):1-7.
- 17) Katre N., (2012), Use of vegetable waste through aerobic composting of village Bamhani, District: Gondia (Maharashtra state), India, *International Journal of Life Science Biotechnology and Pharma Research*, 1(4):134-142.
- 18) Krogman U., Boyles L., Martel C. and Comas K., (1997), Bio solids and sludge management, *Water Environment Research*, 69:534-549.
- 19) Lazcano C., Gomez-Brandon M. and Domínguez J., (2008), Comparison of the effectiveness of composting and vermicomposting for the biological stabilization of cattle manure, *Chemosphere*, 72:1013-1019.
- 20) Marshal E., (1995), Analytic study to evaluate associations between dumpsites and birth effects, ATSDR CO. LTD: Atlanta
- 21) Medina M., (2002), Globalization, Development and municipal solid waste management in third world countries, Tijuana. Mexico: E1 Colegio de la Frontera.
- 22) Mehta N. and Karnwal A., (2013), Solid waste management with the help of vermicomposting and its applications in crop improvement, *Journal of Biology and Earth Sciences*, 3(1):8-16.
- 23) Melero M., Vanderlinden K., Ruiz J. and Madejon E., (2008), Long-term effect on soil biochemical status of a vertisil soil under conservation tillage system in semi-arid Mediterranean conditions, *European Journal of Soil Biology*, 44(4):437-442.
- 24) Mylavarapu R. and Zinati G., (2009), Improvement of soil properties using compost for optimum parsley production in sandy soils, *Science and Horticulture*, 120:426-430.
- 25) Nabegu A., (2010), An analysis of municipal solid waste in Kano Metropolis, *Journal of Human Ecology*, 31(2):111-119.
- 26) Nguyen P., Matsui Y. and Fujiwara T., (2011), Assessment of plastics waste generation and its potential recycling of household waste in Can Tho City, Vietnam, *Environmental Monitoring and Assessment*, 175(1-4):23-35.
- 27) Nwanta A. and Ezenduka E., (2010), Analysis of Nsukka metropolitan abattoir solid waste in South Eastern Nigeria: Public health implications, *Archives of Environmental and Occupational Health*, 65(1):21- 26.
- 28) Parthasarathi K., Balamurugan K. and Ranganathan L., (2008), Influence of vermicompost on the physico-chemical and biological properties in different types of soil along with yield and quality of the pulse crop - Black gram, *Iran Journal of Environmental Health Science and Engineering*, 5(1):51-58.
- 29) Postma J., Montanri M. and Van den Boogert PHJF., (2003), Microbial enrichment to enhance disease suppressive activity of compost, *European Journal of Soil Biology*, 39:157-163.
- 30) Pushpavalli R., Arulthasan T. and Kandaswamy K., (2014), Growth, nutrient uptake and yield of Okra (*Abelmoschus esculentus* (L.) Moench) as influenced by organic and inorganic K fertilizers, *Academia Journal of Agricultural Research*, 2(10):203-206.
- 31) Rushton L., (2003), Health hazards and waste management, *British Medical Bulletin*, 68(1):183- 197.
- 32) Sadaria S., Malavia D., Khanpara V., Dudhatra M., Vyasand M. Mathukia R., (1997), Irrigation and fertilizer management in Onion (*Allium cepa* L.) and its residual effect on Groundnut (*Arachis hypogaea* L.), *Indian Journal of Agronomy*, 42(4):709-712.
- 33) Sankoh F., Yan X. and Tran Q., (2013), Environmental and health impact of solid waste disposal in developing cities: A case study of Granville Brook Dumpsite, Freetown, Sierra Leone, *Journal of Environmental Protection*, 4(7):665-670.
- 34) Savci S., (2012), An agricultural pollutant: Chemical fertilizer, *International Journal Environmental Science and Development*, 3(1):77-80.
- 35) Sharma S., Angoorbala B. and Rameshwari M., (2014), Effect of different chemical fertilizers on growth parameters and Chlorophyll of Wheat (*Triticum aestivum* L. GW 366),



- International Journal of Agriculture and Crop Sciences*, 7(14):1371-1377.
- 36) Singh K., Snman A., Singh P. and Srivastava T., (2007), Improving quality of sugarcane-growing soils by organic amendments under subtropical climatic conditions of India, *BiolFertil Soils*, 44:367-376.
- 37) Singh S., (2015), Effect of organic manures on growth, yield and economics of Coriander (*Coriandrum sativum* L.), *Journal of Eco-friendly Agriculture* 10(2):124-127.
- 38) Sonmez I., Kaplan M. and Sonmez S., (2007), An investigation of seasonal changes in nitrate contents of soils and irrigation waters in greenhouses located in Antalya-Demre region, *Asian Journal of Chemistry*, 19(7):5639-5646.
- 39) Sood N., (2004), Solid waste management study for free town (component design for World Bank, draft report project no. P078389, Great falls, Virginia.
- 40) Talageri and Narayana J., (2013), Status of Bhendi crop (*Abelmoschus esculentus* (L) Moench) by vermicompost, FYM and NPK fertilizers, *International Journal of Environmental Science*, 2(3):118-124.
- 41) Tandon H., (2011), Bio fertilizers and organic fertilizers - a sourcebook-cum-directly.
- 42) Umesha S., Divya M., Preasanna K., Lakshmipathi R. and Sreeramulu K., (2014), Comparative effect of organics and biofertilizers on growth and yield of Maize (*Zea mays* L.), *Current Agricultural Research*, 2(1):1-9.
- 43) United Nations Environment Program Agency (UNEP); (2006), Informal solid waste management.
- 44) Vedpathak M and Chavan B and Pirgonde B, (2015), Management of agricultural solid waste through Vermicompost, NADEP compost and pit compost method, *International journal of management, IT and engineering*, 5(5):211-216.
- 45) Vedpathak M and Chavan B, (2016), Effects of organic and chemical fertilizers on growth of Coriander (*Coriandrum Sativum* L) crop, *International journal for scientific research & development*, 4(10):631-634.
- 46) Vedpathak M and Chavan B, (2016), Fertilizers effects on growth and yield components of Fenugreek vegetable (*Trigonella foen um-graecum* L.) in a field trial, *International journal for innovative research in science and technology* 3(7):180-183.
- 47) Vedpathak M and Chavan B, (2018), Effect of vermicompost on germination and morphological characteristics of Cluster Bean (*Cyamopsis Tetragonolobus* L) Seedling, *IAETSD Journal for advanced research in applied sciences*, 5(6):67-72.
- 48) Wani S. and Lee K., (1992), Fertilizers, organic manures, recyclable wastes and biofertilisers (Tandon HLS, Ed.), New Delhi.
- 49) Wiederholt R., Franzen D. and Johnson B., (2005), Livestock manure utilization in no-till cropping systems. North Dakota State University Agriculture and University Extension, North Dakota, USA.
- 50) World Bank (WB), (2005), Waste management in China: Issues and recommendations, East Asia infrastructure development.
- 51) Xiao Y., BaI X., Ouyang Z., Zheng H. and Xing F., (2007), The Composition, trend and impact of urban solid waste in Beijing, *Environmental Monitoring and Assessment*, 135(1-3):21-30.

**Challenges and Strategies for Sustainable Agriculture in India.**

**Dr. Sucheta Y. Naik**

Associate Professor in Commerce Shree Mallikarjun and Shri Chetan Manju Desai College,  
Canacona Goa

Corresponding Author- **Dr. Sucheta Y. Naik**

Email-[sucheta.nk@gmail.com](mailto:sucheta.nk@gmail.com)

DOI-10.5281/zenodo.7476151

---

**Abstract**

Agriculture is the backbone of the Indian Economy and it has a significant contribution towards its GDP, employment generation and creating foreign exchange and to have favorable Balance of Payment. Recently, Indian agriculture is affected due to many factors such as climate change, low yield, old technology, urbanization, land use pattern and soil salinity etc. To make country self-sufficient and self-reliant in respect to food and for the future prospect of the economy, sustainable development of agriculture should be the top most priority of the country. Present paper tries to find out the major challenges which develops problem in developing agriculture and tries to highlight few recommendations for sustainable agricultural development. Study also observes the recent policy and action taken by the Government on this issue.

**Key words:** Agricultural development, sustainable, organic farming, farmer's suicide

---

**Introduction:**

For future development of agriculture, 2015 was an important year as sustainable goal focused on promoting sustainable agriculture to end hunger, achieve food security and to improve nutrition. Agricultural sector plays a very important role in the country's economy. It helps to raise the farmer's income in particular and development of non-agricultural sector in general. There are close linkages between farm and non-farm sectors. To develop industry and service sector at a faster speed agricultural development has to focus on growth, equity and sustainability. Sustainable agriculture development integrates following three main goals - Environmental health, economic prosperity and livelihood sustainability. In other words, sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable agriculture is environmental friendly method of farming that allows the production of crops without damaging to the farm and health of the people.

In the last few years food and agriculture is changing significantly due to the increase demand. To increase production to cope up agricultural demand, there are few challenges in respect to size of the farm, poverty, degraded technology, climate change, urbanization and so on. Present study tries to find out the challenges towards sustainable agriculture and accordingly

make recommendations that will be helpful in achieving sustainable agriculture.

**Objectives Of The Study:**

The following are the twin objectives of the paper

To review the challenges towards achieving sustainable agriculture in India

To make recommendations that could be helpful in achieving sustainable agriculture.

**Methodology:**

The paper is based on secondary information collected from research articles, newspaper and other website information. This paper basically highlights the challenges to sustainable agriculture and gives possible strategies that could be considered necessary for sustainable and efficient agricultural development in India.

**Challenges For Sustainable Agriculture**

**Climate Change:** Climate change is growing threat to food and agriculture due to its high dependence on climate and weather. Climate of a country or any locality regulates the nature and quality of vegetation and crops. Increase or decreases in the seasonal temperature reduce the duration and quantity of many crops. In India, the agricultural crop depends on monsoon, and either high or low monsoon causes disasters in farm crop. Another cause is heat waves which impact on Rabi crops. These uncertainties hit the small farmers. Climate Change is projected to have significant impact on conditions affecting agriculture, including temperature, snow and glacial run

## ***Agriculture Development towards Sustainability***

off. Rise in temperatures caused by increasing greenhouse gases is likely to affect crops differently from region to region. Rising sea level reduces land along the coast lines and nearly 6.73 million hectares of agricultural land is affected by salt problems and represent a serious threat to food production to meet the needs of the country (Sharma, 2011).

**Urbanization:** rapid urbanization exercises pressure on the available farm land and water resources. Agricultural land is getting converted to non-agricultural land for residential and industrial development in a large scale, which needs to stop with proper land use policy. Common property resources needed to be protected well. Fast urbanization also causes, downward trend in the number of farm workers (Ghadiyali and Kayasth 2012) and there is a shift in the occupational structure from farming to manufacturing. People now prefer to work in the industrial sector or the service sector rather than working on the farm.

**Groundwater Level:** Groundwater is an important source of irrigation as it provides over 60% of irrigation. The rise of groundwater irrigation greatly contribute to large food production gains, by increasing production in the dry season and reducing the sensitivity of crops to weather variability. Unfortunately, ground water level is rapidly depleting in many regions. Study shows that, groundwater levels have dropped by more than 8 m on average since 1980s. Coupled with policies that support highly subsidized, unmetered, and unregulated electricity, farmers have largely been able to withdraw groundwater in many parts of India. Based on the data published by CGWB in the states for the two time-periods and the over exploitation and critical nature categories of groundwater status, it can be inferred that the situation is alarming in Rajasthan, Punjab and Haryana, especially due to indiscriminate use in the last ten years (Kareemulla, 2017). Extensive use of irrigation facilities in many states, especially by pumping ground water has resulted in depletion of ground water. This may be one of the causes of water scarcity in the near future.

**Use of Chemical Fertilizers:** According to a study conducted by Binoo and Vijayaragavan (2001) in Kerala, it was found that due to the high cost of organic manure and its non-availability in required quantities, the farmers were forced to use chemical fertilizers in higher quantities. This continuous and massive application of the agrochemicals are causing degradation of the environment in terms of reduction in soil fertility, water pollution and indirectly significant contribution to the global warming, climate change and ozone layer depletion. The rise in use of chemical inputs has created adverse environmental and health impacts. The extensive use of pesticides has also resulted adverse effects which is harmful for human consumption.

**Farmers' Suicides:** Farmers' exploitation by the money lenders can be one of the causes of farmers' suicides. Indebtedness was the reason behind the suicide of 93% of farmers. Even though there has been an impressive growth in institutional credit since 1951, the dependence of farmers on non-institutional sources for agricultural credit remains as high as 36 per cent. The suicide of farmers are caused by various reasons such as Indebtedness, Crop failure, Inability to sell the crops grown, low return on yield and Family problems. The indebtedness of farmers is one of the main reasons driving them to commit suicide. The problem starts with the availability of timely credit. The banking sector is not ready to provide credit to agriculture for avoiding risk. From 1991 to 2001, the indebtedness of farmers has grown by two times. Agriculture credit became a low priority, with some committees suggesting withdrawal of credit support to farmers. Credit for housing and buying a car is available at a 9% to 11% rate of interest while the crop loans to the farmer are 17%.

**6. Low yield:** low yield is another issue facing the agricultural sector of India. Farm yield of India is 30-50% lower than that of developed nations. Average farm size, poor infrastructure, low use of farm technologies and decrease of soil fertility are leading contributors to low agricultural productivity. Indian farms are small (70% are less than 1 hectare, the national average is less than 2

## ***Agriculture Development towards Sustainability***

hectares) and therefore have limited access to resources such as financial services, credit, support expertise or irrigation solutions. Low yield limits a farmer's ability to invest into their farm's future to increase productivity and decrease risks associated with their crops. Due to low income, farmer cannot invest into education, healthcare and training of their families.

**Competitiveness of Farmers-** It is imperative to raise the agricultural competitiveness of farmers with small

land holdings. Productivity improvement to increase the marketable surplus must be linked to assured and remunerative marketing opportunities.

**7. Competitiveness of farmers:** it is essential to raise the agricultural competitiveness of farmers with small land holdings. Productivity improvement to increase the marketable surplus must be linked to assured and remunerative marketing opportunities. Crop production will increase and sustainable only when competitiveness of farmers will improve.

**8. Lack of crop insurance mechanism to farmers:** despite having approximately 60% of the gross cropped area rain fed, agricultural insurance mechanism in India is very weak. In India the net sown area is around 140 mha and the gross cropped area around 200mha, but insured area is only 15 mha, which is a biggest challenge as compared to other developed nations.

### **Strategies To Achieve Sustainable Agriculture**

**Controlling Migration:** People are migrating towards city with the expectation of better livelihood but migration adds the slum population in cities. Therefore, rural population should be given employment in their areas and a chance to prosper (Chahal, 2015). The local bodies in various states need to play an active role in formulating and implementing appropriate policies/incentives to retain the rural workforce and divert the unemployed towards viable farming.

**Organic Farming:** With the increase in population our compulsion would be not only to stabilize agricultural production but to increase it further in sustainable manner. The scientists have realized that the Green Revolution, with high input use has reached

a plateau and is now sustained with diminishing return of falling dividends. Organic farming helps in Protecting the long term fertility of soils, Nitrogen self-sufficiency through the use of legumes and biological nitrogen fixation, as well as effective recycling of organic materials including crop residues, Weed, disease and pest control relying primarily on crop rotations, diversity, organic manuring, resistant varieties biological and chemical intervention (Gaur, 2016). Organic farming can be helpful in achieving sustainable agriculture. It needs to be popularized among the farmers, with some minimum support for those who take the initiative in order to avoid any loss.

**New Technologies:** According to Lenka (2015) greenhouse technology of farming has enhanced farm productivity by 3-4 times ahead of normal farming pattern. In the same way poly house farming has raised the agricultural output at about 10 times higher than the previous time due to cost efficiency, absence of insecticides and pesticides and with temperature controlled atmosphere. These success stories of different innovative farming pattern can enhance agricultural productivity with the government and various institutional support (ibid).

**Contract Farming:** Contract farming is a system for the production and supply of agricultural produce under forward contracts, the essence of such contracts being a commitment to provide an agricultural commodity of a type, at a time and a price and in the quality required by known buyers, it basically involves four things: pre agreed price quality, quantity and time, the essence of such arrangement being a commitment to provide an agriculture commodity of a type, at specified time, price and in specified quantity to a known buyer. Contract farming exists between a farmer and a cooperative or processing organization. Commitment driven' contract farming is a viable alternative farming model, which provides assured and reliable input service by farmers and desired farm produce to the contracting firms (Panotra al, 2018).

**Rural Composting:** The broad objectives of rural composting are conserving recycling farm residue resources, safeguarding rural



## ***Agriculture Development towards Sustainability***

public health maintaining or improving the quality of the environment, all at a cost and involving microbiological processes. An appropriate compost technology will make the recycling of farm wastes and will minimize the pollution of water and land resources (Shukl al, 2016). Same can be used as alternative for chemical fertilizers.

Mandatory rainwater harvesting: whenever farms are small, community rainwater harvesting can be promoted. Equity in water sharing essential for cooperation in water saving. Some method of community management like a Pani Panchayat will be useful.

### **Recent Policy Action Taken By The Government Of India:**

To improve soil fertility on a sustainable basis through the **soil health card scheme**. To support the organic farming scheme **Parmpargat Krishi Vikas Yojana** . It allocated a sum of Rs.5300crore.

Other steps include improved access to irrigation through **Pradhan mantri Gram Sinchai Yojana**, enhanced water efficiency **through per drop more crop**

Continued support to **MGNREGA**

The creation of a **unified national agriculture market** to boost the incomes of farmers.

To raise the existing norms of **compensation by a 50%** .Existing compensation amount is Rs.9000per hectare for irrigated crop, rs, 4500per ha. For unirrigated crop and rs. 12000per ha. For perennial crop. Further the compensation will be given to all those who have suffered **even one third loss, relaxing the existing criterion of minimum damage of at least 50%**.

### **Conclusion**

The increasing awareness about the safety and quality of foods, long term sustainability of the present farming system persuades sustainable agriculture practices. The organic farming has emerge an alternative system of farming which not only address the quality and sustainability concerns, but also ensure profitable livelihood option for rural community of India. Making agriculture more climate resistant and environmentally sustainable is the need of an hour to overcome climate issues. The use of

biotechnology and breeding will be important in developing eco-friendly, disease-resistant, climate-resilient, more nutritious and diversified crop varieties. Wider use of digital technology and extension services would be helpful in information sharing and generating awareness among the farmers. More subsidies on agricultural credit, crop insurance, contract farming and minimum support price will help to keep farmers happy for a happy nation. Small-farm management will

improve productivity, profitability and sustainability of the farming system which will go a long way to ensure agricultural sustainability.

### **References:**

1. Sharma, V.P.(2011), "India's Agricultural Development under the new economic Regime, policy perspective and strategy for the 12<sup>th</sup> Five Year Plan, Ahmedabad.
2. Ghadiyali T.R. and Kayasth M.M. (2012), Contribution of Green Technology in Sustainable Development of Agriculture Sector, Journal of Environmental Research and Development.vol.7, No.1 A
3. ChahalMukesh (March 2015) Sustainable Development and Agriculture sector Issue and Challenges, International Journal of Management Research and Review,ISSN 2249-7196,IJMMR, Vol.5, Issue 3, Article No.11, pages 217-222.
4. Basu D. Debarshi D., Kartik M. (2016); 'Farmer Suicides in India: Trends across
5. Major States, 1995-2011', Economic and Political Weekly, Vol. LI, No.21.
6. Bethu Sudhakar (July 2016); 'Sustainable Agriculture Development in India: Issues & Challenges',Paripex - Indian Journal of Research, Vol. 5, No.7,ISSN-2250-1991, IF: 5.215, IC Value: 77.65.
7. Gaur Manisha (January-June 2016); "Organic Farming in India: Status, Issues and Prospects', SOPAAN-II Vol. 1, Issue 1, Pages: 26-36.
8. D,souza,John,(2019) "Sustainable Development of Agriculture in India";Indian Economy" ISBN no.9789380837895 –Broadway publishing House Page26-33.



**Organic Farming: Best Alternative Towards Sustainability**

**Dr. Manisha A. Mahatale<sup>1</sup> Dr. Ashish K. Mahatale<sup>2</sup>**

<sup>1 2</sup> Janata Mahavidyalaya Chandrapur

Corresponding Author- **Dr. Manisha A. Mahatale**

Email- [manishamahatale@gmail.com](mailto:manishamahatale@gmail.com)

DOI-10.5281/zenodo.7476228

---

**Abstract**

Organic farming and food processing practices are wide-ranging and necessitate the development of socially, ecologically, and economically sustainable food production system. Food quality and safety are the two important factors that have gained ever-increasing attention in general consumers. Conventionally grown foods have immense adverse health effects due to the presence of higher pesticide residue, more nitrate, heavy metals, hormones, antibiotic residue, and also genetically modified organisms. Organic farming uses almost exclusively biological and natural materials and processes to produce food. The practice aims to protect human health and conserve, maintain or enhance natural resources, with the goal to preserve the quality of the environment for future generations while being economically sustainable. Organic farming has grown rapidly throughout all over the world. One of the most valuable benefits of organic farming is the improvement in soil quality, which can be expressed in terms of chemical, physical and biological properties and their interactions. To promote food security and sustainability, ecologically intensive farming systems should reliably produce adequate yields of high-quality food, enhance the environment, be profitable, and promote social wellbeing. Yet, while many studies address the mean effects of ecologically intensive farming systems on sustainability metrics, few have considered variability. Although India was far behind in the adoption of organic farming due to several reasons, presently it has achieved rapid growth in organic agriculture and now becomes one of the largest organic producers in the world. Therefore, organic farming has a great impact on the health of a nation like India by ensuring sustainable development.

**Keywords:** Organic farming, Environment, Food, Health, Soil, Pesticides, Sustainable Development

---

**Introduction:**

There are many definitions of organic farming, which is also known as ecological agriculture (Gosling et al., 2006) or biodynamic agriculture (Lampkin, 2002). Some have considered organic farming and sustainable agriculture synonymous, because they are both based on sustainability of agroecological systems. Sustainability can be defined as meeting the need of the present without compromising the ability of future generations (WCED, 1987). The word "organic" is legally protected in some countries, avoiding their indiscriminate use in non-organic products. In the European Union (EU), for example, this word has been protected since the early 1990s in English-speaking countries. The equivalent in French, Italian, Portuguese and Dutch-speaking countries is "biological", and "ecological" in Danish, German and Spanish-speaking countries (FAO, 1998). Food quality and safety are two vital factors that have attained constant attention in common people. more ecologically and authentically

by local systems. Organically grown food and food products are believed to meet these demands. In recent years, organic farming as a cultivation process is gaining increasing popularity. Organically grown foods have become one of the best choices for both consumers and farmers. Organically grown foods are part of go green lifestyle. Organic farming is growing in India. However, while a switch to 'natural' farming has its benefits, scientists argue that it may also result in lower crop productivity, thereby endangering food security in the country.

"Organic farming is our duty," Prime Minister Narendra Modi said, while addressing the nation on the 75th Independence Day on August 15.

Organic farming also known as ecological farming or biological farming, is an agricultural system that uses fertilizers of organic origin such as compost manure, green manure, and bone meal and places emphasis on techniques such as crop rotation and companion planting. It originated early in the 20th century in

reaction to rapidly changing farming practices. Certified organic agriculture accounts for 70 million hectares (170 million acres) globally, with over half of that total in Australia. Organic farming continues to be developed by various organizations today. Biological pest control, mixed cropping and the fostering of insect predators are encouraged. Organic standards are designed to allow the use of naturally-occurring substances while prohibiting or strictly limiting synthetic substances. For instance, naturally-occurring pesticides such as pyrethrin are permitted, while synthetic fertilizers and pesticides are generally prohibited. Synthetic substances that are allowed include, for example, copper sulfate, elemental sulfur and Ivermectin. Genetically modified organisms, nanomaterials, human sewage sludge, plant growth regulators, hormones, and antibiotic use in livestock husbandry are prohibited. Organic farming advocates claim advantages in sustainability, openness, self-sufficiency, autonomy and independence, health, food security, and food safety. Organic farming aims for human welfare without harming the environment and follows the principles of health, ecology, fairness and care for all including soil. The modern concept of organic farming combines the tradition, innovation and science. Most of the organic growers have expressed that lack of support price for organically grown crops and marketing infrastructure as the major constraint in promotion of organic agriculture. Although, much progress on research in organic farming has been done, the new emerging areas of human health benefits, understanding the economics with environmental markets, climate friendly farms and carbon farming with organic farming system models needs to be addressed in future. The certification systems of grower group, participatory guarantee system, know your farm and know your food should be promoted in large scale.

The need of continuously raising the yield, relevant to the continuously increasing market demand, has led to inordinate utilization of the natural and non-renewable resources and energy. Conventional farming

in the face of the Green-revolution system allows the agricultural production capacity to be significantly increased, leading to the highest possible yield per hectare. The improvement of soil fertility through additional application of fertilizers and plant protection chemicals, as well as the utilization of modern agricultural machineries for tilling, irrigation, sowing and crops harvesting, could reach the most remarkable economic benefits on the farm level and thus to provide food production necessary for the fast growing human population. The high yield per hectare and good quality products for the market have given farmers the guarantee of a secure income and consumers the availability of a large spectrum and choice of agricultural products at a reasonable price, independent of the season. The overproduction of different foodstuffs, e.g. sugar, wheat, milk, meat etc., is the luxury problem of the consumerist society. Most of the agricultural foodstuffs on the market in developed countries are mainly produced by such intensive agriculture systems. The excessive use of synthetic chemicals, which vastly contaminate the environment, as well as the mechanical soil disturbance and irrigation, have led to a generation of resistant insects, fungi, weeds, etc., accumulation of chemicals in crops and soil, pollution of water and air and consequently contribute to some extent to the greenhouse effect and global warming.

#### **History of organic farming:**

History states that the movement for organic way of life recognized in 1905, it could gain ground after realizing the ill effects of modern agriculture in the late 1990's. In 1905, the British botanist Sir Albert Howard, often referred to as the father of modern organic agriculture, documented traditional Indian farming practices, and came to regard them as superior to conventional agriculture science. During 1940, In Japan, Masanobu Fukuoka, a microbiologist working in soil science and plant pathology, quit job as a research scientist, returned to his family's farm, and devoted the next 30 years to develop a radical no-till organic method for growing grain, now known as "Fukuoka farming". Many other practices such as Rishi krishi, Natueco farming, homa farming,

## Agriculture Development towards Sustainability

panchagavyakrishi and bio dynamic farming are associated with organic agriculture. The reports indicates organic farming can minimize energy consumption by 30.7 % per unit of land by eliminating the energy required to manufacture synthetic fertilizers and pesticides and by using internal farm inputs, thus reducing fuel used for transportation. India can emerge as global leader due to the presence of large number of organic producers (almost 7 lakh producers) and they needs to be supported with technical knowledge and inputs besides marketing infrastructure.

### Aims and objectives of organic farming:

To produce high quality food in sufficient quantity.

To increase the fertility of soil for longer period of time.

To process organic products using renewable resources.

To produce long lasting and good quality textiles.

To minimize all forms of pollution.

To produce fully biodegradable organic products.

To develop valuable and sustainable ecosystem.

To maintain sociological and ecological balance.

To minimize health problems due to the presence of harmful pesticides.

To increase food quality and safety.

### Advantages of organic farming

Organic farming is environmentally friendly since it helps improve soil fertility and thereby the repeated usage of that particular patch of land for agricultural purposes is possible.

It helps in reducing deforestation caused due to agricultural practices.

Organic farming is seen as a safer alternative. Chemicals do not find a place in this farming technique; farmers use only organic products such as cow dung instead.

To conserve natural resources and biodiversity

Prevent toxic material present in the food.

Prevent different types of the pollutions.

The foods become healthier natural and tasty

Prevent residues present in the food material

This type of farming should be eco-friendly should not affect the environment

We should decrease the soil degradation

No effect to the biological diversity in the system

By the organic farming we should get products they could not have any chemical residues and toxic substances

Instead of using theartificial fertilizers natural fertilizers like bio compost and other are been used

### State-wise major crops grown under organic farming in India

Arunachal Pradesh	Maize/sorghum, Pulses, oilseeds, tea/coffee, herbal/medicinal plants
Andhra Pradesh	Cotton, maize, pulses, oilseeds, fruits and vegetable
Assam	Tea/coffee, fruits and vegetables
Chhattisgarh	Rice, wheat, vegetables
Delhi	Wheat, vegetables
Goa	Fruits, vegetables
Gujarat	Cotton, pulses, oilseeds, vegetable
Haryana	Basmati rice, wheat, maize, vegetable
Himachal Pradesh	Wheat, fruits, vegetables
Jammu and Kashmir	Spices, fruits and vegetables
Karnataka	Cotton, rainfed wheat, maize, sorghum, pulses, oilseeds, vegetables
Kerala	Spices, vegetables, herbals
Manipur	Spices, vegetables, herbals
Maharashtra	Cotton, rice, wheat, pulses, oilseeds, spices, vegetables
Madhya Pradesh	Soybean, wheat, vegetables
Meghalaya	Spices, vegetables
Punjab	Basmati rice, wheat, vegetables
Sikkim	Maize, sorghum, vegetables, spices, herbs
Rajasthan	Cotton, wheat, seed spices, vegetables

***Agriculture Development towards Sustainability***

Tamilnadu	Tea, herbs, spices
Uttar Pradesh	Rice, wheat, maize, vegetables
Uttarakhand	Basmati rice, vegetables, maize, sorghum, herbs, spices
West Bengal	Tea and vegetables

**Government schemes for the organic farming**

National project on organic farming (NPOF) o National horticultural mission (NHM) o National project on management of soil health and fertility (NPMSH and F). There was an organization called national organic farming association (NOFA) it will educate the farmers about the importance of organic farming and it will release monthly magazines and also yearly calendars and they also give training to the farmers. In India, organic and natural farming are being promoted through several schemes including the Paramparagat Krishi Vikas Yojana, Mission Organic Value Chain Development for North Eastern Region under the National Mission for Sustainable Agriculture and more. According to one definition, organic food production also includes farming techniques that do not use genetically modified organisms, growth hormones, and antibiotics.

**Conclusion:**

Ever since there has been urbanization and industrialization, the population explosion has also been in one of the causes of concern for environmentalists and governments alike. To fulfil the hunger of our growing population, harmful agricultural practices have been employed to increase crop production and decrease the time of production through artificial ways. These ways include the use of chemical fertilizers, harmful pesticides, fungicides, herbicides and insecticides to improve the production rate of the crops. While these techniques might help farmers to improve their yield, they are short-sighted in nature and can cause poisoning of the food we consume. Hence organic farming is the ultimate solution to prevent this disaster upon human civilization. Certainly, organic farming has many benefits ranging from reduced environmental pollution to increased soil quality. Organic farming is one of the best farming methods to decrease the cost of the production and also to increase the quality of

the product and the product should be free from the chemical residues and other toxic substances. Let us hope that organic farming will lead all farmers, and their consumers, toward a more productive, prosperous, sustainable, and healthy future. Organic farming has increased tremendously in importance over the past 20 years, including in developing countries, and the global market for organic products has grown. Organic agriculture, in general, is recognized to produce lower yields compared to conventional agriculture, but at the same time, to be more profitable and environmentally friendly, providing equally or more nutritious pesticide-free foods, and additional agroecosystem and social benefits. However, due to the yield gap between organic and conventional farming, the differences in the cost effectiveness are deep, so organic agriculture continues to be a minor alternative to conventional agriculture. Hence organic farming is the best alternative towards sustainability.

**References:**

1. Edward-Jones, G., O. Howells. 2001. The origin and hazard of inputs to crop protection in organic farming systems: are they sustainable? *Agricultural systems*, 67: 31-47.
2. Elliott, E.T. 1994. The potential use of soil biotic activity as an indicator of productivity, sustainability and pollution. In: Pankhurst, C.E., B.M. Doube, V.V.S.R. Gupta, P.R. Grace (Eds.). *Soil Biota: Management in Sustainable Farming Systems*. CSIRO, Melbourne, pp. 250–256.
3. Eltun, R. 1995. Comparisons of nitrogen leaching in ecological and conventional cropping systems, nitrogen leaching in ecological agriculture. *AB Academic Publ.* 103-114.
4. FAO, Food and Agriculture Organization, 1998. Evaluating the potential contribution of organic agriculture to sustainability goals. *Environment and Natural Resources*



***Agriculture Development towards Sustainability***

- Service. Sustainable Development Department. FAO's technical contribution to IFOAM's Scientific Conference, Argentina, November 1998. <http://www.fao.org/DOCREP/003/AC116E/AC116E00.HTM> Accessed March 2007.
5. FAO, Food and Agriculture Organization of the United Nations. 2002. Organic agriculture, environment and food security. Environment and Natural Resources, 6-48.
  6. FiBL, Forschungsinstitut fuer Biologischen Landbau. 2003. Organic Farming in Europe - Provisional Statistics 2002, Provisional Results of a FiBL Survey. <http://www.organic.aber.ac.uk/stats.shtml> Accessed Nov 2006.
  7. Padel S, Lampkin N. The development of governmental support for organic farming in Europe. In: Lockeretz W, editor. Organic farming. An international history. Oxfordshire: CAB International; 2007. p. 93–122. [[Crossref](#)], [[Google Scholar](#)]
  8. IFOAM. Norms-IFOAM basic standards for organic production and processing, IFOAM accreditation on criteria for bodies certifying organic production and processing including policies related to IFOAM Norms. Tholey-Theley: International Federation of Organic Agriculture Movements; 2002. [[Google Scholar](#)]
  9. Willer H, Lernoud J, editors. The world of organic agriculture. Statistics and emerging trends 2015. FiBL-IFOAM report. Bonn: Research Institute of Organic Agriculture (FiBL), Frick and IFOAM – Organics International; 2015. [[Google Scholar](#)]
  10. Yussefi M, Willer H. The world of organic agriculture - statistics and future prospects. Tholey-Theley: International Federation of Organic Agriculture Movements – IFOAM; 2003. [[Google Scholar](#)]
  11. Huber B, Schmid O, Moller C. Standards and regulations: overview. In: FiBL&IFOAM – organics international. The world of organic agriculture. FiBL&IFOAM; 2017. p. 150–157. [[Google Scholar](#)]
  12. Borlaug NE. Ending world hunger: the promise of biotechnology and the threat of antiscience zealotry. Plant Physiol. 2000;124:487–490. [[Crossref](#)], [[PubMed](#)], [[Web of Science](#)], [[Google Scholar](#)]
  13. Huang J, Pray C, Rozelle S. Enhancing the crops to feed the poor. Nature. 2002;418:678–684. [[Crossref](#)], [[PubMed](#)], [[Web of Science](#)], [[Google Scholar](#)]
  14. Cong R, Li H, Zhang Z, et al. Evaluate regional potassium fertilization strategy of winter oilseed rape under intensive cropping systems. Large-scale field experiment analysis. Field Crops Res. 2016;193:34–42. [[Crossref](#)], [[Web of Science](#)], [[Google Scholar](#)]
  15. Panda R, Patra S. Depletion and contribution pattern of available potassium in Indian coastal soils under intensive cropping and fertilization. Int J Pure Appl Biosci. 2017;5(2):1144–1152. [[Crossref](#)], [[Google Scholar](#)]
  16. Yue Q, Xu X, Hillier J, et al. Mitigating greenhouse gas emissions in agriculture: from farm production to food consumption. J Clean Prod. 2017;149:1011–1019. [[Crossref](#)], [[Web of Science](#)], [[Google Scholar](#)]
  17. Birt CA. Food and agriculture policy in Europe. AIMS Public Health. 2016;3(1):131–140. [[Crossref](#)], [[PubMed](#)], [[Web of Science](#)], [[Google Scholar](#)]
  18. Carlier L. Organic farming: back to the past or the solution for a sustainable agriculture – chance and challenge for the Bulgarian and Romanian agriculture. Paper presented at: Organic farming: CAP Conference; 2005 Oct 4–5; Sofia, Bulgaria. [[Google Scholar](#)]
  19. Council Regulation EEC 2078/92 on agricultural production methods compatible with the requirements of environmental protection and landscape. Official J L. 1992;215:85–90. [[Google Scholar](#)]
  20. Carlier, L. Ecological and sustainable forage crop production: a good agricultural practice. Bulg J Agric Sci. 1998;4:129–140. [[Google Scholar](#)]



21. Stojanovic Z, Manic E. Cross-border cooperation, protected, geographic areas and extensive agricultural production in Serbia. *Econ Agric.* 2010;57(SI-1):79–90. [[Google Scholar](#)]Schiml S, Puchta H. Revolutionizing plant biology: multiple ways of genome engineering by CRISPR/Cas. *Plant Methods.* 2016 [cited 2017 Oct 12];12:8. DOI:10.1186/s13007-016-0103-0 [[Crossref](#)], [[PubMed](#)], [[Web of Science](#)®], [[Google Scholar](#)]
22. Bertholdsson NO. Breeding spring wheat for improved allelopathic potential. *Weed Res.* 2010;50:49–57. [[Crossref](#)], [[Web of Science](#)®], [[Google Scholar](#)]
23. Barabaschi D, Tondelli A, Desiderio F, et al. Next generation breeding. *Plant Sci.* 2016;242:3–13. [[Crossref](#)], [[PubMed](#)], [[Web of Science](#)®], [[Google Scholar](#)]
24. Andersen MM, Landes X, Xiang W, et al. Feasibility of new breeding techniques for organic farming. *Trends Plant Sci.* 2015 [cited 2017 Oct 12];20. DOI:10.1016/j.tplants.2015.04.011 [[Crossref](#)], [[PubMed](#)], [[Web of Science](#)®], [[Google Scholar](#)]
25. Dileep Kondepati. “Research Paper on Organic Farming”. *Acta Scientific Agriculture* 3.2 (2019): 92-93

## **Agricultural Laws in India: An Analysis**

**Dr. Asha R. Tiwari**

Associate Professor NTVS's College of Law Nandurbar

Corresponding Author- **Dr. Asha R. Tiwari**

Email-[ashartiwari@gmail.com](mailto:ashartiwari@gmail.com)

DOI-10.5281/zenodo.7476237

### **Abstract**

Majority of Indian population in rural areas depends on agriculture sector for their livelihood. Agriculture in India still today depends much on the monsoon. But due to uncertainty of monsoon, farmers are unable to make their both ends meet. Numerous problems such as uncertainty in monsoon, low income, indebtedness, migration, child labour etc, prevail in this sector. The farmer who toils day and night to feed the entire nation himself remains hungry due to lack of proper income from agriculture. Hence Agricultural Laws are very necessary for protecting and safeguarding the interest of the agriculturists. Agricultural law means the laws, regulations and treaties etc that govern the agricultural land holding, agriculture supply chain like production, marketing, and sales etc. Indian Government has enacted various laws relating to land, seeds, Pests and pesticide, fertiliser, livestock, marketing and labour in agricultural sector. Various agricultural universities have been opened to impart modern agriculture education to the students. Through this paper the author seeks to highlight the various laws relating to agricultural sector and the implementation of such laws in India in context to current scenario.

**Keywords:** Agriculture, Laws & Regulations, Government schemes.

**Introduction:** Agricultural and industrial sectors are the two important key players for the development of any economy. Agriculture supplies raw materials to various industries like sugar, textile, jute, cotton etc. Food processing industries too are dependent on agricultural. Therefore, the development of these industries is much dependent on agriculture sector. In India where we have population explosion, the role played by agricultural sector to suffice the need of our country is very crucial. Therefore steps must be taken to make the agricultural sector more and stronger. However like other sectors, this agricultural sector too faces many problems such as marginalisation of agricultural workers, sustainability, lack of irrigation facilities & dependency on monsoon, over dependence on traditional crops, Supply channel bottlenecks and lack of market understanding, Government handling of the issue, increase in Migrant Labour, low Wages, and Transportation & other infrastructure, lack of education etc. To overcome these problems Government of India has enacted various laws.

### **Agricultural Legislations**

To overcome the problem of fragmented and dispersed holdings, various laws were enacted such as Bombay Prevention of Fragmentation and Consolidation of Holdings Act, 1948, the

Punjab Holdings (Consolidation and Holding) Act, 1953, The UP Consolidation of Holdings Act, 1953, The Rajasthan Holdings (Consolidation and Prevention of Fragmentation) Act, 1954 etc. Similar laws were enacted in entire India.

### **Land Acquisition Act, 1894**

The Land Acquisition (Amendment) Bill, 2007 was passed in the Lok Sabha in 2009 with the aim to protect the interests of the poor farmers whose land is acquired for setting up industries.

### **Sale & Purchase of Agricultural Land :**

The procedure for the sale and purchase of land differs from state to state. For example, the sale and purchase of agricultural land in the state of Maharashtra is governed by the Maharashtra Tenancy and Agricultural Lands Act 1948 (MTAL Act).

### **Land Tenure & its Usage Rights.**

Every State in India has its own laws relating to land usage rights & ownership of agricultural land.

### **Article 246 of the Indian Constitution**

It mentions that the State legislatures have exclusive powers to make laws in relation to any of the matters set out in the State List (List II) of the VII Schedule to the Constitution, which includes "land, rights in or over land, land tenures including the relation of landlord and tenant, and the

collection of rents and transfer and alienation of agricultural land".

## **Transfer of Property Act 1882**

Section 117 exempts the provisions governing leases to agricultural purposes unless and until State government declares it through notification in the Official Gazette that it is applicable.

## **Seed legislations**

Seeds Act, 1966

Seeds (Control) Order, 1983.

Protection of Plant Varieties and Farmers' Rights Act, 2001

## **Fertilizer legislations**

The Industries (Development and Regulation) Act, 1951

The Essential Commodities Act, 1955.

Fertilizer (Control) Order, 1957/1985

Fertilizer (Movement Control) Order, 1960/1973/2001 (FMCO)

## **Pests and Pesticide legislations.**

The Insecticides Act, 1968 and Insecticides Rules, 1971. Insecticide (Amendment) Act, 2000.

The Destructive Insects and Pests Act, 1914 .

## **Genetically modified organisms (GMOs) and agricultural biotechnology**

Protection of Plant Varieties and Farmers' Rights Act (PPVFRA), 2001

National Biodiversity Act, 2002

National Seed Policy, 2002

Plant Quarantine (Regulation of Import into India) Order, 2003

Foreign Trade Policy, 2006

Food Safety and Standards Act, 2006

Recombinant DNA Safety Guidelines, 1990

Revised Recombinant DNA Safety Guidelines, 1994

## **Legislations governing Agricultural Marketing in India**

Agricultural Produce Market Act.

The Agricultural Produce (Grading and Marketing) Act, 1937.

The Weights and Measures Act 1985.

Food Safety and Standards (Amendment) Act 2008.

Agricultural Produce Market Committee (APMC) Act etc

## **Legislations in Livestock Sector**

1. The Livestock Importation Act, 1898, amended in 2001.

2. The Glanders and Farcy Act, 1899.

3. Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009.

## **Labour Laws governing Agriculture Sector in India.**

The Minimum Wages Act, 1948.

Equal Remuneration Act 1976.

The Bonded Labour System (Abolition) Act 1976.

Inter-State Migrant Workmen (Regulation of Employment And Condition Of Service) Act, 1979.

Child Labour (Prohibition and Regulation Act), 1986

The Mahatma Gandhi Rural Employment Guarantee Act, 2005 (w.e.f 2-10-2009)

The Unorganised Worker's Social Security Act, 2008. Etc.

Recently in the year 2020 Government brought three Acts for Farmers.

The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act 2020.

The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act 2020'

The Essential Commodities (Amendment) Act 2020.

But due to huge protest of farmers all over the nation, Government has repealed these three enactments by passing The Farm Laws Repeal Bill 2021.

## **Government Schemes**

Computerization of land records (CLR)

Farmers Agriculture Service Centers FASCs

Comprehensive Crop Insurance Scheme

Indira Awas Yojana

Jawahar Gram Samridhi Yojana (JGSY)

Bharat Nirman

Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

Rastriya Swasthya Bima Yojna :

Aam Aadmi Bima Yojna etc

## **Conclusion and Suggestions:**

Apart from various legislations as mentioned above, Government has undertaken various measures too such as Panchayat (Extension to Scheduled Areas) Act, 1996, Consumer Protection Act 1986 (Amended in 2019) etc for uplifting the status of agriculturist.

Despite this Farmer Suicide is everyday's news. Creating Legal Awareness among people is must so they can understand their rights and demand for implementation of

various laws, Rules, Regulations, Government Schemes framed for them. We must come forward to see that the agriculture sector gets its due share. NGO's too must work out for farmer's upliftment. Special Panel of Advocates must be dedicated for resolving farmer's legal Issues. Special Care must be taken to see that children of farmers are educated so that they would not be exploited due to their ignorance. Let us all come together and extend our helping hands to Agricultural Sector so that people working in such sector can also live a dignified life like us.

**References:**

- 1) Dr. J.N. Pandey, 'Constitutional Law of India', Central Law Agency 51th Edition 2014.
- 2) Dr. S.R. Myneni, 'Labour Law II', Asia Law House 1<sup>st</sup> Edition 2018.
- 3) Dr. V. G. Goswami 'Labour And Industrial Laws', Central Law Agency 9<sup>th</sup> Edition 2011.
- 4) Narendra Kumar, 'Constitutional Law of India', Allahabad Law Agency 9<sup>th</sup> Edition 2015.
- 5) S. N Misra, 'Labour And Industrial Laws', Central Law Publication 23th Edition 2007.
- 6) <https://www.latestlaws.com/bare-acts/central-acts-rules/food-agriculture-laws>



**Challenge to Indian Agriculture : Land Fragmentation – Causes, Its Implications and Remedies**

**Prof. Yuvraj Pandharinath Jadhav**

Vice-Principal & Head Department of Economics MVP's Arts, Sci. & Commerce. College Ozar  
(Mig) -422206 Tal. Niphad, Dist. Nasik.

Corresponding Author- **Prof. Yuvraj Pandharinath Jadhav**

Email: - [yuvrajadhav69@gmail.com](mailto:yuvrajadhav69@gmail.com)

DOI- 10.5281/zenodo.7476252

---

**Abstract :**

Agriculture is considered the backbone of Indian economy which provides the employment to the 55% population of the country. After the acceptance of the globalization Indian economy has witnessed the remarkable changes through the improvement in the growth rate with higher contribution of the industrial and service sector. In this process agriculture sector has received the benefits through the use of technology and high yielding varieties. Currently Indian agriculture sector is passing through the tough times as number of farmers suicide has increased which has led to raise the farmers distress in the country. Agriculture sector has many challenges but land fragmentation has been issuing serious threats to the sector. Number of marginal farmers has been increasing which has resulted into the decrease the income level of the farmers. Effect of the lower land ownership creates the multiplier challenges to this sector. Problems of the land fragmentation in the Indian agriculture sector need to solve in order to maintain the sufficient growth rate of the sector.

---

**Introduction**

Indian economy is fastest growing economy in the world. Since 1991 growth rate of the economy has been remained magnificent over the 7 percent. India has achieved success in terms of the enormous expansion of the service sector into the economy along with Industrial sector. India is the second largest nation in terms of population and also having highest demographic dividend as compared to other countries. Whole world is looking towards India as chief drivers of the world economy and also considers growth of engine for world. Over the past few decades, the Indian economy has been acquiring higher capabilities in terms of food security, social overhead capital, technology, human development and an overall economic growth. Though the economy is remained successful on the some overall factors, but in this entire process of high growth era Agriculture sector is going through the tough time. As initially it is said the India is basically agriculture based economy. This sector still constitutes 65 percent employment to the population. From the outside it seems Indian economy is passing through the golden age of development, but agriculture sector is emerging problems for the economy as its sluggish growth rate. Currently composition of GDP as service sector contributes 56 %,

Industrial sector 29% and Agriculture sector contributes 15 %. It indicates the growth of the economy is not equitable for the agriculture sector. Theories defines that as economy grows, comes up with higher industrialization its leads to decline of agriculture sectors shares in the GDP. But Indian agriculture sector is facing challenges. As one of the most agriculture dominated economy its is also having more farmers suicide in the country. It has arise biggest paradox of the economic development. From farm subsidies to farm loan waivers, the Indian government spends crores on farmer welfare, but these efforts will be inadequate unless they can tackle an increasingly daunting barrier: lack of land. The provisional figures from the latest agriculture census reveals how land the most critical input for agriculture is getting more fragmented

Loan waiver has arrived a solution to the government to get rid of the agriculture problems. But this is not the final solution for the entire challenges of agriculture. To address issues of this sector root causes of the problems need to take into account. Researcher find out the land fragmentation of the Indian agriculture has emerged the main reason for agriculture's weak performance. Researcher in this paper will focus on the main causes of land

## Agriculture Development towards Sustainability

fragmentation and explore the implications of land fragmentation for the Indian economy and will suggest remedial measures as possible solution to the problem.

### Objectives

To understand the main causes of land Fragmentation

To explore the Implications of land Fragmentation on Indian Economy.

To suggest remedial measures for the solution to this problem.

Land fragmentation in India has important reasons. After the Independence Indian economy has guided by the planning commission for the economic growth. At the Primary stages of the development government gave priority to the agriculture sector, as setting infrastructure projects in rural area. In the Seventies India implemented land reforms in order to achieve equitable land holding pattern. At some extent it has achieved some moderate success.

As India is agriculture based economy, throughout the growth process pressures on agriculture for employment did not decline as it was expected. Population of India has been increasing, and this lead to become problems for the agriculture sector. Land fragmentation is consistently is taking place due to some reasons as its follows.

1. **High Population growth** : Population in India has been consistently increasing and it is said this country at the second stages of Demographic cycle, Where death rate of the population has been reduced as acquiring greater health facilities in the Indian society, But birth rate of population has not declined due to social status of the Indian women still remains secondary. The population growth rate has shown in the following table.

Decade	Population Growth Rate
1951	1.25
1961	1.96
1971	2.20
1981	2.22
1991	2.16
2001	1.97
2011	1.64

(Source – Population Census 2011)

From this table, growth rate of the population clarifies that population in India has been increasing. And it has created enormous pressure on agriculture to provision of employment. This gigantic burden of high population led to land fragmentation of the land holding and created further issues for agriculture.

**2. Inheritance System:** As India has enormous population; Inheritance system in the country has received huge attention. This pattern kept working from one generation to another generation. In rural area literacy level of the people low, as they could not move out for the job to industrial sector. They have to make dependent on the agriculture for survival. And due to this they make demand of their own share in inherited land, and it creates inception for land fragmentation. This process keeps working from generation to generation. Because of this, It has divided land in more acres. This Shrinking size of the land has shown in following table.

### India's Shrinking Farms (Average Farm Size)

Year	Land Size (In hact)
1976-77	2.00
1995-96	1.41
2015-16	1.08

(Source – Agriculture Census 2015-16)

From the above table it describes the impact of inheritance on the shrinking farm size. It also reflects that after the 20 years, land divides within the brothers. In spite of having government job to a brother, he also demands for inherited land and it leads to more fragmentation of land holding. This is also main cause of land division. Today 73 % land fragmentation is happening due to inheritance and legal provision of living independently in single family.

**3. Infrastructure Development:** This is also considers important reason for land fragmentation. As government takes imitative for infrastructure development in rural area such as building of roads, mobile towers, it lead to occur land division. Some times in the family for their own requirement of well digging land has to divide.

**4. Family Disputes:** Nowadays, a Family dispute has also become important cause for

## ***Agriculture Development towards Sustainability***

the land divide into more pieces. Indian Society has problem of family disputes. Due to this most of the land fragmentation happens. Within family no one take the cooperative side, everyone has wish to live independently and breaking of joint family structure. Sometimes family members deliberately come at the point of disputes for the land distribution. Because a brother has to sell his share of land as he feels that part of belongs to him for his own expenditure. In India most of violence has happened so far over the issue of land distribution. In these serve circumstances; Head of the family distributes land between his sons. So, it leads to more divide of the land into a single acre. Because of this fragmentation of land has increased in India at the fourfold level.

### **Implications of Land fragmentation:**

As Indian agriculture sector is passing through the serve challenges of land fragmentation, this has resulted into huge implications for the agriculture sector and overall economy. Some major consequences of this problem as follows.

**1. Operational Size Declined:** The agriculture Census 2015-16 shows that the area under farming in India declines from 159.59 million hectares in 2010-11 to 157.14 million hectares in 2015-16. The average size of operational holdings in India has declined from 1.15 hectares to 1.08 hectares. It means that Agriculture sector in in deep crisis as farm size is reduced to 1.08 hect. Due to high land fragmentation lowering of farm size has been emerged as the big threats to the Indian Economy.

**2. Low Productivity:** As land division is taking place at fourfold time, it has led to low productivity of the farm sector. The fragmentation has resulted into increasing time and cost of input such as labor, fertilizers and pesticides. In the absence of it, productivity has been declining. In the lower size of the farm, economies of scale unable to function properly and benefits of the scale does not go into the way of small land holder. Due to this agriculture productivity is remaining low as compare to other countries.

**3. Low Income of Farmers:** As lower the size of farm land, more marginal farmers in the agriculture sector. This farmer uses better inputs, fertilizers but still they are

unable to increase their incomes. Given household sizes in rural India, small farms struggle to generate enough income for everyone in a household and often lack alternative sources of income. Most of the time production cost of the crops remains high to the marginal farmers. As they have to use their own inputs, it leads to more spending on inputs where the other family members inputs such as tractor, other equipment's remains idle. Due to family disputes over the land, no one help to each other to get rid of high production cost and finally resulted into the lower income.

**4. Growing Income Inequality: Generally farm size is an important determinant of income and, consequently, income inequality.** For marginal farmers those having less than a hectare of land, household consumption exceeded net monthly income of less than ₹ 5,500 from both farming and non-farming activities. In the current situation Farmers income has lowered due to the farm crisis, and other side cost of survival has been increasing. Nowadays, 2015-16 agriculture census data reveals that nearly 100 million farming households would struggle to make ends meet. Examining farmer incomes between 2003 and 2013, it is found that incomes grew the least for marginal farmers and growth of incomes was proportional to the size of a farm. Doubling of farm incomes is a reality only for the largest land-owning group. Benefits of the large scale production, economies of scale limited only to the large rich land holders farmers. So, as result of this Income inequality in the agriculture sector has increased.

**5. Higher Farmers Suicide:** As farm size in the agriculture sector is declining, it has resulted into higher farmers suicide is happening in India. Lower land size leads to lower productivity along with Higher production cost, and lower the crop price exacerbated the further situation of the farmers as they can't repay the loan of the banks, Moneylenders. Finally cramping depression ends with the farmers suicide. This is the real situation of the Indian marginal farmers. Today Indian farmer is going through the difficult condition.

**6. Lack of Agriculture land In Future:** If as speed of land fragmentation don't curtail,

## ***Agriculture Development towards Sustainability***

India will end with having no agriculture land for the cultivation in future. Because as of now numbers of farmers are increasing into the marginal farmers category. This number will increase more if land divide don't stop. And will have more poverty in future than current numbers.

**7. Lower Growth Rate of Agriculture:** It is because of the lower size of the land, as numbers of marginal farmers has increased in the sector, productivity of the sector is remaining below than its potential. This sector has arrived in such situation where the share of the agriculture sector in the GDP remains only up to the 15 %. Its creates more multiplier effects on entire sectors of the economy.

### **Remedial Measures:**

As above implications indicates that further land fragmentation can aggravates more to the agriculture sector, and in order to avoid more damage to the economy some strong action need to take to the government. For this researcher has suggested the some remedial measures as possible solutions the problem. These are follows

#### **1. Ban on the Further Land fragmentation:**

Time has come now to take right and strong measures in order to avoid more destruction of the agriculture sector. Ban on the Further Land fragmentation, This measure can be become good solution to the problem. If government makes law and implement it appropriately, it will definitely save the farm land by breaking into more small pieces.

#### **2. Improving Land Records:**

Government should improve land records more carefully. It will help to stop more land divide. Government officials will able to understand the remaining size of the farm land.

#### **3. Provision of Non- farm Employment Opportunities:**

Excess burden of the population on agriculture sector can be reduced through the implementation of this measure. Government should provide such employment opportunities through the setting up agro based business into rural area so that further land fragmentation can be avoided.

#### **4. Counseling of the people:**

In Indian Agriculture sector government need to focus on the counseling of the farmers on the not to divide land. It can be help to start cooperative farming and can be save the land from fragmentation. Government should bring awareness within the farmers through organizing programs.

#### **5. Improvement in the Infrastructure:**

Current infrastructure in rural area is inadequate, to overcome of this government need to invest more into roads, irrigation projects so that will help to boost productivity of agriculture and farmers will not sell land through fragmentation.

#### **References:**

1. Brian Lobo -Maharashtra : Land Reforms: Turning the Clock Back Economic & Political Weekly Vol. 37, Issue No. 06, 09 Feb, 2002
2. Dr.B.R.Ambedkar -"Small holdings in India and their remedies" –
3. Agarwal, S. K. (1972). Economics of land consolidation in India. New Delhi: Chand P
4. Government of India -The Agriculture Census 2015-16
5. Vishnu Padmanabhan- The land challenge underlying India's farm crisis- Live mint 15 Oct 2018



**Use of non-conventional methods for the extraction of value-added products from citrus waste**

**Mr. Ghadge Amit Babasaheb**

Department of Science Smt. Ratnaprabhadevi Mohite Patil College of Home Science for Women,  
Akluj, Tal-Malshiras, Dist-Solapur

Corresponding Author- **Mr. Ghadge Amit Babasaheb**

Email: [amitghadge9921@gmail.com](mailto:amitghadge9921@gmail.com)

DOI- 10.5281/zenodo.7476261

---

**Abstract**

Oranges, grapefruit, lemons, limes, and mandarins are just a few of the citrus fruits that are grown most frequently worldwide. Nearly half of the weight of fresh fruit is wasted in the citrus processing business, which generates enormous amounts of trash. Orange juice results in a significant quantity of waste generation. The bioactive chemicals are typically extracted from orange peel using traditional extraction methods. carotenoids are hydrophobic and unstable at higher temperatures, under the influence of light and oxygen, and under other external conditions, their usage in food, cosmetic, and pharmaceutical goods is restricted. The use of safer and less harmful substitutes has begun to be addressed, and it has been a priority to reduce the negative effects that solvents routinely used in industry have on the environment and human health. The major classes of carotenoids, chlorophyll, anthocyanin, and betalains are represented by the pigments that the UAE is stated to have extracted from by-products. Conventional techniques that use organic solvents have a same negative environmental impact as citrus waste because they demand lengthy extraction times, a lot of energy, and other resources.

**Key words:** solvent extraction, ultrasound extraction, citrus, oranges, green-extraction, pigments

---

**Introduction**

Oranges, grapefruit, lemons, limes, and mandarins are just a few of the citrus fruits that are grown most frequently worldwide. Brazil is the world's top exporter of citrus fruits that have been processed, particularly frozen orange juice concentrate. Due to rising consumer demand, their cultivation and production is increasing every year. Nearly half of the weight of fresh fruit is wasted in the citrus processing business, which generates enormous amounts of trash.<sup>1</sup> Orange peel is a source of many polyphenols, carotenoids, dietary fibre, sugar, essential oils, ascorbic acid, and considerable amounts of some trace components.<sup>2</sup> Due to the fact that orange peel, which is made up of flavedo and albedo, makes up over a quarter of the total fruit mass, the high production of orange juice results in a significant quantity of waste generation. Citrus trash also contains other carotenoids. Orange peel extracts offer a variety of pharmacological properties that are crucial for the prevention of many human diseases as a result of their chemical makeup. The

aforementioned bioactive chemicals are typically extracted from orange peel using traditional extraction methods. The green approach led to the development of various extraction techniques that are quick, effective, and prevent the degradation of thermolabile chemicals. In orange peel, alpha-carotene, beta-carotene, lutein, zeaxanthin, and -cryptoxanthin are the most prevalent carotenoids.<sup>3</sup> The recovery of these natural value-added elements from citrus trash, such as fibre, bioactive compounds, additives, and pigments, has improved. Depending on the kind of solvent used and the extraction method, the total carotenoid concentration ranges from 11 to 204 mg of -carotene equivalents per 100 g of dry weight. They are typically extracted using acetone, ionic liquids, and a mixture of hexane and isopropanol, but these methods can be hazardous to the environment.

The oils are increasingly used as solvents since they are non-toxic and non-irritating. Increased immunity and a decreased risk of developing degenerative illnesses

including cancer, Alzheimer's disease, and cardiovascular disease are linked to an organism's intake of carotenoids.<sup>4</sup> Because carotenoids are hydrophobic and unstable at higher temperatures, under the influence of light and oxygen, and under other external conditions, their usage in food, cosmetic, and pharmaceutical goods is restricted. Encapsulating carotenoids in various delivery systems is one approach to solving the aforementioned issue. For the encapsulation and release of carotenoids, a variety of biopolymers were used as carrier materials, including starch, cyclodextrins, carrageenan, pectin, alginate, etc.<sup>5</sup> Natural pigments called carotenoids have grown in importance in the food business as a replacement for rapidly dated artificial colours. Natural compounds are now more in demand than their synthetic counterparts, and there has been more focus on the differences between natural and synthetic products in recent years. The advent of the "Green Chemistry" concepts has changed how both academia and industry construct chemical processes as a result of growing environmental and sustainable development concerns over the past few decades. The use of safer and less harmful substitutes has begun to be addressed, and it has been a priority to reduce the negative effects that solvents routinely used in industry have on the environment and human health. Alternative extraction methods with "greener" and "more sustainable" credentials have been developed by researchers.<sup>6</sup> Ultrasound is a new technology that has been extensively researched in the food industry to enhance procedures and outcomes.<sup>7</sup> The passage of acoustic waves and acoustic cavitation generate several mechanisms that are responsible for variations in the original matrix of the sample when ultrasound is applied to a product with solid or fluid properties. By extracting substances of interest, such as natural pigments, one can make use of the effects of ultrasound to benefit from by-products.

#### **Extraction of Natural Pigments From By-Products Using Ultrasound Assist**

By-products may be utilized as a fresh sample or one that has already been conditioned. Sample preparations frequently involve freezing or drying using hot-air, sun, or freeze-drying techniques.<sup>8</sup> The dried materials are next ground or chopped, then sieved to continue with UAE. After the samples are ready, they are combined with a solvent and put through the UAE process to produce extracts rich in natural pigments. These extracts can then be employed in a variety of food, medicinal, and cosmetic applications as dried pigment or concentrated extract. The major classes of carotenoids, chlorophyll, anthocyanins, and betalains are represented by the pigments that the UAE is stated to have extracted from by-products.<sup>9</sup>

#### **Carotenoids extraction from by-products using ultrasound assist**

Lipophilic pigments known as carotenoids, which are primarily generated by plants, algae, and some creatures like arthropods and salmonids, are what give things their distinctive yellowish, orange, and reddish hues.<sup>10</sup> Both xanthophylls, which contain oxygen in their chemical formula, and carotenes, which do not, are two major categories of carotenoids. Carotenogenesis of carotenes and xanthophylls is governed by the transcript genes, which are primarily regulated by light and temperature. Many other natural carotenes and xanthophylls are synthesised from lycopene, which is regarded as the first colored carotenoid in the process. Alpha carotenes are produced from lycopene, and whereas beta-carotene is transformed into lutein, Alpha-carotene is changed into a variety of different compounds, including cryptoxanthin, zeaxanthin, antheraxanthin, capsanthin, violaxanthin, and neoxanthin. Due to their ability to act as antioxidants and as precursors of vitamin A, carotenoids are crucial functional metabolites in the human body and have been linked to significantly lower rates of cancer, cardiovascular disease, and age-related macular degeneration. Conventional techniques that use organic solvents have a same negative environmental impact as citrus waste because they demand lengthy extraction

times, a lot of energy, and other resources.<sup>11</sup> The difficulties of traditional extraction techniques, the accessibility of citrus waste, and the growing desire to minimize environmental impact have all boosted interest in the proper treatment of this sort of trash. As a result, research into unconventional technologies known as "green extraction methods" has become more important.

#### **Experimental bases for Ultrasound Assisted Extraction**

Using waves with a frequency exceeding 10 MHz, ultrasonic application, also known as ultrasound assisted extraction (UAE), is a cutting-edge method.<sup>12</sup> Initially, it was intended to preserve food, but in the past ten years, it has also been employed to extract beneficial components (mainly polyphenols). Due to the technique's simplicity, benefits like shorter extraction times, higher extract yields, and the use of water as a solvent rather than organic solvents have been mentioned, all of which lower environmental hazards. UAE is regarded as a "green extraction process" due to these factors.<sup>13</sup>

Citrus fruit residues have been used to extract bioactive substances and pectins using the cavitation and disruptive capabilities of USN. In numerous investigations, the extraction of carotenoids, phenolic compounds, and pectins from citrus waste by USN is described along with the impact of the parameters utilized. The method's optimization and a study design are usually incorporated in USN studies. The response surface methodology (RSM) is highly helpful in this area. Since carotenoids are naturally occurring fat-soluble pigments that give citrus fruits their distinctive yellow, orange, and red hues as well as their roles in photosynthesis and photoprotection, the peel is primarily the material employed in the extraction of carotenoids from citrus waste.<sup>14</sup> Its 40 terpenoid carbons, made from isoprenoids, are connected by double and single bonds that make up its structure. Some types of carotenoids are more closely associated to polar solvents like acetone or a-polar solvents like hexane because of their structure.<sup>15</sup> These

solvents are extremely hazardous and challenging to get rid of. Studies on the effectiveness of extracting phenolic components from citrus residues utilising UAE provide information on this topic.

The primary and secondary metabolites in plants are phenolic compounds, which have more than 9000 known chemical configurations. The two primary types of polyphenols in citrus species are flavonoids and phenolic acids.<sup>16</sup> However, the main phenolic chemicals found in orange peel are flavonoids.<sup>17</sup> Several studies have detailed the effectiveness of UAE against CE and the parameters examined to recover phenolic chemicals from citrus waste. For instance, The most sensitive parameters for the extraction of phenolic acids from tangerine peel (*Citrus unshiu* Marc) using USN are time, temperature, and the power of the equipment. The scientists found that increasing the extraction duration (10–40 min), power (3.2–30 W), and low temperatures (15°C and 30°C) enhanced the yield of the extracts.<sup>18</sup> They demonstrated the effectiveness of UAE against CE (maceration) and showed that they could achieve better results with shorter extraction times. Similar to this, Khan et al. compared the extraction of polyphenols from orange peel using UAE and CE (*Citrus sinensis* L.).<sup>19</sup> They demonstrated that the particle size of 2 cm<sup>2</sup> favored a greater yield, recovering 38% and 41% more of naringenin and hesperidin, respectively, in comparison to the sample treated with CE, even though it is true that they did not identify the factors that significantly influenced the results. The efficiency of UAE against CE in the extraction of polyphenols (*Citrus reticulata* L.) from mandarin peels was then compared by Safdar et al. in 2017.<sup>20</sup> They used methanol 80% as the solvent and found that the UAE samples had the greatest concentration of TPC (3248 mg GAE/100 g). Using ethanol 80% as the solvent, they also demonstrated that the main component in orange peel.

Citrus waste's primary component of the cell wall is pectin, a complex carbohydrate that is chemically organized as a galacturonic

acid polymer with a variable amount of methyl ester groups and abundant in citrus peel. For use as a byproduct, this chemical is frequently extracted using traditional techniques. Numerous research demonstrate that using an unorthodox methodology, like UAE, can produce good extraction outcomes. For instance, Bagherian et al. employed USN treatment to extract grapefruit skin pectins (albedo).<sup>21</sup> They were able to extract 17.92% of the pectins with a 25-minute extraction period utilising acidified water with a pH of 1.5 and 0.1 N HCl as the extracting agent. Wang et al.<sup>22</sup> also studied the effectiveness of ultrasound aided heating extraction (UAHE) for extracting pectins from grapefruit peel in comparison to traditional heating extraction (CHE). As an extraction solvent, deionized water that has been pH-adjusted by 0.5 M HCl was utilized. In comparison to pectin extracted by CHE, the pectin yield of grapefruit peel treated by UAHE was 16.34% higher. The authors noted that power intensity and extraction temperature, as well as their interactions with power intensity and sonication time, both had an impact on the pectin yield. Additionally, the pectins extracted by UAHE had a degree of esterification, polyphenols, and flavonoids concentration of 65.52%, 4.21 g GAE/mg, and 1.76 g RE/mg, respectively.

### **Conclusion**

The United Nations' sustainable goals by 2030 are in line with the present emphasis in reducing industrial and food waste. Researchers have been more interested in employing ecologically friendly technology to extract bioactive chemicals from food waste, such as citrus leftovers. These substances have potential for re-use in the food, pharmaceutical, and cosmetic industries. It is well recognized that bioactive substances and pectin can be recovered from citrus waste using traditional procedures. However, because organic solvents are used, conventional procedures need a large time and energy investment, making them an undesirable choice.

The replacement of unconventional approaches, on the other hand, has demonstrated a significant number of benefits in a framework of green extraction for the extraction of high biological value chemicals from citrus by-products. The majority of researchers who use unconventional approaches conduct an optimization study since certain parameters can affect the outcomes depending on the properties of the chosen technologies and samples. The most important factors to take into account when choosing the best technology are the type of waste and the molecules that need to be removed. However, further research is required on the bio-accessibility, bioavailability, and validation of high biological value chemicals found in citrus waste.

### **References :**

1. Ngoc, U. N., & Schnitzer, H. (2009). Sustainable solutions for solid waste management in Southeast Asian countries. *Waste management*, 29(6), 1982-1995.
2. Sharma, K., Mahato, N., Cho, M. H., & Lee, Y. R. (2017). Converting citrus wastes into value-added products: Economic and environmentally friendly approaches. *Nutrition*, 34, 29-46.
3. Ampomah-Dwamena, C., McGhie, T., Wibisono, R., Montefiori, M., Hellens, R. P., & Allan, A. C. (2009). The kiwifruit lycopene beta-cyclase plays a significant role in carotenoid accumulation in fruit. *Journal of Experimental Botany*, 60(13), 3765-3779.
4. Do, N. H., Truong, Q. T., Le, P. K., & Ha, A. C. (2022). Recent developments in chitosan hydrogels carrying natural bioactive compounds. *Carbohydrate Polymers*, 119726.
5. Wani, T. A., Shah, A. G., Wani, S. M., Wani, I. A., Masoodi, F. A., Nissar, N., & Shagoo, M. A. (2016). Suitability of different food grade materials for the encapsulation of some functional foods well reported for their advantages and susceptibility. *Critical Reviews in Food Science and Nutrition*, 56(15), 2431-2454.
6. Clarke, C. J., Tu, W. C., Levers, O., Brohl, A., & Hallett, J. P. (2018). Green and sustainable



- solvents in chemical processes. *Chemical Reviews*, 118(2), 747-800.
7. Zheng, L., & Sun, D. W. (2006). Innovative applications of power ultrasound during food freezing processes—a review. *Trends in Food Science & Technology*, 17(1), 16-23.
  8. Pei, F., Yang, W. J., Shi, Y., Sun, Y., Mariga, A. M., Zhao, L. Y., ... & Hu, Q. H. (2014). Comparison of freeze-drying with three different combinations of drying methods and their influence on colour, texture, microstructure and nutrient retention of button mushroom (*Agaricus bisporus*) slices. *Food and bioprocess technology*, 7(3), 702-710.
  9. Sharma, M., Usmani, Z., Gupta, V. K., & Bhat, R. (2021). Valorization of fruits and vegetable wastes and by-products to produce natural pigments. *Critical Reviews in Biotechnology*, 41(4), 535-563.
  10. Zia-Ul-Haq, M. (2021). Historical and introductory aspects of carotenoids. In *Carotenoids: Structure and Function in the Human Body* (pp. 1-42). Springer, Cham.
  11. Mwaurah, P. W., Kumar, S., Kumar, N., Attkan, A. K., Panghal, A., Singh, V. K., & Garg, M. K. (2020). Novel oil extraction technologies: Process conditions, quality parameters, and optimization. *Comprehensive reviews in food science and food safety*, 19(1), 3-20.
  12. Junaid, P. M., Dar, A. H., Dash, K. K., Ghosh, T., Shams, R., Khan, S. A., ... & Bhagya Raj, G. V. S. (2022). Advances in seed oil extraction using ultrasound assisted technology: A comprehensive review. *Journal of Food Process Engineering*, e14192.
  13. Zheng, B., Yuan, Y., Xiang, J., Jin, W., Johnson, J. B., Li, Z., ... & Luo, D. (2022). Green extraction of phenolic compounds from foxtail millet bran by ultrasonic-assisted deep eutectic solvent extraction: Optimization, comparison and bioactivities. *Lwt*, 154, 112740.
  14. Upadhyay, R. K. (2018). Plant pigments as dietary anticancer agents. *International Journal of Green Pharmacy (IJGP)*, 12(01).
  15. Frank, H. A., Bautista, J. A., Josue, J., Pendon, Z., Hiller, R. G., Sharples, F. P., ... & Wasielewski, M. R. (2000). Effect of the solvent environment on the spectroscopic properties and dynamics of the lowest excited states of carotenoids. *The Journal of Physical Chemistry B*, 104(18), 4569-4577.
  16. Crozier, A., Jaganath, I. B., & Clifford, M. N. (2006). Phenols, polyphenols and tannins: an overview. *Plant secondary metabolites: Occurrence, structure and role in the human diet*, 1, 1-25.
  17. Molina-Calle, M., Priego-Capote, F., & de Castro, M. D. L. (2015). Development and application of a quantitative method for determination of flavonoids in orange peel: Influence of sample pretreatment on composition. *Talanta*, 144, 349-355.
  18. Ma, Y. Q., Chen, J. C., Liu, D. H., & Ye, X. Q. (2009). Simultaneous extraction of phenolic compounds of citrus peel extracts: Effect of ultrasound. *Ultrasonics sonochemistry*, 16(1), 57-62.
  19. Khan, M.K.; Abert-Vian, M.; Fabiano-Tixier, A.S.; Dangles, O.; Chemat, F. Ultrasound-assisted extraction of polyphenols (flavanone glycosides) from orange (*Citrus sinensis* L.) peel. *Food Chem.* **2010**, 119, 851–858.
  20. Safdar, M.N.; Kausar, T.; Jabbar, S.; Mumtaz, A.; Ahad, K.; Saddozai, A.A. Extraction and quantification of polyphenols from kinnow (*Citrus reticulata* L.) peel using ultrasound and maceration techniques. *J. Food Drug Anal.* **2017**, 25, 488–500.
  21. Bagherian, H.; Ashtiani, F.Z.; Fouladitajar, A.; Mohtashamy, M. Comparisons between conventional, microwave-and ultrasound-assisted methods for extraction of pectin from grapefruit. *Chem. Eng. Process. Process Intensif.* **2011**, 50, 1237–1243.
  22. Wang, W.; Ma, X.; Xu, Y.; Cao, Y.; Jiang, Z.; Ding, T.; Ye, X.; Liu, D. Ultrasound-assisted heating extraction of pectin from grapefruit peel: Optimization and comparison with the conventional method. *Food Chem.* **2015**, 178, 106–114.

**Agriculture of India: A SWOT Analysis**

**Dr. Nitinkumar M. Patil<sup>1</sup> Ranjana Mhalgi<sup>2</sup>**

<sup>1,2</sup>The S.I.A. College of Higher Education, Dombivli (E), P-88, MIDC Residential Area, Dombivli Gymkhana Road, Near Balaji Mandir, Dombivli (East), Tal. Kalyan, Dist. Thane,

Corresponding Author: **Dr. Nitinkumar M. Patil**

**E mail-** [nitinkumar.patil1970@gmail.com](mailto:nitinkumar.patil1970@gmail.com)

**DOI- 10.5281/zenodo.7476281**

---

**Abstract**

The study sought to investigate the current and future potential of Indian agriculture in the year 2022 using a strategic planning and management technique called SWOT analysis. Based on secondary data and empirical evidence, this theoretical study concludes that, though Indian agriculture has some strengths and many opportunities, it also has specific weaknesses like small size of land holdings, low crop productivity, inadequate financial investment in agricultural education, research and extension activities, substandard infrastructure, inadequate and low-grade storage facilities, shortage of electricity and frequent power cuts, erratic nature of monsoon, inefficient agro-based industries etc. while, low agricultural productivity, loss of agricultural produce and climate change are the major threats to Indian agriculture. The study reveals that a thorough investigation of the agricultural status and implementation of suitable policies are a must to overcome the weaknesses and threats to this sector.

**Key Words:** Agriculture, Strengths, Weaknesses, Opportunities, Threats

---

**Introduction:**

India is mainly an agricultural country (Goyal and Singh, 2016). Agriculture plays an important role in the development of Indian economy. Along with its allied sectors, agriculture in India provides livelihood to its people, particularly to the rural masses. It significantly contributes to the Gross Domestic Product (GDP) of the country and thus, India has been identified globally as a key player in the agriculture sector. In the recent past, India has witnessed green, white, yellow and blue revolutions to enhance its food production. It has the world's largest cattle population and a large area under wheat, rice and cotton. In addition, this country is also identified as one of the major producers of pulses, spices and milk. It produces fruits, vegetables, tea, sugarcane, wheat, rice, and farmed fish on large scale. Indian agriculture holds the record for the second-largest agricultural land in the world and directly and indirectly it generates employment for the majority of the Indian population. However, today, agriculture in India is witnessing many natural and human-induced challenges viz. small and fragmented landholdings, exploitation of farms, unreliable rainfall, inadequate irrigation facilities and seed supply, soil erosion, faulty methods of cultivation, overuse of chemical fertilizers and pesticides, deterioration of soil, substandard

infrastructure including storage facilities and quality of roads etc. There are wide gaps between yield potential and the national average yields of agricultural commodities. "In addition to stressed natural resources and inadequate rural infrastructure, there was clear evidence of technology fatigue, run-down delivery systems in credit, extension and marketing services and of insufficient agricultural planning at district and lower levels" (Planning Commission, 2011). With this background, the study attempts to understand the present and future potential of Indian agriculture by using a strategic planning and management technique called SWOT analysis.

**Materials and Methods:**

The present study is based on the secondary data obtained from government publications like drafts of the planning commission, research articles, information available on e-media and empirical evidence. A strategic planning and management technique called SWOT analysis was used to identify the Strengths, Weaknesses, Opportunities and Threats to the agriculture sector of India. In fact, SWOT analysis is a framework used to evaluate the present agriculture scenario in India and arrive at the conclusion. This tool was used to assess both the internal and external factors, as well as the current and future potential of Indian agriculture during the year 2022. The

## Agriculture Development towards Sustainability

obtained results are presented in theoretical form.

### Results:

The present study is conducted in view to understand the current and future potential of Indian agriculture. This has been achieved with the help of conducting a SWOT analysis and the obtained results are given below.

### Strengths

1. India is a land of diversity, it can also be seen in terms of basic resources like land, water, climate, soil, flora and fauna. The country receives plentiful sunshine except during the period of Southwest Monsoon.
2. India is blessed with many perennial rivers like Ganga and a very long coastline. Its coastline touches nine states viz. Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha, West Bengal and two Union Territories viz. Diu-Daman and Puducherry.
3. India possesses two major biodiversity hotspots viz. the Western Ghats region and the Eastern Himalayan region. The country's biodiversity hotspots provide a habitat to many fragile animal species. The country is having a large floral biodiversity with more than 40,000 species.
4. The geographical background of India provides a diverse range of habitats that supports a large number of animal species. The aquatic biodiversity in India is also rich. It is characterized by a variety of plants and animals.
5. A variety of animals including cows, buffaloes, goats, sheep, horses, camels, ass and pigs are domesticated in the country.
6. Development in the field of biotechnology has provided farmers with the tools that make production cheap and more manageable. Drought-tolerant, disease-resistant, short-duration and high-yielding crop varieties are being developed in the country by using biotechnology.
7. Modeling and forecasting of drought index using machine learning techniques, use of effective Drought Index, Technology Repository, ICAR Geo and Krishi Portal are some of the e-resources induced services made available by ICAR (ICAR 2019).
8. The country has achieved a fourfold increase in food grains production as compared to a threefold increase in population (from 50 million tons in 1950 to 230 million tons in 2010). The country has the second-largest area under cultivation and the highest area under irrigation (55.8 million hectares). China has 54.5 million hectares of land under irrigation and the United States has 22.4 million hectares of land under irrigation. The country is the world's largest user of fertilizers (11% of the world's dosage). The country is now first in the production of Pulses (Masood et. al, 2009).
9. The coastline of the country offers a variety of marine resources and many suitable places to develop harbours being used to conduct international trade of agricultural commodities.
10. The country experiences a variety of agroclimatic conditions suitable for the cultivation of numerous agricultural products including cereals, legumes, fiber crops, oil seeds, vegetables, fruits and some cash crops like jute, cotton and sugarcane.
11. Multipurpose projects and dams constructed across many seasonal and perennial rivers in the country avail water for irrigation. Different sources of irrigation viz. canals, wells, lakes and tube wells are developed to irrigate crops.
12. Agricultural universities and *Krishi Vigyan Kendras* have undertaken different research activities to develop advanced and high-yielding crop varieties.
13. National-level government organizations like Indian Council of Agricultural Research (ICAR) are helpful in coordinating agricultural education and research in the country.
14. Agriculture sector in India still contributes 14% of the Gross Domestic Product and it still employs over 52% of the labour force of the country and over 70% of the Indian rural workforce (Singh, M. 2011).

***Agriculture Development towards Sustainability***

15. Quality seeds of food and cash crops are made available by both public and private companies.
16. The government has taken initiatives to supply chemical fertilizers at subsidised rates. It also promotes the use of organic farming
17. Agricultural markets run by Agricultural Produce Market Committees (APMCs) and weekly markets are playing an important role to develop a good marketing network for the sale of agricultural produce.
18. Innovations in agriculture and smart farming technology are being brought from various developed countries of the world which have resulted in an increase in agricultural productivity.
19. Well-established agro-based industries like sugar factories, cotton and textile mills, *Dal* mills and oil mills in the country are making continuous demand for agricultural produce.
20. Agricultural inputs like machinery, seeds, chemical fertilizers, agrochemicals etc. are being produced by both government and private industries in the country.
21. Rice, wheat, millets, pulses, tea, coffee, sugarcane, oilseeds and cotton are some of the crops being produced in the country at a large scale.

**Weaknesses**

1. Average size of land holdings in the country is small and the farms possessed by farming families are scattered.
2. Financial investment in agriculture-related education, research and extension activities is not sufficient.
3. Basic infrastructure including storage facilities, transportation network, market and credit support system is not up to the mark.
4. Inadequate supply of electricity and frequent power cuts in rural parts of the country restricts agricultural development.
5. As Indian agriculture is severely dependent on monsoons with the erratic nature of rains, it is highly unstable.
6. Agro-based industries of the country are weak and inefficient, they cannot pay reasonable prices for the agricultural produce being used as a raw material.

7. Agro-processing industry in India is not yet developed up to its full potential which can generate employment in rural parts of the country by establishing value addition projects.
8. Appropriate low-cost farm technology is not prevalent in the country.
9. Prices of agricultural produce depend on the demand and supply of agricultural products in the market and thus, price fluctuations are experienced often.
10. Farmers in India are having less access to modern technology.
11. With inadequate storage and agro-processing facilities in the country, a considerable amount of agricultural, horticultural, piscicultural and dairy products goes to waste. Thus, the country experiences large post-harvest losses.
12. A sizable portion of grains, fruits, vegetables, dairy products, fish catch etc. goes to waste during the process of transportation and storage.

**Opportunities**

1. In India, most of the agriculture is rainfed and is being used for cultivating core cereals. As rainfed agriculture is almost free from the use of chemicals, the produce can fetch fair prices in the national and international markets.
2. As the country enjoy diverse agro-climatic conditions, a variety of food and cash crops can be cultivated along with the practice of pisciculture, dairy farming, apiculture, sericulture, horticulture, floriculture and agro-forestry.
3. As there is a huge demand for chemical-free agricultural produce, there is a large scope for the development of organic farming.
4. A maximum possible arable land of the country can be brought under cultivation.
5. As majority of the working population prefer to purchase ready-to-eat food material, the food processing industry has a large potential in the country. Such industries should be established, strengthened and expanded. This can create large employment opportunities in the rural parts of the country.



**Agriculture Development towards Sustainability****Threats**

1. Degradation of agricultural land due to erosion, pollution and salinization is a threat to Indian agriculture. Deforestation is responsible for soil erosion, while the practice of over-irrigation is responsible for the salinization of soil.
2. A sizable loss of agricultural produce in the country is the result of weeds and outbreaks of pests and diseases.
3. Farmers in remote parts are not enthusiastic to accept the transformation taking place in the field of agriculture.
4. Global warming-induced climate change is one of the major limiting factors to the growth of agriculture in India. The rise in average atmospheric temperature, frequently occurring droughts, floods and cyclones are responsible for the loss of agricultural productivity in some specific areas of the country.
5. With rising costs of agricultural inputs and high risks involved in the agricultural sector, farmers are willingly leaving this sector. Some of the farmers have committed suicide in the states viz. Maharashtra, Karnataka, Chhattisgarh and Telangana.

**Discussion**

Agriculture is the backbone of Indian economy. As it depends on erratic rains, it involves a huge risk. Despite promising strengths and huge opportunities, Indian agriculture has some weaknesses like small size of land holdings, low crop productivity, inadequate financial investment in agricultural education, research and extension activities, substandard infrastructure, inadequate and low-grade storage facilities, shortage of electricity, frequent power cuts, insufficient and incompetent agro-based as well as food processing industries etc. while, low agricultural productivity, loss of agricultural produce and climate change are the major threats to Indian agriculture. Government should frame appropriate agricultural policies and execute them to eliminate the weaknesses.

**Acknowledgment**

The authors are grateful to the farmers who share their views on India's current and future scenario of agriculture.

**References**

1. Goyal, S.K, and Singh, Shree, Ram, (2016). Indian Agriculture and Farmers-Problems and Reforms, Indian Agriculture and Farmers Pp. 79-87.
2. ICAR (2019). Annual Report, Indian Agricultural Statistics Research Institute. PUSA, New Delhi, Pp.-1-252.
3. Masood, A., Gupta, S. and Basu, P. S. (2009). Higher levels of warming in North India will affect crop productivity. The Hindu Survey of Indian Agriculture. The Hindu group of Publications, pp: 44-48.
4. Planning Commission, (2011). Draft on Faster, Sustainable and More Inclusive Growth –An approach to Twelfth Five Year Plan, available at [http://planningcommission.nic.in/plans/planrel/12appdrft/approach\\_12plan.pdf](http://planningcommission.nic.in/plans/planrel/12appdrft/approach_12plan.pdf)
5. Singh, M. (2011). Prime Minister's address at the IFPRI Conference on 'Leveraging Agriculture for Improving Nutrition and Health. Available at <http://pib.nic.in/newsite/release.aspx>

**Agro-Based Industries: The Backbone of Rural Development**

**Dr. Gayatri S, Tiwari**

Associate Professor Dept of Commerce Smt. K.L.Mv. Amravati

Corresponding Author- **Dr. Gayatri S, Tiwari**

Email- [gayatri tiwari@gmail.com](mailto:gayatri tiwari@gmail.com)

DOI- 10.5281/zenodo.7476297

**Abstract-**

Agriculture and agro-based industries are the pillars of economic structure and socio-economic development in any developing economy. Agro-based industries also play a very important role in solving the problems of poverty, unemployment, inequality and regional imbalance. Agro-based industries depend upon agriculture for their raw-material and other basic inputs. These industries are easy to establish and help in the upliftment of the rural economy and proper utilization of rural resources available in rural areas. But there are various problems with the growth and development of agro-based industry in India. The Govt. is constantly striving for the development of agro-based industries all over India. The government is helping these industries through various schemes.

Agriculture plays a dynamic role in the Indian economy. It is a significant sector of our economy as it contributes to the countries' total GDP and provides direct and indirect employment to rural agricultural and non-agricultural labourers. Indian agriculture has recorded remarkable growth over the last few decades. Agro-based industries and food processing industries completely depend on agriculture. Internal trade in agricultural products helps in the increase of the service sector. It plays an important role in international trade. It is the only main source of food supply and it provides a regular supply of food to a huge size of the population of our country. Agriculture and industry are essential mechanisms of the development process because of their joint relationship. Agriculture provides raw materials to the industry and the output of the industry is used in agriculture to increase production.

**Agro-Based Industries:** The industry that deals with the supply, processing, and distribution of farm products and mainly depends on agricultural products as raw materials are called agro-based industries. The raw material is the main basis for the establishment of these industries. Agro-based industries also play a very important role in solving the problems of poverty, unemployment, inequality and regional imbalance. Agro-Based industries are those industries that are directly or indirectly related to agriculture. It covers many industrial, manufacturing and processing activities based on agricultural raw materials

as well as activities and services that go as inputs to agriculture. Agro-based industries depend on agriculture for their raw-material and other basic inputs.

**Types of Agro-based industries in India**

Agro-industry could cover a variety of industrial, manufacturing and processing activities based on agricultural raw materials as also activities and services that go as inputs to agriculture. Agro-based industries in India can be generally classified into the following types:

**Agro-produce processing units-** These units are not involved in manufacturing. They mainly deal with the protection of perishable products and the utilization of by-products for other uses. No new product is manufactured e.g: Rice mills, Dal mills etc,

**Agro-produce manufacturing units-** These units manufacture totally new products. Finished goods are entirely different from their original raw material e.g: sugar industries, Bakery, Textile mills etc,

**Agro-inputs manufacturing units-** Industrial units which produce goods either for mechanization of agriculture or for increasing productivity come under this type e.g: Agriculture implements, Seed industries, Plumpest, Fertilizer and pesticide units etc,

**Agro service centre-** Agro service centres are workshops and service centres which are engaged in repairing and servicing pump sets, diesel engines, tractors and all types of farm equipment.

**Today's Need of Agro-Based Industries:**

## ***Agriculture Development towards Sustainability***

The agro-based industry is viewed as the sunrise sector of the Indian economy because of its vast potential for growth, likely socio-economic impact, specifically on employment and income generation and for the ability to keep itself recession-proof. These industries are easy to establish. These industries help in the upliftment of the rural economy and proper utilization of rural resources available in a rural areas.

- 1. Employment generation-** Agro-industries have the potential to provide employment for the rural population not only in farming but also in off-farm activities such as handling, packaging, processing, transporting and marketing of food and agricultural products.
- 2. Regional development-** It helps to reduce the regional imbalance. The urban area is the engine of the economy; However, agro-based industries can uplift the rural economy and can provide regional balance and reduce the disparity.
- 3. Increase the standard of living-** These industries generate employment and income opportunities so that the rural population improve their standard of living.
- 4. Export promotion-** The exports can be promoted through the Agricultural and Processed Food Products Export Development Authority (APEDA). As India is an agriculture-based economy, it can provide various agro-based products which will result in more exports.
- 5. Poverty alleviation-** These industries generate employment and income opportunities and reduce the poverty level.
- 6. Industrial production:** The agricultural products are changed into manufactured products which leads to the production of the industry and improves participation in GDP.
- 7. Increment in farmer's income-** The agro-based industry can play a vital role as farmers can provide regular raw materials to these industries.
- 8. Reduce migration:** It prevents the migration of people from rural to urban areas. When agro-based industries will

be established in rural areas, job opportunities will be more and hence migration of labours will be reduced.

- 9. Stabilize the agricultural sector-** This industry can help people make profits out of agriculture and help stabilize the agricultural sector.

**10. Resolve the problem of exploitation -** These industries support resolving the problem of exploitation of the farming community by traders and middlemen.

- 11. Diversification of food choices:** When agricultural products become raw materials for this industry, it creates various types of products which leads to an increasing variety of food choices.

- 12. Link the different sectors:** It inspires balanced growth between the agriculture, industry and service sectors. Agriculture sector production is linked to the manufacturing sector and then to the service sector through marketing and advertisement.

### **Some Notable Agro-Based Industries in India**

**Textile Industry-** This industry plays a vital role in the Indian economy because it is the biggest employer in the country after agriculture. India is also the second-largest manufacturer and exporter of textiles and clothing in the world.

**Sugar Industry-** The sugar industry is responsible for the supply of sugar, which is considered an essential part of human food.

**Vegetable Oil Industry-** The Indian vegetable oil industry accounts for about 5% of the world's vegetable oil production. India is the largest consumer of edible oils in the world. The leading brands of edible oils in India include Fortune, Saffola, Sundrop, Dhara and Dalda.

**Tea Industry-** India is the second-largest tea producer in the world. Also, India is one of the world's largest consumers of tea. The leading tea manufacturers and exporters in India include Tata Global Beverages, Goodricke Group, and Assam Company India Limited among others.

**Coffee Industry-** India is the sixth-largest producer and the fifth-largest exporter of coffee in the world. The increase in coffee

consumption ignited a cafe culture in India and there are many brands that attract consumers.

**Leather Goods Industry**-The demand for leather is driven by the fashion, furniture, interior design and automotive industries. It is among the top ten foreign exchange earners in the country.

**Industry of the Dairy**- The dairy industry is one of the best sources of second-hand money for Indian farmers, making it one of the most popular occupations in rural areas across the country. The raw material in this industry is milk, while the finished products from this industry are Butter, Cheese, Cream, Condensed Milk, Dried Milk, Packaged Milk, Ice Cream etc.

**Bamboo Industry**-The bamboo plantation is a common exercise in India's eastern regions. It provides a valuable source of income for these areas' people.

**Jute Industry**-The jute business is a significant agro-based industry in India, supporting the livelihood of over a million people. The jute sector is currently expanding very fast, and it has now well-known as an important part of our economy.

All of these agro-industries are important to the economy of our country. They employ a big portion of our population while also sustaining our economy.

#### **Agro-based Industry and Women:**

Agro-based industries are comparatively easy to start and provide income in rural areas with less investment by effective and efficient operation of local agricultural raw materials. Women have an important role in the agro-based industry. Home-based industries don't need formal education, training and skills to participate in economic activities. This enables women to participate in home-based economic activities. Today many rural women are getting empowered due to agro-based industries. Apart from taking care of the house, these women also contribute to these industries. Many industries are well managed by rural women. However, today the country needs to provide education and skill-based training to every rural woman so that they can be empowered. Women in India are deprived of these because of infrastructural and other socio-economic barriers. Women's participation in agro-

based industries can be an important income to secure the family livelihood. However, for women to engage in agro based industries they need various assets and capital.

#### **Problems Of Rural Agro Based Industries**

There are Various problems of the growth and development of agro based industry in India.

The major problems of Agro based industry are the shortage in the production of crops. It is very clear that agro based industry is much dependent on the agricultural production. This will directly influence the overall development of agro based industries.

1. **Seasonal in nature**- Agro-based industries depend upon agriculture for raw material. But agriculture is seasonal in nature. So this industry also becomes seasonal in nature.
2. **Perishable products**- The products of agriculture are perishable in nature and hence create wastage due to the poor availability of the cold chain.
3. **Tax and duty**- The higher govt. taxes and duties lead to unfair competition with the big companies.
4. **Traditional pattern of production**- These industries use old and traditional patterns of manufacturing. so, need technology advancement, integration, and regular assessment for competing with big brands and reducing the cost of production.
5. **Lack of transportation and Infrastructural facilities**- Due to poor connectivity and logistics problem also cold chain have poor availability.
6. **Quality control and poor standard**- The poor quality of products pose a big challenge to exports.
7. **Lack of Skill and training** -In agro Based industries, the workers have no skills or are not trained person to work properly so production is low.
8. **Marketing problems**-There is a lack of proper national/international market, a lack of storage facility, problems in



## ***Agriculture Development towards Sustainability***

transportation, longest chain middleman, unsuitable market research and development activities, competition with Multi-National Companies, and dependence on government subsidy all these factors affect the agro-based industries.

- 9. Management problem** - Many times, agro-industries face management problems due to the absence of professional managers in their units and sometimes the lack of help of the partners due to vested interest. This may cause litigation among the partners and result in the malfunctioning of the units.

### **Govt. Schemes to Promote Agro-Based Industry**

India's economic growth cannot be sustained for long because the purchasing power of farmers has not improved. If there is no purchasing power, there will be no demand for consumer goods. The government is implementing various schemes to promote agro-based industries. The govt. is constantly striving to promote agro-based industries all over India.

Foreign Direct Investment has been put on the automatic way in the seed sector, dairy sector, animal husbandry, and controlled atmospheric poly houses.

Pradhan Mantri MUDRA Yojana is a scheme launched for providing loan options. Ten lakh to the non-corporate, non-farm small/micro-enterprises.

The Stand-up India Scheme facilitates bank loans between ten lakh and one crore to at least one Scheduled Caste (S.C.) or Scheduled Tribe (S.T.) borrower and at least one-woman borrower per bank branch for setting up rural creativity.

Gramin Bhandaran Yojana aims to meet the requirements of farmers for storing farm produce, processed farm produce, and agricultural inputs.

The Scheme of Fund for Regeneration of Traditional Industries (SFURTI) aims to organize traditional industries (such as bamboo, khadi, and honey) and artisans into clusters to make them competitive and provide support for their long-term sustainability, sustained employment, and enhanced marketability of products.

The Credit Linked Capital Subsidy Scheme (CLCSS) is an organizer of technology up-gradation of small-scale and micro industries. It will also encourage the innovation and digital empowerment of MSMEs.

**Conclusion:** Agriculture is the backbone of the Indian economy. Agro-Based industries are very important because they increase agricultural products, gain foreign exchange, boost the level of income of people, support role in women's empowerment, and contribute significantly to industrial output as well as the country's economy by providing jobs and opportunities for people to improve their economic standard. The govt. should provide different types of funds for agro-based industries so that the people of rural areas turn to these industries. Along with the development of rural areas, the economic development of the country will also take place.

### **E-references-**

1. [https://www.researchgate.net/publication/320465578\\_Performance\\_of\\_agro\\_based\\_industries\\_in\\_India](https://www.researchgate.net/publication/320465578_Performance_of_agro_based_industries_in_India)
2. <https://www.tractorjunction.com/blog/agro-based-industries-in-india-types-importance-scenario>
3. <https://www.tractorjunction.com/blog/agro-based-industries-in-india-types-importance-scenario/>
4. <https://www.mechjobs.in/agro-based-industries-types-importance-challenges-and-government-schemes/>

**Issues, Challenges and Prospects of Indian Agriculture**

**Mrs. Arpita Laddha**

Asst. Professor, Dept. Of Commerce Smt. Kesharbai Lahoti Mahavidyalaya

Corresponding Author- **Mrs. Arpita Laddha**

Email-[ahladdha@gmail.com](mailto:ahladdha@gmail.com)

DOI- 10.5281/zenodo.7476306

***Abstract***

Agriculture sector has an important place in Indian Economy even though it contributes only around 20% to GDP of the country and 50% to national income. India is still called an agrarian economy as it supports directly or indirectly about 42% of workforce of the country. India has had record agricultural production of 315.7 million tonnes although the productivity per acre of land is still a challenge. Indian farmers are looking to increase their income and in order to achieve the same are diversify their crops and looking for allied agriculture activities. Although the country is leader in production of various crops still the price volatility remains a concern. There are many concerns in agriculture like lack of power, irrigation, fragmented ownership etc., but what is more important is the solution for these problems which lies in the future and looks promising due to new technologies and innovations which are coming up in the field.

**I. Introduction**

India is a rural country having 65% of the population living in rural areas in around 6,50,000 villages. Indian economy is often known as an agrarian economy. Majority of our population is directly or indirectly dependent upon agriculture for livelihood. Agriculture provides direct employment to nearly 41.49% of working population of country.

Agriculture contributes about 20% to GDP of the country. The overall development of the country depends on the growth and development of rural areas as they contribute 50% to national income. The rural economy has continuously been supporting to the economy of India. Rural economy has performed even when there has been distress in other sectors of the economy. Even during COVID – 19 times, Indian agriculture showed remarkable flexibility and sturdiness. The success in terms of production has ensured the food security for the country.

India has witnessed a revolution evolving from a food deficient and import dependent country in 1960s to a global powerhouse of agricultural production today. India is leader in production of milk, pulses, jute and spices and ranks second in production of rice, wheat, cotton, sugarcane, tea, groundnut, fruits and vegetables. Even though the share of agriculture in GDP is declining it continues to grow in gross term. Rural India contributes significantly in the development

of nation through export of various agricultural products.

This chapter highlights the Major Issues of Agriculture in India in Section II. Section III highlights the challenges of Indian Agriculture. Section IV describes the Key Trends expected in Indian Agriculture.

**II. Issues of Indian Agriculture**

Despite the importance of agriculture in Indian economy and increase in production, Indian agriculture still faces various issues which needs to be addressed urgently through various reforms. The problems are discussed below:

**Small and fragmented land holdings:**

Decreasing size of land holding is one of the major concerns of Indian agriculture as more than 90% farmers are smallholders or marginal. The average size of operational holding has decreased to 1.08 hectares as per 2015-16 Census.

**Adaptation to climate change**

**disturbance:** The climate in the country has become very unpredictable. The areas either receive too much rainfall and face flood or are heavy no rain and face drought. The reason for such change is global warming and the farmers need to adapt the changes and select the crops accordingly.

**Low farm productivity:** Although the production has increased still the farm productivity per unit of land is very low in India which overall results in extra cost to the farmers.

## ***Agriculture Development towards Sustainability***

**Shortage of good quality seeds for marginal & small farmers:** Good quality seeds are considered crucial for better productivity in different agro-climatic zones. The good quality seeds are very costly and unaffordable for marginal and small farmers. Lack of quality seeds at reasonable rates is one of the greatest impediments to bridge the vast yield gap.

**Less value-addition at primary level:** The farmers at primary level are not able to add value to the produce because of inadequate raw material, traditional production, high cost, layout and factory facilities, inadequate machineries and capital, poor education and knowledge of farmers and poor attitude of entrepreneurs along with no market and research. Adding value to agricultural products is a worthwhile endeavor because it gives higher returns, opportunity to open new markets and extend the marketing season for farmers and helps in creating a new recognition for the farms.

**Instability in agricultural prices:** Farm product prices fluctuate relatively more than the prices of manufactured goods. The prices of agricultural goods depend upon the demand and supply of agricultural produce in local market as well as demand in international market, geopolitics, inflation and availability and attractiveness of substitute goods as well.

**Lack of Mechanization:** Overall mechanization level in the country is around 40-45%. Leading country in manufacturing tractor and many other implements is itself lacking behind to develop mechanization for own small sized farms. There is a huge difference in level of mechanization in different parts of the country due to size of landholdings, government support, knowledge of technology and financial inability of farmers.

**Lack of irrigation facilities:** Only one third of the farmers are having irrigation facilities and the remaining are still dependent on monsoons. Irrigation is an important parameter for agriculture as timely and sufficient supply is the key to

better production. The country even lacks proper supply of power which is required for irrigation,

**Lack of PHM (Post Harvest Management) and marketing facilities:** India loses around 40% of the food produced in the country. Indian farmers suffer loss worth 92,651 crores per year due to poor storage and lack of transport facilities. Farmers suffer post-harvest due to faulty practices, poor sorting & grading practices, improper packing, marketing and other exogenous factors.

**Inadequate government support:** Government support to agriculture has been low on innovation and the support which is provided is ineffective and inefficient. Further the prices are controlled by government whereas there is no control on the cost that is incurred looking at the rising prices of inputs.

**Soil Erosion:** Soil Erosion is increasing due to deforestation, erratic rainfall, imbalanced fertilization, excessive tillage, and use of heavy machinery. Crop residue burning, overuse of pesticides, poor crop rotation and poor irrigation facilities have led to degradation of 130 million ha of land in the country. Also 6.74 million ha of land has problem of soil salinity and water logging which ends in loss of crops. The ground water level is also getting deteriorated.

**Inefficiency of Farmer Producer Organizations (FPOs):** FPOs lack adequate resources which makes it difficult for them to attract and retain members and carry out their activities. They are inefficiently managed, lack farmer participation and proper communication and governance.

**Scarcity of capital and subsidy:** There is a lack of initial investment as there is almost no support from government in most cases. The subsidy from government for fertilizers and electricity to farmers has increased many folds but there are regions which receive more subsidy (Northern & Central) and they outperform the areas receiving less subsidy (South & NE). Govt. schemes do not

reach small farmers as there is lack of awareness among them.

### **III Challenges of Indian Agriculture**

**Raising agricultural productivity per unit of land:** It is going to be the main engine for agricultural growth. Water resources are limited and need to contend with industrial and urban needs too. We need to go all out exploiting all possible ways to improve productivity by increasing yields, diversification to higher value crops and develop value chain to reduce marketing costs.

**Reducing rural poverty:** Rural development is the key to achieve economic growth and is a challenge in front of agriculture. Despite regional disparity development efforts of the government and the World Bank must benefit poor, landless, women, scheduled castes and tribes to bring betterment and growth in agriculture.

**Ensuring food security:** Agriculture needs to increase its production manifolds in order to fulfill the rising demand of food in the country. There has been a slowdown in agricultural growth and is a major concern as the yields in the country are not at par with the yields achieved in the world.

### **IV Key Trends Expected in the Future**

Agriculture being a key economic driver needs to adapt various challenges that it is facing today. The trends in agriculture that are expected in the coming future are enumerated below:

**Increase in food production:** India has witnessed tremendous increase in agriculture production after introduction of Green Revolution. This is further going to increase in future as there is a huge gap between what we produce presently and what will be required in future to feed the ever increasing population.

**Change in Consumption Pattern:** Due to globalization and increase in individual income and health consciousness the demand for fruits, vegetables, dairy products, fish meat and high value greens is growing. Even there is an increase in demand for processed food having good quality at affordable prices.

**Land Consolidation:** There will be land consolidation on huge scale either a real or a virtual one to achieve economies of scale for small land owners. India is witnessing a shift

wherein everybody is getting used to work online or get the work done through online mode which will help in future to convert the existing agricultural ecosystem into a digital one.

**Increase in Competitiveness:** With new private players entering the field there will be an increase in competition. It will lead to new and innovative products, better inputs and customized farm machinery at competitive prices giving better return to farmers.

**Agricultural labour will move to more productive jobs:** Already one can witness that rural farm economy is moving off-farm to allied industries related to agriculture and post-production activities are becoming familiar among the rural labours. Labours get better paid and have better work profile.

**Crop Diversification:** It can be used as a tool to promote sustainable agriculture, reducing the dependency of country on others and increase the income of the farmers. Agriculture is the backbone as it not only fulfills the demand of food for the people but also other development needs. The farmers will diversify to produce commercial and horticultural crops as it gives better returns.

**Reduce dependency for energy:** India is looking to reduce its dependency on oil and gas and hence ethanol production will be encouraged which will also help in diversifying the use of sugarcane which is in excess in the country.

**Prudent use of land:** In order to make the use of land more prudently vertical and urban farming will be promoted vigorously in long term and even the efforts will be made to bring the barren deserts and seawater under cultivation to increase area under cultivation.

**New growing medium:** Soil-less, water-based farming like hydroponic farming which can be done in less space is going to accelerate as it eliminates the problems that are linked to soil based farming. Even the agriculture based on air i.e., aeroponics is going to be the future to achieve sustainable development.

**Precision farming:** Farming which will be based on soil testing and automation using artificial intelligence will be more predominant in future as it will help in



## ***Agriculture Development towards Sustainability***

taking the decision about usage of inputs in agriculture. The sensors and drones will be used to get better precision, quality, and environment in cost effective manner.

**Use of Nano-Technology:** The agriculture sector is facing enormous challenges in relation to change in climate, decrease in soil fertility, macro, and micronutrient deficiency, over usage of chemical fertilizers and pesticides. Application of nano-technology in agriculture will reduce the wastage and increase the yield.

**Digital Agriculture:** Use of digital technology will integrate the efforts of farmers and government. The use of digital technology will help farmers to keep themselves updated about the new tools and keep them informed about the new schemes offered and will bring transparency in transferring of money directly to their accounts.

**Automation in Agriculture:** The operations in agriculture will be automated in the future. Farmers will rely on robots to automate the repetitive tasks in the field. Automation will help farmers to focus on improving overall productivity of the farms rather than worrying about slow farm processes. Automation will help in reducing the human errors and provide convenience.

**Artificial Intelligence:** Artificial Intelligence will provide real time insights of the farm conditions allowing the farmers to be proactive. AI will help in predicting weather forecasts, crop yield and prices helping farmers take timely decisions. AI will enable corrective response if required.

**Drones:** Increasing farm productivity while saving costs is challenging. Drones are equipped with camera which facilitate aerial imaging. Drones are already in use for spraying pesticides in the region.

**Controlled Environment Agriculture (CEA):** Variable and extreme harsh weather conditions hamper old farming methods. Further going crops in urban areas pose significant challenges which can be controlled by CEA. Here the plant gets controlled proportion of light, temperature, humidity and nutrients

**Improved storage & supply chain facilities:** The farmers will gain tremendously with improvement in storage

and supply chain as it will help farmers to store the goods and get better prices for their goods hence improving the income of farmers

### **V Conclusion**

Increasing population, increasing average income and globalisation effects in India will increase the demand for quantity, quality and nutritious food and variety of food. The increasing population will decrease the available cultivable land as it will have alternative usage. Hence there is an urgent need to step up and make policies which will help us overcome the challenges ahead. The future holds a lot of opportunities for Indian farmers, they need to adapt the new practices and innovations to increase the production as well as their income.

**Road To Revival Of Agro-Tourism Sector In India: Post Covid-19 Pandemic**

**Dr. Susan Alex**

Assistant Professor, Department of Economics K. P. B. Hinduja College of Commerce

315, New Charni Road, Mumbai

Corresponding Author- **Dr. Susan Alex**

Email-[susanalex9@gmail.com](mailto:susanalex9@gmail.com)

DOI- 10.5281/zenodo.7476314

**Abstract**

Tourism as an engine of growth has helped several countries to transform their economies. Tourism has immense potential to generate permanent employment opportunities and eliminating poverty, infrastructural development, bring in additional income sources and benefit local communities economically and socially. Tourism has branched to newer areas like Agro-Tourism, which an innovative agricultural activity related to tourism and agriculture and has a great capacity to create additional source of income and employment opportunities in rural areas. The Covid-19 pandemic has severely impacted tourism industry causing economic crisis by impacting economies, livelihoods, public services and opportunities across the globe. Revival of this industry will be dependent on the hygiene and sanitation conditions, physical distancing, education and governmental support to boost confidence of the tourists.

**Key Words:** Agro-Tourism, Economic Development, Challenges & Benefits, Covid-19 pandemic, recovery strategies

**Introduction**

" Agritourism is another way to generate income from the land, and is a great way to introduce your farm brand to consumers, which could open the door to developing a loyal consumer base for other products the farm or ranch provides."

~ Logan Hawkes

Tourism as an engine of growth has helped several countries to transform their economies. Tourism has immense potential to generate permanent employment opportunities and eliminating poverty, infrastructural development, bring in additional income sources and benefit local communities economically and socially. Tourism has branched to newer areas like Agro-Tourism, which an innovative agricultural activity related to tourism and agriculture and has a great capacity to create additional source of income and employment opportunities in rural areas.

The term 'agro-tourism' was initially used in the US, but it originated from an Italian National Legal Framework passed in 1985. The term "agritourism" is often used interchangeably with "agri-tourism," "agrotourism," "farm tourism," "agricultural tourism," or "agritainment." Agritourism means travel organized around farming, small-scale food production or animal husbandry, promoting overnight farm stay to diversify the income of farmers and support

the landscape of farming operations.<sup>1</sup> The Agri Tourism Development Corporation (ATDC) instituted in 2004 in Baramati, Maharashtra, which was the first state in the country to realize the potential of Agro-Tourism. A pilot project in Baramati district in 2005, in Maharashtra has paved way for almost 330 registered agro-tourism centers spread across 29 districts.

Some format of rural, cultural tourism and recreation already exists in the country that gives the tourists flavor of local cuisine, dances, dresses, and heritage, e.g. International Yoga and Music festival-Rishikesh, Rann Mahotsav-Gujarat, Nongkem Dance Festival-Meghalaya, Pushkar Camel Fair-Rajasthan, Hemis Festival - Ladakh, Hornbill festival - Nagaland, etc. Agri-tourism is a combination of farm stays along with a mix of culture and exposure to rural life style.

**Objectives**

The present study is an experiment for the development of rural areas which are used for agricultural purposes. As agriculture in India is seasonal in nature most farmers need an alternate source of income. The concept of Agro-tourism was conceived to

<sup>1</sup> Sarath, S., & Sivakumar, S. D. (2020, November 23). To enhance income of farmers, consider Agri-Tourism. The New Indian Express. Retrieved November 24, 2022, from <https://www.newindianexpress.com/opinions/2020/nov/23/to-enhance-income-of-farmers-consider-agri-tourism-2226815.html>

create an alternative source of income, as well as create employment opportunities, and provide a global exposure to village ambience, local cuisine, culture and art. The objectives of present research are follows:

To explore the concept of agro-tourism.

To study and scope of agro-tourism of rural areas.

To understand the benefits of agro-tourism in rural areas.

To find out the major challenges of agro-tourism sector and make suggestions to establishment and operations of agro-tourism.

## **Research Methodology**

The present research work is exploratory in nature and based on the secondary source of data collection. The information and secondary data were collected from academic journals, Reference books, reputed newspaper and official websites of the Tourism Ministry of India and department and Tourism Boards of different states of India.

## **Concept of Agro-Tourism**

The new face of tourism, Agritourism is defined as "Travel that combines agricultural or rural settings with products of agricultural operations – all within a tourism experience". According to Mr. Pandurang Tavare<sup>2</sup> (Founder / Chief Promoter of ATDC, Pune): Agro-Tourism is that Agri-Business based activity, where native farmers offer tours to their agriculture farm to allow a person to view them growing, harvesting, and processing locally grown foods or any agriculture produce the person would not come across in their city or home country, and often would provide a home-stay opportunity along with the local cuisine and culture. Eco-tourism and Agro-tourism are quite similar, where the former is provided by the tour companies and in the latter the local farmers offer tours to their agriculture farm along with entertainment, education and fun-filled experiences for the urban tourists.

## **Scope and Benefits of Agro-Tourism**

Agriculture is a most important occupation in the but, today it has become unprofitable due the irregular monsoon, fluctuating agricultural prices etc. and hence, there is need to introduce some innovative agricultural activities which will help to farmers in rural areas. Agro-Tourism show immense potential to bring in economic changes to the way of doing traditional agriculture. Presently people living in overcrowded urban areas have very little access to nature as many live their daily hectic lives commuting between the homes and work. Agro-tourism gives an opportunity to these peoples to enjoy rural life and also an opportunity to the farmers to engage in traditional agricultural farming activities and also earn some additional income.

Agro-tourism, eco-tourism and rural tourism are emerging as key sectors of tourism business in India and has a vast scope in the present scenario of tourism business in India due to the following reasons:

1. Agro-tourism is a sustainable form of tourism business and provides an additional source of income for the farmers and also creates new jobs at local levels.
2. It gives an opportunity to urban tourists to escape from hectic life of the city gives them a glimpse of the rich diversity in the village ambience, local cuisine, rural games, traditional dresses, festivals and food, culture and art
3. It is ecofriendly which is very essential in the present environmental scenario and helps the tourists familiarize with the rural lifestyle and roots of early civilization.
4. It is less expensive gateway of tourism and the cost of accommodation, food, travel and recreation is very low in comparison to other type of tourism, thereby widening the scope of tourism.
5. It is a source of knowledge to urban students studying about Agriculture science as well as the curious urban population to learn about plants, animals, see the traditional handicrafts and art as well as experience the rural lifestyle and their languages, culture, tradition etc. while moving with the pace of modern technology

<sup>2</sup> Raja, V. (2022, January 6). 'father of agritourism' helps over 600 farmers earn Rs 58 crore; here's how. The Better India. Retrieved November 22, 2022, from <https://www.thebetterindia.com/272052/agritourism-maharashtra-farmer-agriculture-tourists-earn-money-successful-farm-stays/>

***Agriculture Development towards Sustainability***

6. It helps the tourists to find peace and tranquility through a nature friendly life style.
7. Health-conscious Tourists also get an opportunity to eat the traditional cuisine often made with Organic food grains and also detoxify themselves with traditional medical practices like ayurvedic spas.
8. They also experience the unique environment of the villages with its diverse flora and fauna, and natural beauties of mountains, water bodies.
9. It brings cultural transformation between urban and rural people including social moral values. Farmers tend to improve their standard of living due to the contacts with urban people.
10. Employment opportunities to the farmers including farm family members and youth is increased many folds and the additional income source for the farmers act as shield to protect against income fluctuation. Thus, in the process it supports and further promotes rural and agricultural development process.

**Challenges of Agro-tourism in India**

However, Agro-tourism is a boon for the development of our rural society but there are some challenges as: India has a greater potential of the development of the agro-tourism centers due to the good natural and climatic conditions. Although it is possible to successfully integrate agro-tourism development into local communities without too many disturbances, there are still many some potential challenges to be overcome. General population is not much aware about the agro-tourism, till date. Farmers often lack good communication skill and sharp business acumen, which is prime requisites for running any commercial enterprise.

Some of the challenges faced is the general lack of awareness about agro-tourism, as well as the lack of good communication skills and a professional commercial approach among the framing community. Farmers especially those with very small size holdings, often leading a hand to mouth existence, face a paucity of funds or capital required for developing the basic infrastructure for the agro-tourism. Lacking proper training in the hospitality sector also another constraint faced among these rural communities, who

are concerned about the increased noise, traffic and the potential impact of outsiders on their closed community. Another issue faced by the tourists is the lack of proper hygiene and basic sanitation requirements considering urban visitors. Yet another constraint is the lack of accessibility and connectivity in many Indian villages, which lack in basic infrastructure like proper roads, electricity and internet.

**COVID Pandemic and Agro-Tourism**

The Covid-19 Pandemic has severely impacted tourism industry causing economic crisis by impacting economies, livelihoods, public services and opportunities across the globe. The social effects of the pandemic have led to high levels of unemployment among tourism workers, which has also increased substantially the poverty rate. The pandemic affected every aspect of our lives and disrupted the world, claiming the lives of millions of people while simultaneously triggering a decline across the global economy.

As per a Confederation of Indian Industry (CII) and Hotelivate study, the travel and tourism industry in India, has been one of the hardest hit facing losses of more than Rs. 5 lakh crores<sup>3</sup>, and might see up to 40 million job losses (both direct and indirect) and about \$17 billion in revenue losses in the future.<sup>4</sup> although it is not an easy task, the Indian government, along with industry and institutions through joint efforts can overcome this problem facing the tourism industry, by creating a supportive ecosystem for tourism. Though international and domestic tourism has largely resumed, post-pandemic times have given an opportunity to identifying and recognizing untapped opportunities and for implementing innovative ideas in this domain.

**Suggestions to revive agro-tourism industry post pandemic**

<sup>3</sup> Shrivastava, R. (2021, January 11). Crushed by covid-19, India's tourism sector can rebuild by renewing focus on sustainable practices-india news , Firstpost. Firstpost. Retrieved November 24, 2022, from <https://www.firstpost.com/india/crushed-by-covid-19-indias-tourism-sector-can-rebuild-by-renewing-focus-on-sustainable-practices-9188771.html>

<sup>4</sup> Sarath, S., & Sivakumar, S. D. (2020, November 23). To enhance income of farmers, consider Agri-Tourism. The New Indian Express. Retrieved November 24, 2022, from <https://www.newindianexpress.com/opinions/2020/nov/23/to-enhance-income-of-farmers-consider-agri-tourism-2226815.html>



## Agriculture Development towards Sustainability

As agro-tourism is a service industry, farmers need to be oriented on maintenance of facilities, hospitality and public relation.<sup>5</sup> The agro-tourism may become a cash crop for the local farmers as it can increase their income, leading to revenue generation and improved food security, enhanced entrepreneurial skills and the diversification and uniqueness of traditional food crops within the county and also be an instrument of the rural employment generation. Urban customers demand for the facilities like safe and clean accommodation, clean water and hygienic food from the agro-tourism service provider. Some of the suggestions to promote a revival of this industry are as follows:

1. In this post-pandemic times, the tourists expect agro-tourism providers to take specific actions, i.e., disinfect communal rooms, make hand sanitizers available, limiting the maximum number of people allowed on the farm and to common open-access rooms, in order to ensure safety during their stay. So agro-tourism providers should ensure that the kitchens and others places are frequently sanitized, standard operating procedures from social distancing to cashless transactions, protective gears for food handlers, etc. are properly followed.
2. There should be diversification of economic activities by product innovation and agro-business expansion to mitigate tourism revenue loss, by encouraging the farmers to use the available traditional resources in a diversified and innovative way.
3. Encourage training for digital literacy among the agro-tourism providers and also introduce the use of social media to promote agro-tourism through innovations and websites. Family members and other staff can be trained for reception and hospitability.
4. The government should try to provide optimum financial aids to the agro-tourism activities by the grants and institutional finance as well as look into

the development of infrastructure like roads, electricity and internet connectivity.

### Conclusion

The scope of agro-tourism in India is immense due to diversity of natural conditions and different types of agro products as well as variety of rural traditions, festivals. This helps to promote the concept of agro-tourism and gives an opportunity to the tourists to experience rural life, taste the traditional food and to live in a peaceful environment. With the weakening of the second wave of the COVID-19 pandemic and the robust vaccination drive across the nation, the tourism industry has again seen an uptick in bookings and a revival in the footfall of tourists across the country.

Thus, it can be concluded that agro-tourism in India despite the various challenges and the COVID pandemic can be made more robust and appealing to the tourists by implementing creative well-defined strategies of educating the farmers, proper financing, product and service quality improvement, better sanitation, availability of electricity and transportation to rural areas, increased internet connectivity and above all government supported policy structure of agro-tourism.

### References:

1. Bielska, A., Borkowski, A. S., Czarnecka, A., Delnicki, M., Kwiatkowska-Malina, J., & Piotrkowska, M. (2022, November 27). Evaluating the potential of suburban and rural areas for tourism and recreation, including individual short-term tourism under pandemic conditions. *Nature News*. Retrieved November 25, 2022, from <https://www.nature.com/articles/s41598-022-24503-z>
2. Burns, P., & Holden, A. (2005). *Tourism: A new perspective*. Prentice Hall.
3. Chandra, P. (2003). *Global ecotourism: Codes, protocols & charters*. Kaniskha Publishers.
4. Devalla, R. (2022, November 23). Agri-tourism to draw tourists, empower farming communities. *The Hans India*. Retrieved November 27, 2022, from

<sup>5</sup> Devalla, R. (2022, November 23). Agri-tourism to draw tourists, empower farming communities. *The Hans India*. Retrieved November 27, 2022, from <https://www.thehansindia.com/news/cities/visakhapatnam/agri-tourism-to-draw-tourists-empower-farming-communities-770553>

- <https://www.thehansindia.com/news/cities/visakhapatnam/agri-tourism-to-draw-tourists-empower-farming-communities-770553>
5. ETHospitalityWorld. (2022, November 8). Culinary tourism is on the cusp of explosion in India, says report - ETHospitalityWorld.com. Retrieved November 21, 2022, from <https://hospitality.economictimes.indiatimes.com/news/operations/food-and-beverages/culinary-tourism-is-on-the-cusp-of-explosion-in-india-says-report/95370070>
  6. Hema, C. (2022, March 22). From agro to sustainable tourism... here's how Maharashtra is reinventing the idea of tourism amid the covid-19 pandemic. Free Press Journal. Retrieved November 28, 2022, from <https://www.freepressjournal.in/weekend/from-agro-to-sustainable-tourism-heres-how-maharashtra-is-reinventing-the-idea-of-tourism-amid-the-covid-19-pandemic>
  7. Jagran, K. (2022, February 14). Agri-tourism: Idukki farmers to provide tourists with a 'fresh from farm' experience. Krishi Jagran Agriculture News. Retrieved November 25, 2022, from <https://krishijagran.com/agriculture-world/agri-tourism-idukki-farmers-to-provide-tourists-with-a-fresh-from-farm-experience/>
  8. Koul, V. (2022, September 9). Agri-tourism: Another hope for tourism in post-Covid Era - ET TravelWorld. ETTravelWorld.com. Retrieved November 27, 2022, from <https://travel.economictimes.indiatimes.com/news/tourism/experiential/agri-tourism-another-hope-for-tourism-in-post-covid-era/94094452>
  9. Nalla.Babu , 2022. (2022, November 6). Research station at Chintapalle Banks on Agri Tourism to popularise tribal areas: Visakhapatnam news - times of India. The Times of India. Retrieved November 28, 2022, from <https://timesofindia.indiatimes.com/city/visakhapatnam/research-station-at-chintapalle-banks-on-agri-tourism-to-popularise-tribal-areas/articleshow/95329427.cms?from=mdr>
  10. Raja, V. (2022, January 6). 'father of agritourism' helps over 600 farmers earn Rs 58 crore; here's how. The Better India. Retrieved November 22, 2022, from <https://www.thebetterindia.com/272052/agritourism-maharashtra-farmer-agriculture-tourists-earn-money-successful-farm-stays/>
  11. Ranade, P. S. (2008). Ecotourism: Focus on wildlife and local communities. ICFAI University Press.
  12. Sarath, S., & Sivakumar, S. D. (2022, September 16). How states can give a boost to agri-tourism. The Hindu BusinessLine. Retrieved November 20, 2022, from <https://www.thehindubusinessline.com/opinion/how-states-can-give-a-boost-to-agri-tourism/article65900436.ece>
  13. Sarath, S., & Sivakumar, S. D. (2020, November 23). *To enhance income of farmers, consider Agri-Tourism*. The New Indian Express. Retrieved November 24, 2022, from <https://www.newindianexpress.com/opinions/2020/nov/23/to-enhance-income-of-farmers-consider-agri-tourism-2226815.html>
  14. Shrivastava, R. (2021, January 11). Crushed by Covid-19, India's tourism sector can rebuild by renewing focus on sustainable practices-India news, Firstpost. Retrieved November 24, 2022, from <https://www.firstpost.com/india/crushed-by-covid-19-indias-tourism-sector-can-rebuild-by-renewing-focus-on-sustainable-practices-9188771.html>
  15. Staff, O. T. (2022, November 3). The rise of agri-tourism and where you can experience it. <https://www.outlookindia.com/outlooktraveler/>. Retrieved November 27, 2022, from <https://www.outlookindia.com/outlooktraveler/explore/story/72284/the-rise-of-agri-tourism-and-where-you-can-experience-it>
  16. Timesofindia.com. (2022, May 17). Agri-tourism in India: Beautiful farmstays to get back to your roots. Times of India Travel. Retrieved November 28, 2022, from

<https://timesofindia.indiatimes.com/travel/hotels/agri-tourism-in-india-beautiful-farmstays-to-get-back-to-your-roots/photostory/91621690.cms>

17. Timesofindia.com. (2022, September 19). Uttar Pradesh to boost rural tourism, 18 districts earmarked for the project. Times of India Travel. Retrieved November 23, 2022, from <https://timesofindia.indiatimes.com/travel/travel-news/uttar-pradesh-to-boost-rural-tourism-18-districts-earmarked-for-the-project/articleshow/94308057.cms>

**Website:**

1. <https://www.maharashtratourism.gov.in/agro-tourism>
2. <https://www.agritourism.in/>
3. <http://www.ecoindia.com/sustainable-tourism/>
4. [https://en.wikipedia.org/wiki/Tourism\\_in\\_India](https://en.wikipedia.org/wiki/Tourism_in_India)
5. <https://ecotourism-world.com/what-is-agritourism/>
6. <http://www.ecoindia.com/sustainable-tourism/>

**Online-to-offline mode shifting of Agricultural Products: E-commerce  
becoming New Retail for Agri-Products.**

**Rachna Ashish Rathi**

Assistant Professor, Dept. of Commerce, Smt. Kesharbai Lahoti Mahavidyalaya, Amravati

Corresponding Author- **Rachna Ashish Rathi**

Email-[ashishgptbhu@gmail.com](mailto:ashishgptbhu@gmail.com)

DOI- 10.5281/zenodo.7476331

---

**Abstract:-**

With the renewed normal stage of Indian economy, economy of rural India has been paid precise attention. E-commerce of agricultural produce is considered as a valuable means to solve rural economic problems. In the rapid development of new retail, the e-commerce channel of agricultural produce is constantly showcasing new changes. First of all, based on the indication of agricultural produce E-commerce and online /offline mode, this paper shows the purpose status and problem statement of the online offline mode in range of agricultural products which puts forward resultant suggestions for the expansion of offline to online mode of agricultural produce in e-commerce.

**Key words:-** E commerce, Agriculture Products, economy etc

---

**Introduction**

As the ongoing development of new retail forum is high, agricultural produce have immensely extended its channel of sale from offline to online e-commerce mode. To a certain degree, the slow sales problem of agricultural products is being solved effectively. Due to its characteristics of "online consumption, offline experience", the offline to online mode has been identified by many consumers. The E-commerce of offline to online channel of agricultural products is favorable in improving farmers income and surplus which enhances the competitiveness of agricultural produce industry. The use of modern information technology such as the internet for providing a plutonic network platform for trading for

both the sectors that is ., producers and operators of agricultural products has become a immense spectrum for growth. This platform enhances exchange of agricultural products, sales, payment and a series of activities which are carried out accordingly. Agricultural produce for E-commerce can successfully take lead of the fact, that users can straight away select fruits, vegetables or any other agricultural produce on the E- platform, and hence the corresponding merchants can deliver directly to the door online and can hence complete the complete sales process. The offline to online mode is to use different online strategies for online marketing and purchasing so as to drive off-line business and expenditure, and to assist off-line



dealings due to the Internet. The purpose of the Offline to online mode in the field of agricultural products will help to promote the transformation and upgrading of agricultural products and which will henceforth enhance management mode in a complete way. Agricultural Businesses can magnetize customers online, and consumers can therefore screen goods and settle accounts all electronically. The Businesses that provide offline services, and the combination of online and offline means therefore makes the sale of farming products more significant .

Application Advantages of Application of Offline to Online Mode : Achieving Precision Marketing through payment in the online form even for customers who start online then to offline are usually back online, hence providing control of records for agricultural businesses and forming data of sales of agricultural products. This becomes the value accumulation of the Offline to online mode that can be excavated. Through the statistics and analysis of transaction data, the marketing effect can be quantified to provide more accurate marketing solutions for businesses, and consumers can also get more personalized services from them . Dropping Logistics expenditure nowadays, has become the significant reason that non- restricts the expansion of agricultural produce. E-commerce has grown from Internet base to logistics base. Because of the inflating cost of logistics and the low competence of

transportation, the consumption experience is condensed. This has become a blockage in the development of agricultural produce in the E-commerce. The materialization of the offline to online mode makes complete use of the stock and geological location that is advantageous for offline physical stores. To an assured extent, there is a very fine solution to the "last kilometer" crisis, which wholly reduces logistics costs, improves the Customer experience using the offline know-how to drive the sale of farming products online even the offline retail store provides experience of agricultural products, services for self-raising and cultivating customer spending habits. This eventually will not only sustain consumer's individual needs, but also enhance the consumer's experience. Rapid information broadcasting of e-commerce platforms has upgraded businesses which can therefore instantly cater to powerful spending power.

In latest years, the trend of development of agriculture infused internet has expanded online sales of major agricultural products and it has been accepted and admired, and now has become a new focal point for economic growth in the retail industry. In last few years, electronic sales of agricultural products has rapidly grown as a trend. *NABARD has partnered with ONDC to push e-commerce in the agriculture domain*<sup>(1)</sup>.

E-commerce has immense prospective to attend to multiple constraints referring the agriculture sector of India. In the traditional agricultural value chain, the prospective for

e-commerce commotion is elevated where mediators pocket farmers margins. Agriculture E-commerce if does away with intermediaries by creating direct links among farmers and buyers, consumers, retailers wholesalers, will create straight linkages with impending customers which will then channelize the quality storage facilities which can significantly reduce post-harvest wastage, particularly of the perishable agricultural products. According to IFPRI, the post-harvest losses in India amounted to USD 13 billion in 2020<sup>(2)</sup>.

Farmers ,Logistic providers, input suppliers are the stake holders in value chain of Agriculture E commerce which is created when the E-commerce platforms endorsing Agricultural products is set in motion. etc. Access is gained by Farmers to get higher-quality inputs through online suppliers at a enhanced price than neighboring markets hence excelling cost efficiencies. In addition, quicker access to well-organized transportation supports farmers largely reducing the time it usually takes for the agricultural produce to reach consumers.

A virtuous cycle is created by Agricultural e-commerce . The preliminary advantages that agricultural E-commerce creates is improvised incomes, reduction of wastage as well as way in to financial services attracts more and more farmers to the e-commerce network and incentivize entity farmers to enlarge their on-farm savings and yield. As a result,with an raise in dimensions and regularity of agricultural e-commerce

transactions, funds in agricultural e-commerce infrastructure can remain high.

*Ninjacart, DeHaat, Bijak, Way cool, Farmizen, StoreHippo, and Agrostar are the major agri tech startups in India addressing different pain points<sup>(3)</sup>. For example, Ninjacart works closely with farmers to procure fresh fruits and vegetables and supply them to retailers, hotels, restaurants and even apartment complexes; Farmizen enables buyers to buy organic agricultural products from farmers directly; DeHaat provides full-stack agricultural services to the farmer in the form of quality material inputs, science-based personalised farming advisory and a platform to sell agri produce to institutional buyers; StoreHippo is a SaaS-based e-commerce platform that helps other firms in leveraging e-commerce. So far, StoreHippo has helped agritech platforms like Arya.ag and Plantix in their e-commerce-based solutions<sup>(4)</sup>.*

At present, the main inclusions in the e-commerce modes mainly are B2B, B2C and C2C. The major mode of farming products e-commerce is to trade agricultural products from Reliance fresh, Amazon pantry , Bigbasket and other platforms, the other is a vertical e-commerce platform specializing in selling agricultural products, such as Grofers, Zopnow etc. With the expansion of Internet market, the conventional e-commerce channels of farming products has not been able to meet the tailored needs of new consumers. Due to the combination of

electronic sale of farm products and offline physical stores, the way of Offline to online sale has emerged aggressively as the time require. The offline to online mode of agricultural products takes up full use of the advantages of online stage, with local suitable transportation and stores that are offline, so that patrons can enjoy privileged prices even when they are experiencing the feature of farm products offline, and Farm Products E-commerce Platform Combination of virtual and reality Offline Retail Store demand transfer Value. Though Offline to online mode has many advantages in the new retail environment, there are still some problems. For example, the agricultural product grouping doesn't match the real need of consumers. Companies take the low-cost direction, that is a hurdle in long-term development. The class of agricultural products are not guaranteed. The promotion and examination are not up to the mark, and no users are ever satisfied. Directing and Guiding Consumers' Online Purchase Behavior due the popularity of the Internet, people keep buying agricultural products through multiple channels. Consumers are found usually buying in agricultural markets or supermarkets, as there are no fixed online expenditure habits. The homogeneity of farming products for e-commerce is comparatively high, and the uniqueness of agricultural products are not palpable. Multiple activities like sales Promotion, improvement in consumers' repurchase rate, and gradual convert

consumers of agricultural products from offline to online. Farmers can produce agricultural products that are customized accordingly to the needs of consumers that mainly focuses on the production of agricultural products which has high demand. Agricultural products have a higher impact on the geological environment. The planting and selection of high-quality agricultural products must be firmly controlled at all stages. The superiority, classification and grading of agricultural products should have a minimal standard. Normal casing of agricultural products will also provoke potential consumers interest in buying. The labeling of farming products and the description of basic information on the packaging of farming products are also the incarnation of sameness. In order to ensure the originality of farming products and prevent agricultural products from getting damaged during transportation, packaging materials and fillers should be rigorously scanned and transported after all-inclusive scrutiny. Farming products logistics mostly uses cold chain transportation, so improvement in cold chain technology is a must. So basically it can be said that standardized procedure is extremely important for the development of e-commerce of farming products.

#### **Conclusion :**

When customers buy farming products online, they often counter check the description and estimation of farming products. User's evaluation hence reflects

the service level that the business can deliver and the quality of farming products. It is therefore necessary and important to respond to the consumer's assessment in an appropriate manner, as well as getting feedback from a proper medium and improved evaluation in a timely manner, can reduce the rate of poor evaluation, and boost the trust of users. Online assessment reflects the user's know-how. Businessmen need to improve service level, attach importance to offline experience, and improve customer's purchase rate by increasing positive comments .

## **Reference :**

- 1) <https://m.economictimes.com/tech/technology/ondc-partners-with-nabard-to-activate-e-commerce-in-agritech/articleshow/92322805.cms>
- 2) <https://www.ifpri.org/blog/india-forum-securing-harvest-food-security>
- 3) <https://www.forbesindia.com/article/agritech-special-2022/from-ninjacart-to-vegrow-5-indian-agritech-startups-to-watch-out-for/79589/1>
- 4) <https://analyticsindiamag.com/agri-e-commerce-is-ripe-for-the-taking/>



**Nanotechnology a tool for Sustainable Agriculture against stress: An assessment**

**Indra Jeet Chaudhary<sup>1</sup> Mangesh M. Vedpathak<sup>2</sup>**

<sup>1</sup>Department of Environmental Science, Savitribai Phule Pune University (Maharashtra) India

<sup>2</sup>Shriram Institute of Information Technology, Paniv, Tal. Malshiras, Dist-Solapur, (Maharashtra), India

Corresponding Author- **Indra Jeet Chaudhary**

Email: [indrajeet.cug@gmail.com](mailto:indrajeet.cug@gmail.com)

DOI-10.5281/zenodo.7476353

---

**Abstract**

Abiotic and biotic factors are the major causes that affect the productivity of crops. Many tools of modern science have been widely applied for crop improvement under environmental stress. In this way, nanotechnology is the major green technologies which are provided to the protection of plants against stress. Under various stress condition nanoparticles are the major contributor to increasing germination, seedling growth, physiological activities including photosynthesis and nitrogen metabolism, leaf activities of CAT, POX, and APX, chlorophyll contents, protein, carbohydrate contents, and yield, and also positive changes in gene expression indicating their potential use in crop improvement. Therefore, selection of nanotechnology for crops improvement will be very useful tool. Nanoparticles enhances root hydraulic conductance and water uptake in plants and showing differential abundance of proteins involved in oxidation-reduction, ROS detoxification, stress signaling, and hormonal pathways. The mobility of the nanoparticles is very high, which leads to rapid transport of the nutrient to all parts of the plant. In particular, the most actual is to find ways to increase the adaptation potential of cultivated plants with the use of Nano particles in stressful conditions.

**Keywords:** Nanotechnology; Sustainable Agriculture; Stress

---

**1. Introduction**

Agriculture is the backbone of the any countries, now a days due to climatic variation and industrial revolution food production is the tuff task for farmers. Population of the World is increasing day by day and expected it reach 9.1 billion at 2050, but production of agriculture is not increased parallel to population (Alexandratos and Bruinsma, 2012). Therefore increasing yield or productivity is a basic challenges in areas that affected by environmental stress condition. According to Acquaah, (2007), as per estimation 70% yield reduction influence by abiotic stress directly or indirectly. Abiotic stresses affect the plants morphology, physiology,

biochemical and molecular changes and also adversely affect the growth and productivity of plant (Chaudhary and Rathore, 2018, 2019, 2020, 2021, 2022). Abiotic stress including drought, ozone, salinity and temperatures are the most prevalent stresses and threatening food security globally (Rathore and Chaudhary, 2019, 2021; Villalobos-López et al., 2022). For minimization of yield loss due to stress, various tool are uses by the researchers such as development and selection of tolerance plants. Conservative breeding systems have met with limited success in improving the stress tolerance of crop plants involving inter-specific or inter-generic hybridization. The conventional

breeding approaches are limited by the complexity of stress tolerance traits, as well as the low genetic variability of yield components under stress condition and lack of efficient selection criteria. It is important, therefore, to look for alternative strategies to develop stress tolerant crops. All traditional breeding methods including selection, hybridization, polyploidy and mutation have utilized for genetic improvement of crop plants. For this resolution exploration of novel plans and their exploitation in complement to existing traditional and advanced breeding tools is the need of the hour. Now a days globally food production demands has increased. Therefore farmer uses various resources such as fertilizers and pesticide for food production. But these resources causing to pollution in environmental components.

The new or latest technology is introduces that is nanotechnology it is a most promising for agriculture and plant biotechnology (Scrinis and Lyons, 2007; Chaudhary and Singh, 2020). Currently nanotechnology is the major technique for improving growth and development of plant against stress (Scrinis and Lyons 2007; Chaudhary and Singh, 2019). Application of nanoparticle positively and negatively affects the plant growth and physiology. Nanotechnology includes novel properties of nanomaterial that make informal for agricultural research in crop enhancement sequencer as well as mitigation to stresses (Carmen et al. 2003). Nanotechnology has been temporarily defined as relating to materials, systems and methods which work at a scale of 100 nanometres (nm) or less. 'Nano' usually refers to a size scale between 1 and 100 nm. Nano materials are composed of components with very small size, and these components have impacts on the

properties of materials at the macro level. Nano materials have a relatively larger surface area when compared to the same mass of material produced in a larger form. Nano particles can make materials more chemically reactive and affect their strength or electrical properties. The particles have high surface to volume ratio that increases their reactivity and possible biochemical activity (Dubchak et al. 2010). Therefore selection of nanoparticle and their positive effect under stress condition of plants will have a better tool for sustainable agriculture.

## **2. Nanotechnology**

Nanotechnology is the emergence technology and it's used wide applications in diverse fields, and more attention is being paid on the nanomaterial synthesis from metals (Au, Ag, Pd, etc.) or metal oxides (ZnO, SiO<sub>2</sub>, TiO<sub>2</sub>, etc). Various method are available for synthesis of nanomaterial such as physical, chemical and biological (Jeevanandam et al., 2018). Thrustly, nanoparticles not only synthesize by chemically but also focusing on biological synthesis. Some metallic nanoparticles synthesise by using plants or its extract because they containing enzyme, protein, antioxidants, phytochemicals, alcohol and cofactors etc (Aboyewa et al., 2021). During the production of metal nanoparticles from metal salts, these compounds serve as a reducing and stabilizing agent. Hence it is helpful in finding most eco-friendly and promising nanoparticle synthesis solutions, which enables a controlled synthesis of well-defined size and shape while also preventing pollution of the atmosphere (Kumar and Yadav, 2009, Sharma, 2009, Siddiqui et al., 2014). Nanoparticles (NPs) achieve high surface to volume proportion which improves their bioavailability,

bioactivity and other biochemical activity (Dubchaket al., 2010). As a result, it is anticipated that the application of nano biotechnology tools in the agricultural sector will improve plant growth, development, productivity, and biotic and abiotic stress tolerance. Plants were also observed to be capable of producing natural mineralized nano-materials (NMs) necessary for growth under certain conditions (Wang et al., 2001). In addition, it is anticipated that as knowledge of nanotechnology grows, it will be able to be capitalized on to become a major economic engine that will benefit farmers and consumers as well as the environment.

### **3. Role of nanoparticles into the plants**

Accumulation of nanoparticle by plant tissues can be positively affect to the plant by scavenging reactive oxygen species and protects proteins, lipids, and nucleic acid content (Rajputet al., 2020). The accumulation rate of nanoparticle by root to plants might be influence by particle properties and environmental conditions (Chen, 2018). In recent field study observed that plants uptake of CB and MB NMs. Among CB NMs, the most studied substances are the fullerene C70, the fullerol (C<sub>60</sub>(OH)<sub>20</sub>) and CNTs; while the maximum studied MB NMs are TiO<sub>2</sub>, Au, Ag, Cu, CeO<sub>2</sub>, FeO, and ZnO NPs. Absorption, translocation, and accumulation of NPs processes depend upon the plant species and the size, type, chemical composition, functionalization and stability of the NPs. Generally, NPs enter the plant root system via the lateral root junctions and reach the xylem via the cortex and the pericycle (Dietz and Herth, 2011). The mechanism behind interaction of nanoparticles using plant system is primarily depends upon chemical processes

which produce reactive oxygen species, ion cell membrane transport activity, oxidative damage and lipid peroxidation. Once go into in the plant cells NPs react with sulfhydryl, carboxyl groups and ultimately change the protein activity. The NPs can also form complexes with membrane transporters or root exudates and eventually be transported into the plants (Watanabe et al., 2008; Kurepa et al., 2009). Nanomaterial's flow from plants leaves to roots, stem and producing grain and from one root to another. Xylem is the main passages of uptake and transportations to the shoot and leaves of plant (Birbaum et al., 2010; Pola et al., 2012). The nanomaterials are able to penetrating via the leaf cuticle and into the cell cytoplasm (Sharif et al., 2013). In the cytoplasm function, the NMs may bind with different cytoplasmic organelles and interfere with the metabolic processes at that site of the cell (Zhang and Monteiro, 2009). One of the pathways also reported that, particle size of 20 nm Ag nanoparticles can be traversed in the plant cells through plasmodesmata (Unrine et al., 2012; Yan and Chen, 2019). A research study was carried out on generational transmission of C70-NOM in rice vegetation with aiming to find the presence of black aggregates of C70 inside the leaves of the second generation of the plants treated with fullerenes only in their first generation (Lin et al., 2009). Various studies conducted for understanding of function of nanomaterial in plant growth and development as well as provide protection against stress (Fig.1, Table.1).

Fig. 1. Role of nanoparticle in to plants

### **4. Nanotechnology for agricultural sustainability**

Nanotechnology can play an important role in plant productivity through control of

nutrients (Gruère, 2012; Mukhopadhyay, 2014). Nanoparticle have diverse asset and activity that it is possibility to assess environmental health problem (Prasad et al., 2014). Structure and properties of nanoparticle include chemical composition, shape, surface structure, surface charge, behaviour have the influence the toxicity (Ion et al., 2010). Most commonly Nanomaterials have similar chemical composition and referred as larger scale bulk materials that have different sizes or shapes. They can be exhibit their different toxicity. In agricultural field, application of the nanotechnology plays an important role in crop yield production. It is also identified as potential technology used to improve agricultural productivity which is important step within the sustainable developments. In the agricultural and food production areas based applications of nanotubes, fullerenes, biosensors, controlled delivery systems, nanofiltration, etc. had been discovered (Ion et al., 2010; Sabir et al., 2014). Drug delivery mechanisms in plants system is to be good technology and also helpful on resources in the management of agricultural field and it is useful to maintain the soils fertility. Major abiotic factors include drought, salinity, alkalinity, metals, submergence and mineral toxicity or deficiencies which cause stress in plant growth system. It is also contributes to decrease in crop growth and yield. Among the abiotic stresses like salinity, drought, UV radiation, temperature, SPM and ozone which are responsible for reduction in crop

yield (Saxena et al., 2016). In case of sessile organism, plants left with no choice however to stand numerous environmental stresses at some point of their lifecycle, consequently they develop their defence in opposition to environmental stresses at diverse stages by way of modulating molecular, biochemical and physiological pathways.

In order to adopt the plant stresses, plants adopt molecular pathways by appropriate modification of gene expressions. There are various investigations which showed that nanoparticles mediated effect on plants growth and development is concentration dependent. Regulating the activities of antioxidant enzymes like SOD, CAT and POD are involved in nanoparticles (Laware and Raskar, 2014). The researcher Laware and Raskar (2014) studied on effect of exposed TiO<sub>2</sub> nanoparticles the on seedlings of Onion. He concluded that, seed germination and seedlings growth in onion were enhanced at low concentration of TiO<sub>2</sub> Nanoparticles whereas effect suppressed at higher concentrations. Laware and Raskar (2014) in his experiment showed that enzymes activity were higher at lower concentration (10-30 µg/ml) of TiO<sub>2</sub> and reduced at higher concentration (40 and 50 µgml<sup>-1</sup>) (Laware and Raskar 2014). Lu and his co-workers (2002), concluded that TiO<sub>2</sub> and SiO<sub>2</sub> nanoparticles have shown potential to improve seed germination growth of Glycine seeds (Kurepa et al. 2009).



**Table 1. Nanotechnology and its role on plant growth and development**

S. No.	Nanoparticles	Its role plant growth and development
	Silicon Nanoparticles (SNPs)	Silicon nanoparticle mitigated abiotic stresses in plants and play role in enhancement of antioxidant enzyme activation, enhanced uptake process, co-precipitation of toxic metal ions, and immobilization of toxic metal ions. All such processes, increase plant capabilities to withstand abiotic stresses i.e., salinity, drought, heavy metal toxicity etc. (Liang et al., 2007).
	Nano SiO <sub>2</sub>	Up-regulating the genes and suppressing the effect of salinity on seed germination rate, root length and fresh weight (Almutairi, 2016)
	Silver Nanoparticles (AgNPs)	Induced level of specific antioxidant enzymes and increased chlorophyll content, length of plants, at the same time proline and MDA reduced (Sharma et al., 2012).
	ZnO Nanoparticles	Application of ZnO nanoparticles enhanced seed germination and seedling growth. Increased biomass production Increasing growth, net CO <sub>2</sub> assimilation rate, sub-stomatal CO <sub>2</sub> content, chlorophyll content (Burman et al., 2013; Torabian et al., 2016). because ZnO nanoparticles increases the auxin (IAA) level in roots (sprouts) which promote the growth of plants. Prepared the plants to tolerate drought stress (Cakmak, 2008).
	TiO <sub>2</sub> Nanoparticles	TiO <sub>2</sub> nanoparticle is photocatalytic in nature which can carry out an oxidation–reduction reaction leading to generate superoxide anion radical and hydroxide when exposed to light (Hong et al., 2005) However, photo sterilization by TiO <sub>2</sub> nanoparticles ameliorate plant growth and development (Chaudhary and Singh, 2020).
	Aluminum Oxide Nanoparticle (Al <sub>2</sub> O <sub>3</sub> Nanoparticles)	Aluminum oxide is prime material, used by industry because it possesses good thermal conductivity, high strength and stiffness (Burklew et al., 2012). It is also work in regulation of energy metabolism and cell death, improved plant growth (Mustafa et al., 2015).
	Nano Ag	Reducing generation of cytotoxic by products of glycolysis, increasing the abundance of stress-related proteins, enhancing seedling growth (Mustafa et al., 2015).
	Nano ZnO and Fe <sub>3</sub> O <sub>4</sub>	Reduction in Na <sup>+</sup> and Cl <sup>-</sup> contents, increasing N, P, K <sup>+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup> , Fe, Zn, total chlorophyll, carotenoids, proline, carbohydrates, crude protein and enzymatic and non-enzymatic antioxidants (Soliman et al., 2015).

## 5. Future perspectives

Nanotechnology can change the future of agriculture by innovation of new techniques. Now a day's precision farming,

nutrients absorption ability to plant, disease control, are the major target based technology for agricultural sustainability. For agricultural sustainability

nanotechnology can be used for live record in ecosystem such as food chain stability and energy balances. Sustainable agriculture must be taken as an ecosystem services method, where agro ecosystem provide food to all biotic- living beings live on this biome. Agro ecosystems rely on ecosystem services by natural ecosystem. The calorific energy flow in the ecosystem is important to maintain an ecological balance. In order to maximize agricultural production, new technologies, modernization, an increase in the use of nano-chemical materials, specialization, and government policies are adapted. Establishing the new technology in the food industry is necessary in order to overcome the situation. Therefore, the new and future nanotechnology needed in field of agri food based industries and aims to crop production, use of agro-chemicals such as nanofertilizers, nanopesticides, nanoherbicides, etc., precision farming techniques, intelligent feed, enhancement of food texture and quality, and bioavailability/nutrient values, packaging and labelling, etc. There is need to researchers to focus attention on the field of agricultural nanotechnology or nano foods. Due to their outstanding physical, chemical, and biological properties, nanomaterials and nanotechnologies have received a lot of research attention over the past few decades. Nanomaterials characterised by size, dose, exposure time, surface chemistry, structures, immune response, accumulation, retention time, etc., and other effects should be accessed carefully. In order to develop to detect, validate to access to the effects that each nanomaterial or nanofood has on ecosystems, new analytical techniques must be developed. The life cycle analysis of nanomaterials and Nano foods should to be studied. For this knowledge to be

manipulated, a better wide-ranging data bank and international collaboration in policy, idea, and regulation are required. In addition, the authorities should to provide straightforward instructions and road maps for minimizing the dangers associated risk with using nanotechnology-based products. Consumers, researchers, authorities, industrial sectors should participate in new debates and communication channels for talk about how this technology affects people, the economy, and science. In the long term, nanotechnology may provide economic and innovative development ways for sustainable agriculture and also a routes for human nutritional development worldwide.

## **6. Conclusion**

Agricultural losses causes food crises worldwide. In current scenario agricultural loss by abiotic stress is one of the burning problem. Because abiotic and biotic factors are the major contributors that affect the productivity of crops. Many tools of modern science have been widely applied for crop improvement under environmental stress. In this way, nanotechnology is the major green technologies which are provided to the protection of plants. Now a day's nanotechnology is the growing and latest technology which update day by day in diverse sectors. However, nanotechnology uses for sustainable agriculture against stress is the best practice worldwide. Therefore, the understanding the functioning and unique properties and application of nanoparticle in order to minimise the crop loss due to stress will be important tool for agriculture sectors. Nowadays nanoparticles are the major contributor to increasing germination, seedling growth, physiological activities including photosynthesis and nitrogen

metabolism, leaf activities of CAT, POX, and APX, chlorophyll contents, protein, carbohydrate contents, and yield, and also positive changes in gene expression indicating their potential use in crop improvement. Therefore, understanding of interaction between nanoparticles and plants give beneficial practices to negative impact and natural environment as well as crop improvement too.

## **7. References**

1. Aboyewa JA, Sibuyi NRS, Meyer M, Oguntibeju O.O., 2021. Green Synthesis of Metallic Nanoparticles Using Some Selected Medicinal Plants from Southern Africa and Their Biological Applications. *Plants (Basel)*. 2021 Sep 16; 10 (9):1929. doi: 10.3390/plants10091929. PMID: 34579460; PMCID: PMC8472917.
2. Acquaaah G., 2007. Principles of Plant Genetics and Breeding. Oxford, UK: Blackwell; 2007.
3. Alexandratos, N. and Bruinsma J., 2012. World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO.
4. Almutairi ZM., 2016. Effect of Nano silicon application on the expression of salt tolerance genes in germinating tomato (*Solanum lycopersicum* L.) seedlings under salt stress. *Plant Omics Journal*. 2016;9 (1):106-114
5. Birbaum K, Brogioli R, Schellenberg M. 2010. No evidence for cerium dioxide nanoparticle translocation in maize plants. *Environmental Science and Technology*. 44(22):8718-8723
6. Burklew CE, Ashlock J, Winfrey WB, Zhang B 2012. Effects of Aluminum Oxide Nanoparticles on the Growth, Development, and microRNA Expression of Tobacco (*Nicotiana tabacum*). *PLoS ONE* 7(5): -34783. <https://doi.org/10.1371/journal.pone.0034783>
7. Burman U, Saini M, Kumar P., 2013. Effect of zinc oxide nanoparticles on growth and antioxidant system of chickpea seedlings. *Toxicol Environ Chem*, 95,(4), 605–612.
8. Cakmak I: 2008. Enrichment of cereal grains with zinc. “Agronomic or genetic bio fortification”, *Plant & Soil*, 2008, 30 (2), 1-17.
9. Carmen IU, Chithra P, Huang Q , Takhistov P, Liu S, Kokini JL. 2003. Nanotechnology: A new frontier in food science. *Food Technology*. 57:24-29.
10. Chaudhary I. J. and Rathore D. 2020. Relative effectiveness of ethylene diurea, phenyl urea, ascorbic acid and urea in preventing groundnut (*Arachis hypogaea* L) crop from ground level ozone. *Environmental Technology & Innovation*, 19, 100963.
11. Chaudhary I. J. and Rathore D. 2021. Assessment of ozone toxicity on cotton (*Gossypium hirsutum* L.) cultivars: Its defensive system and intraspecific sensitivity. *Plant Physiology and Biochemistry*. 166, 912-927. <https://doi.org/10.1016/j.plaphy.2021.06.054>.
12. Chaudhary I. J. and Rathore D. 2022. Effects of ambient and elevated ozone on morphophysiology of cotton (*Gossypium hirsutum* L.) and its correlation with yield traits. *Environmental Technology & Innovation*. 25, 102146.
13. Chaudhary, I.J. and Singh, V 2020. Titanium dioxide nanoparticles and its impact on growth, biomass and yield of agricultural crops under environmental stress: A review. *Research Journal of*

- Nanoscience and Nanotechnology. ISSN 1996-5044. DOI: 10.3923/rjnn.2019.
14. Chaudhary, IJ. and Rathore, D 2018. Suspended particulate matter deposition and its impact on urban trees. *Atmospheric Pollution Research* 9; 1072–1082.
15. Chaudhary, IJ. and Rathore, D 2019. Dust pollution: Its removal and effect on foliage physiology of urban trees. *Sustainable Cities and Society* (51) 101696.  
<https://doi.org/10.1016/j.scs.2019.101696>
16. Chen, H., 2018. Metal based nanoparticles in agricultural system: behavior, transport, and interaction with plants. *Chem. Speciat. Bioavailab.* 30, 123–134.
17. Dietz KJ, Herth S. 2011. Plant nanotoxicology. *Trends in Plant Science.* 16(11):582-589
18. Dubchak S, Ogar A, Mietelski JW, Turnau K. 2010. Influence of silver and titanium nanoparticles on arbuscular mycorrhiza colonization and accumulation of radio caesium in *Helianthus annuus*. *Spanish Journal of Agricultural Research.* 8:103-108.
19. Dubchak S, Ogar A, Mietelski, JW, Turnau K., 2010. Influence of silver and titanium nanoparticles on arbuscular mycorrhiza colonization and accumulation of radio caesium in *Helianthus annuus*,” *Span. J.Agric. Res.*, 2010, 8, s103–S108.
20. Gruère, G. P. 2012. Implications of nanotechnology growth in food and agriculture in OECD countries. *Food Policy* 37, 191–198. doi: 10.1016/j.jhazmat.2014.05.079
21. Hong F, Yang F, Liu C, Gao Q, Wan Z, Gu F, Wu C, Ma Z, Zhou J, Yang P 2005. Influence of nano-TiO<sub>2</sub> on the chloroplast aging of spinach under light,” *Biol Trace Elem Res* 104:249–260
22. Ion, A. C., Ion, I., and Culetu, A. 2010. Carbon-based nanomaterials: Environmental applications. *Univ. Politehn. Bucharest* 38, 129–132.
23. Jeevanandam J, Barhoum A, Chan YS, Dufresne A, Danquah MK., 2018. Review on nanoparticles and nanostructured materials: history, sources, toxicity and regulations. *Beilstein J Nanotechnol.* 3;9: 1050-1074. doi: 10.3762/bjnano.9.98. PMID: 29719757; PMCID: PMC5905289.
24. Kumar, V, Yadav, S.K., 2009. Plant-mediated synthesis of silver and gold nanoparticles and their applications. *J Chem Technol Biotechnol* 84:151–157.
25. Kurepa J, Paunesku T, Vogt S, Arora H, Rabatic BM, Lu J, et al. 2009. Uptake and distribution of ultra-small anatase TiO<sub>2</sub> alizarin red S Nano conjugates in *Arabidopsis thaliana*. *Nano Letters*, 10(7):2296-2302
26. Laware SL, Raskar S. 2014. Effect of titanium dioxide nanoparticles on hydrolytic and antioxidant enzymes during seed germination in onion. *International Journal of Current Microbiology and Applied Science.* 3(7):749-760
27. Liang Y, Sun W, Zhu YG, Christie P., 2007. Mechanisms of silicon mediated alleviation of abiotic stresses in higher plants: a review,” *Environmental Pollution*, 147, 422–428.
28. Lin S, Reppert J, Hu Q, Hudson JS, Reid ML, Ratnikova TA, et al. 2009. Uptake, translocation, and transmission of carbon nanomaterials in rice plants. *Small.* 5:1128-1132.



29. Mukhopadhyay, S. S. 2014. Nanotechnology in agriculture: prospects and constraints. *Nanotechnol. Sci. Appl.* 7, 63–71. doi: 10.2147/NSA.S39409
30. Mustafa G, Sakata K, Komatsu S. 2015. Proteomic analysis of flooded soybean root exposed to aluminium oxide nanoparticles. *Journal of Proteomics*. 128:280-297
31. Pola M, Tamara LC, Andrew TH., 2012. Toxicity, uptake, and translocation of engineered nanomaterials in vascular plants. *Environmental Science and Technology*. 46(17):9224-9239
32. Prasad, R., Kumar, V., and Prasad, K. S. 2014. Nanotechnology in sustainable agriculture: present concerns and future aspects. *Afr. J. Biotechnol.* 13, 705–713. doi: 10.5897/AJBX2013.13554
33. Rajput, V., Minkina T., Mazarji M., Shende S., Sushkova S., Mandzhieva S., Burachevskaya M., Chaplygin V., Singh A., Jatav H., 2020. Accumulation of nanoparticles in the soil-plant systems and their effects on human health. *Annals of Agricultural Sciences* 65, 137–143.
34. Rathore, D and Chaudhary, IJ 2019. Ozone risk assessment of castor (*Ricinus communis* L.) cultivars using open top chamber and ethylenediurea (EDU). *Environmental Pollution* 244; 257-269.
35. Rathore, D. Chaudhary, I.J. 2021. Effects of tropospheric ozone on groundnut (*Arachis hypogea* L.) cultivars: Role of plant age and antioxidative potential. *Atmospheric Pollution Research*. 12(3): 334–348. ISSN: 1309-1042. <https://doi.org/10.1016/j.apr.2021.01.005>.
36. Sabir, S., Arshad, M., and Chaudhari, S. K. 2014. Zinc oxide nanoparticles for revolutionizing agriculture: synthesis and applications. *Sci. World J.* 2014:8. doi: 10.1155/2014/925494
37. Saxena, R., Tomar R.S., Kumar M., 2016. Exploring Nanobiotechnology to Mitigate Abiotic Stress in Crop Plants. *J. Pharm. Sci. & Res.* Vol. 8(9), 974-980.
38. Scrinis G, Lyons K. 2007. The emerging nano-corporate paradigm: Nanotechnology and the transformation of nature, food and agri-food systems. *International Journal of Sociology of Agriculture and Food*. 15: 22-44.
39. Sharif F, Westerhoff P, Herckes P. 2013. Sorption of trace organics and engineered nanomaterials on to wetland plant material. *Environmental Sciences: Processes and Impacts*. 2013;15(1):267-274
40. Sharma P, Bhatt D, Zaidi MG, Saradhi PP, Khanna PK, Arora S., 2012. “Silver nanoparticle-mediated enhancement in growth and antioxidant status of *Brassica juncea*,” *Appl Biochem Biotechnol.*, 167,(8), 2225-33.
41. Sharma VK, Yngard RA, Lin Y 2009. Silver nanoparticles: Green synthesis and their antimicrobial activities,” *Adv Colloid Interface Sci*, 2009, 145:83–96
42. Siddiqui MH, Al-Whaibi MH, Faisal M, Al Sahli AA 2014. Nanosilicon dioxide mitigates the adverse effects of salt stress on *Cucurbita pepo* L.,” *Environ Toxicol Chem*, 33(11), 2429–
43. Soliman AS, El-feky SA, Darwish E. 2015. Alleviation of salt stress on *Moringa peregrina* using foliar application of nanofertilizers. *Journal of Horticulture and Forestry*. 7(2):36-47.
44. Torabian S, Zahedi M. Khoshgoftarmanesh 2016. Effect of foliar spray of zinc oxide on some antioxidant enzymes activity of

- sunflower under salt stress. Journal of Agricultural Science and Technology. 18: 1013-1025
45. Unrine JM, Colman BP, Bone AJ, Gondikas AP, Matson CW. 2012. Biotic and abiotic interactions in aquatic microcosms determine fate and toxicity of Ag nanoparticles. Part 1. Aggregation and dissolution. Environmental Science and Technology. 46(13):6915-6924
46. Villalobos-López, M.A.; Arroyo-Becerra, A.; Quintero-Jiménez, A.; Iturriaga, G. 2022. Biotechnological Advances to Improve Abiotic Stress Tolerance in Crops. Int. J. Mol. Sci. 23, 12053. <https://doi.org/10.3390/ijms231912053>
47. Wang LJ, Guo ZM, Li TJ, Li M, 2001. The Nano structure SiO<sub>2</sub> in the plants". Chin. Sci. Bull, 46, 625–631.
48. Watanabe T, Misawa S, Hiradate S, Osaki M. Root mucilage enhance saluminum accumulation in Melastomamalabathricum, an aluminium accumulator. Plant Signalling and Behavior. 3:603-605
49. Yan A, Chen Z. 2019. Impacts of Silver Nanoparticles on Plants: A Focus on the Phytotoxicity and Underlying Mechanism. Int J Mol Sci. 2019 Feb 26;20(5):1003. doi: 10.3390/ijms20051003. PMID: 30813508; PMCID: PMC6429054.
50. Zhang LW, Monteiro RNA. Mechanisms of quantum dot nanoparticle cellular uptake. Toxicological Sciences. 110(1):138-155.

**Significance of Legal Framework for Sustainable Agriculture in India**

**Arafatali Saiyed<sup>1</sup> Akil ali Saiyed<sup>2</sup>**

<sup>1 2</sup>Faculty of Law, Gokul Global University, Siddhpur (Gujarat)

Corresponding Author- **Arafatali Saiyed**

Email-[prof.saiyed@gmail.com](mailto:prof.saiyed@gmail.com)

DOI- 10.5281/zenodo.7476364

---

**Abstract**

Out of three essentials of human life : *Roti, Kapda aur Makaan*, i.e. food, clothing and housing, first two are the produce of agriculture. Classically housing was also based on agriculture products. Conventional items meant for education, i.e. paper, pencil, rubber, etc. are agriculture products. Agriculture in India is one of the rapidly growing sector, generating handsome revenue over the last few years. There is considerable growth of investment in agriculture sector that has lead the growth of the sector. Structured and strategic endeavour by the Government of India has produced satisfactory results and increased the investment in agriculture sector. Various schemes such as National Mission for Sustainable Agriculture (NMSA), Pradhan Mantri Fasal Bima Yojana (PMFBY), and Pradhan Mantri Krishi Sinchai Yojana (PMKSY) introduced for the welfare of all stake holders of agriculture has made overall development of the sector. There have been significant awareness among farmers regarding all sorts of agriculture activities, be it weather condition, climatic impact, organic farming, irrigation as well as agriculture management. This paper aims to signify the importance of the law and policy that plays vital role in promotion and development of sustainable agriculture.

**Keywords:** Sustainable Agriculture, Legal Framework, Farmers' Law

---

**Introduction**

Agriculture is one of the oldest activity and profession in the world. Not only human being but all the creature on the earth survives through agriculture. Agricultural activities in India traces back in Indus civilization. In addition to the food, i.e. vital element of life, it also provides employment and ease of life. Agriculture is quite important sector in the economy of any country. Through the foreign exchange and spawning job opportunities, agriculture plays principal role in economic system. Over and above the food requirement, agriculture also yield raw material for many industries. There is huge potential in forestry, animal husbandry, fisheries, food as well as cash crops for the development of the country. However, this potential needs to properly channelize to get the desired growth and prosperity.

Nashir Akinola defined agriculture as both a science and an art or rather a technology for the exploitation of the primary, secondary and tertiary products of photosynthesis. In addition to planting, and harvesting, agriculture also includes forestry, fisheries,

animal husbandry, food and cash crop, supply chain, etc.

The agriculture industry consist of companies and firms which are involved in cleaning, processing, packaging and storing every kinds of agriculture produces. These products are classified as fibres, foods, raw materials, etc. Fish farming, cattle and animals, dairies, etc. are also included in agriculture industry. There is a considerable size of mechanical industries engaged in manufacturing of farm equipment.

**Sustainable Agriculture**

Various authors, legislations and policy papers have defined sustainable agriculture in their own way. Neil Hamilton (1993) has is defined as developing agricultural practices which protect the environment while preserving the economic profitability of farmers. The basis of the concept is that no agricultural system can be successful in either the short or long term unless it is designed to sustain the resources necessary for its operation. These resources include both physical resources, of soil, air, and water, and also human and social resources of farm

## ***Agriculture Development towards Sustainability***

families, rural communities, and the economic structure necessary for an agrarian system to function. Keeping the combined concern for an environment and economics of farming activities, the goal of sustainable agriculture along with profitability can be harnessed. The Leopold Center under Iowa Code defines sustainable agriculture as 'the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land.' Agriculture activities and practice are carried out in the environment. It also maintains the eco-system and ecology of the place.

### **Need for Legal Regulation**

Agriculture law includes various legal provisions and regulations concerned to the production and selling of agriculture goods. It deals with legal matters related to seeds, water, irrigation, fertiliser, pesticides, packing, processing and transportation of agriculture materials. One of the fundamental prerequisites for the achievement of sustainable development is broad public participation in decision making of which farmers is one. Integrated agricultural development which involves consciously formulated, systematic and multi-sectoral programme to attain the integration of the people in the mainstream of income groups in a country is essential for national policy.

Agricultural practice and development activities take place on the environment. The environment therefore represents a complex system of interconnections (Sands, 2003). The interconnections between the environment and agricultural practices cannot be treated as discrete (Goodie, 1993). This interconnection poses legal challenges as to how to develop and apply a comprehensive and effective set of legal requirements aimed at preventing environmental damage when engaged in agricultural practice. Agriculture-led development is fundamental to sustainable national development as it helps to reduce hunger, poverty, burden of food import as

well as the generation of economic growth and the opening of new way to an expansion of exports. The agricultural sector can be likened to the chicken that lays the egg for the development of any nation, the neglect of which is capable of rendering life to be meaningless. (Erhun, 2019). Uncontrolled expansion of agriculture poses threat on forests and wetlands. Application of pesticides causes damage to fauna and flora as well as soil erosion. Chemical insecticides and artificial spray pollute the air and environment. Air pollution also occurs due to conventional practice of burning natural vegetation and husks.

### **Need for Promotional Policy**

Every country planning to achieve goals of sustainable development in various sector has to first focus on the sustainable agriculture. Sustainability begin from the ground and agriculture being activity of ground is the most important to realise sustainable development in any other sector. Sustainable agriculture integrates sustainability of environment as well as social need of the nation.

The legal policy about agriculture-infrastructure, agri-finance, agri-insurance, etc. affects directly farmers in the every nook and corner of the country. Farmers and farming also depends upon the various rights of farmers as individual and professional laid down in constitution as well as statues passed by legislature. Every state has separate land laws governing the affairs of the land acquisition, maintenance, fragmentation and transfer. Well-designed policy and proper legal provisions are instrumental in promotion and development of sustainable agriculture system for any country.

### **Legal Framework and Policy in India**

As per the Constitution of India, Agriculture is the subject matter of the state. The state governments are primarily responsible for the growth and development of agriculture sector as well as designing perspective plans for their respective states. State is also responsible to ensure effective



## ***Agriculture Development towards Sustainability***

implementation of the programmes/schemes. Nevertheless, central government also supplements the efforts and actions of the state governments through various schemes as well as programmes. Some of the scheme are Pradhan Mantri Fasal BimaYojana, National Bee and Honey Mission, FPOs Scheme, Pradhan Mantri Krishi Sinchai Yojana, etc. The center also provide share in budget, institutional credits, Agri Infrastructure Fund, Agri Infrastructure Fund, etc. Central government also has control on fixing MSP (Minimum Support Price), procurement from farmers, soil health card as well as Neem coating on Urea.

Government has taken several steps for increasing investment in agriculture sector such as promotion of scientific warehousing infrastructure for increasing shelf life of agricultural produce; setting up of Agri-tech Infrastructure Fund for making farming competitive and profitable; developing commercial organic farming, enhanced institutional credit to farmers etc. Government is implementing various schemes for supply of farm inputs, like seeds, fertilizers, agricultural machinery and equipment, irrigation facilities, institutional credit, etc., at subsidized rates to the farmers in the country. Government has recently taken several steps for increasing investment and growth in agriculture sector which include creation of Long Term Irrigation Fund (LTIF), Micro Irrigation Fund for water use efficiency, promotion of commercial organic farming, etc.

Government of India has launched the Central Sector Scheme of financing facility under Agriculture Infrastructure Fund (AIF) to boost Agriculture Infrastructure relating to post harvest management and community farming assets. Under this scheme entities such as farmers, agri entrepreneurs, starts up, Central/ State agency or local body sponsored public private partnership projects etc. can take benefit for setting up eligible infrastructure projects. Under Rashtriya Krishi Vikas Yojana (RKVY) Scheme of

Ministry of Agriculture, grants-in-aid is given to state governments on the basis of the projects approved in State Level Sanctioning Committee Meeting (SLSC). States can take up projects for the development of Agriculture and allied sector in Public Private Partnership (PPP) for Integrated Agriculture Component.

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme is being implemented with a view to provide income support to all landholding farmer families across the country, to enable them to take care of expenses related to agriculture and allied activities as well as domestic needs. Further, Government of India has launched the Aatmanirbhar Bharat Abhiyan (ABA) to strengthen Infrastructure, Logistics, Capacity Building, Governance and Administrative Reforms for Agriculture.

### **Conclusion**

Apart from the legal framework and policies, the foremost driver of sustainability is education and research. Every policy and legal provision remain on paper only unless they are been properly implemented and executed which requires awareness of the same among the stakeholders. Farmers shall not change their practice of farming to protect the environment unless they have information and knowledge regarding the new techniques and practices that yield better. Sustainable agriculture does not deal merely with soil, crop, water or price but also concern farmers, their families and rural communities.

Sustainable agriculture promotes the coherent, practicable, rational and comprehensive use of the environment in such a manner that it remain live-able for next generations also. Sustainable farming requires conservation of resources, social support and economic viability as well as safe for an environment. Therefore, there has to be strict compliance of the legal provisions and regulation. Through the legal sanctions and directives, farming can be practised for increased produced, economically profitable,

and socially equitable without damaging the environment.

**References**

1. Neil D. Hamilton, Feeding Our Future: Six Philosophical Issues Shaping Agricultural Law, 72 NEB. L. REV. 210, 239 (1993).
2. IOWA CODE § 266.39(1) (1997)
3. Neil D. Hamilton, The Role of Law in Promoting Sustainable Agriculture : Reflections on Ten years of Experience in the United States, Drake Journal of Agricultural Law, Vol. 3, (1998) pp. 423-431.
4. Erhun O. Mercy, A Legal Framework for Sustainable Agricultural Practice in Nigeria, Vo. 15, No. 10 (2019) pp. 19-32.
5. Akinola, B. A. Sustainable food security and its rural developmental challenges in Nigeria. Bosem Publishers Nig. Ltd. (2015).
6. Ajala, O. Evolution of agricultural policies and laws in Nigeria. In R. T. Ako & D. S. Olawuyi (Eds.), Food and agricultural law: Readings on sustainable agriculture and the law in Nigeria. Ado-Ekiti: Afe Babalola University Press. (2015).
7. Goodie, A. The nature of the environment (3rd edn.) (1993).
8. Sands, P. Principles of international environmental law. Cambridge, United Kingdom: Cambridge University Press. (2003).

**Organic Farming: A Way of Sustainable Agriculture in India**

**Dr. S. H. Kadekar**

Assistant Professor, School of Social Sciences, S.R.T.M. University, Sub-Campus, Latur (MS)

Corresponding Author- **Dr. S. H. Kadekar**

Email: [shkadekar@gmail.com](mailto:shkadekar@gmail.com)

DOI- [10.5281/zenodo.7476374](https://doi.org/10.5281/zenodo.7476374)

---

**Introduction:**

Agriculture sector plays an essential role in the development of any country. It has wide contribution to overall development of Indian economy. In India, around 50 per cent workforce is engaged in agriculture and allied activities, therefore agriculture is known as a backbone of Indian economy. It provides food to 1.41 billion population and fodder to 535.78 million livestock of India. Agriculture is a supplier of raw material to industrial sector and also contributes to capital formation. The share of agriculture to GDP is 18.8 per cent in 2021-22. Recently share of agriculture in India's export is increasing. Agriculture mainly produces food-grains viz. rice, wheat, coarse cereals, pulses etc. and different commercial products viz. oilseeds, coffee, tea, cotton, raw jute, sugarcane, tobacco etc. Food-grains production is important for food security to the nation and commercial crops yield direct money income to the nation. While considering the significance of agriculture in Indian economy and world economy as well, it should be sustainable to give benefit to the future generations also. In this regard the agriculture development is seen in view of its sustainability. For sustainable development of agriculture the different innovative practices can be employed. Organic farming is also a practice which can take agriculture towards its sustainability. Hence, it can be said that, organic farming is a way of sustainable agriculture.

---

The pollution free agro-products, food and environment are essential for sustaining life of all living being on the earth. For feeding the population and livestock the excessive use of chemicals, fertilizers, pesticides and weedicides in agriculture is become routine practice, but it has caused problems to all living beings on the earth. In this scenario, eco-friendly farming has emerged as the only answer to bring sustainability to agriculture. It not only advocates for stopping or restricting the use of pesticides, but it emphasizes the need for gardening which should create an ecological balance and a micro-environment suitable for health and growth of soil micro-flora plants, animals, farm workers and finally the vast population which consume the farm produce (M. Singh, 2021). Therefore, Organic Farming makes drastic change in agricultural practices and able to take agriculture towards sustainability.

**Meaning of Organic Farming:**

The Meaning can be understood by following definitions of organic farming.

“Organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc.) and to the maximum extent feasible, relies upon crop

rotations, crop residues, animal manures, off-farm organic waste.”(USDA, 1980)

“Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and good quality of life for all involved.” (IFOAM, 2005)

Organic farming means cultivation of plant without the use of synthetic fertilizers, pesticides and weedicides. When we garden organically we need to think of plants as a part of a whole system within nature. Organic Farming or gardening can begin only with paying attention to the soil and adding organic matter to the soil. For this practice the locally available resources are used.

**Principles of Organic Farming:**

As per IFOAM Standards the broad principles and practices of organic farming are as follows (V. Basil Hans and Raghavendra Rao, 2018):

To encourage and enhance biological cycles within the farming system.

To increase, enhance and maintain long term soil fertility.

To mobilize organic matter and nutrient elements locally within closed systems.

To use, as far as possible, renewable resources in locally organized agricultural systems.

To avoid all forms of pollution.

To maintain genetic diversity.

To allow livestock to express their innate behaviour.

To allow adequate returns to the producer.

To produce qualitative food in sufficient quantity this is acceptable socially and economically.

Organic farming is a modern practice and eco-friendly system which leads the farming towards sustainability.

#### **Method to Fertilize Organic Crops:**

Organic farmers generally build healthy soils by nourishing the existing living component of the soil; nutrients are released, transformed and transferred by the microbial inhabitants. Soil organic matter enhances and maintains good soil structure and water-holding capacity of soil. Organic farmers build soil structure and water-holding capacity by feeding soil biota also build soil organic matter with cover crops, compost, and biologically based soil amendments. Hence, plants become produce healthy which are better able to resist disease and insect predation.

#### **Organic Method to Control Pests, Diseases and Weeds:**

In organic farming, primary strategy to control pests and diseases is prevention through good plant nutrition and management. For effective disrupting habitat of weeds, insects and disease organisms, the cover crops and sophisticated crop rotations methods are used by which field ecology is changed. There are different methods to control Weeds like: crop rotation, mechanical tillage, and hand-weeding, as well as through cover crops, mulches, flame weeding etc. In case of unbalanced pest populations, a variety of strategies such as the use of insect predators, mating disruption, traps and barriers are applied. Under the National Organic Rule, initially the growers must use sanitation and cultural practices first before

applying a material to control a weed, pest or disease problem. In organic production use of materials is regulated, strictly monitored and documented. In worst conditions, certain botanical or other non-synthetic pesticides may be applied for controlling weeds, pest or diseases.

#### **Certification of Organic Products:**

Certified organic products are those agricultural products that have been grown and processed according to uniform standards, verified by independent state or private organizations accredited by the USDA. As per the norms, all products sold as "organic" must be certified. The process of certification includes two steps: i) annual submission of an organic system plan and ii) inspection of farm fields and processing facilities. Organic practices viz. long-term soil management, buffering between organic farms and neighbouring conventional farms and record keeping are verified by inspectors. The review of the facility's cleaning and pest control methods, ingredient transportation and storage and record keeping and audit control are come under processing inspections. To maintain the food integrity without artificial ingredients organic foods are minimally processed. Any kind of certified organic product not allows synthetic agrochemicals, irradiation and genetically engineered foods or ingredients.

#### **Present Status of Organic Farming in India:**

As per report published by Research Institute of Organic Agriculture (FiBL) and International Federation of Organic Agriculture Movement (IFOAM), India ranks 4th place in globally certified area under organic farming. At present 59.12 lakh hectare area is under organic farming as certified by National Programme for Organic Production (NPOP) and Participatory Guarantee System (PGS). Still Government of India proposes to add 6.5 lakh hectare area under organic farming through the scheme i.e. Paramparagat Krishi Vikas Yojana (PKVY). In recent years India is exporting various organic products to different 40 countries of the globe.

**Table No.1: Area under Organic Farming in India by Leading States**

Sr. No.	Name of the State	Area in Thousand Hectares
1	Chhattisgarh	3008.61
2	Madhya Pradesh	2370.59
3	Maharashtra	1133.67
4	Rajasthan	686.42
5	Gujarat	602.25
6	Himachal Pradesh	203.04
7	Odisha	184.03
8	Uttar Pradesh	115.59
9	Karnataka	110.7
10	Uttarakhand	113.75

Source: Statista.com

**Benefits of Organic Farming:**

Organic farming is beneficial on following grounds:

Organic farming helps to increase long term fertility of the soil.

It helps to maintain environment health by reducing population.

It reduces human and animal health hazards by reducing the level of residues in the product.

It helps in keeping agricultural production at a higher level and makes it sustainable.

It reduces the cost of agricultural production and also improves the soil health.

It ensures optimum utilization of natural resources for short term benefit and helps in conserving them for future generation.

It reduces risk of crop failure and also saves energy for both animal and machine.

Food from organic farming is more nutritious and better in taste than non organic food which prevents cancer.

Organic farming reduces land erosion and improves soil and water efficiency.

It helps in biodiversity

This farming system eco-friendly and sustainable which can bring significant benefits both to the economy and the social cohesion of rural areas.

**Conclusion:**

As organic products are safe and nutritious for all live beings, organic farming is the best and most viable alternative for conventional farming techniques. It reduces pollution, improves soil health and also maintains environment health. Organic farming minimizes cost of production and generates good income. Government of India is also promoting organic farming by

considering its necessity. Export of organic products by India is increasing day by day among the major countries of the world. Hence, while thinking about the agriculture development at a sustainable level, we can't neglect the role of organic farming, because it is beneficial in increasing products and productivity of agriculture in long time. Finally, without organic farming we can't imagine agriculture sustainability. Therefore, organic farming is a way of sustainable agriculture in India.

**References:**

1. Dutt Rudra, Sundaram K.P.M. (2010): *Indian Economy*, New Delhi, S. Chand & Company Ltd.
2. Ministry of Agriculture & Farmers Welfare (2022), Land Used for Organic Farming, PIB Delhi; Government of India.
3. M. Singh (2021): *Organic Farming for Sustainable Agriculture*, Indian Journal of Organic Farming, Volume 1, Issue 1, Choudhary Publishing Media (Page 1-9).
4. V. Basil Hans and Raghavendra Rao (2018): *Organic Farming for Sustainable Development in India*, Acta Scientific Agriculture (ISSN: 2581-365X), Volume 2, Issue, Page-96-102.
5. S. Chandra and S. K. Chauhan, "Prospects of organic farming in India," *Indian Farming*, vol. 52, no. 2, pp. 11-14, 2004.
6. Vatsyayan Amit (2018): "*The Indian Organic Market - A New Paradigm in Agriculture*", ASSOCHAM, India.
7. J. K. W. (2016): *Organic Agriculture in India and Participatory Guarantee Systems (PGS): A Case Study From West Bengal*. Jharkhand Journal of Development and Management Studies, 14:7037-7055
8. <http://www.agricoop.nic.in>
9. <http://www.statista.com>



**Agricultural development is the backbone of the economy!**

**Dr. Prakash Laxmanrao Dompale**

Assistant Professor, Shri Shivaji Law College, Kandhar, Dist.-Nanded.

Corresponding Author- **Dr. Prakash Laxmanrao Dompale**

Email-[prakashdompale@gmail.com](mailto:prakashdompale@gmail.com)

DOI- 10.5281/zenodo.7476389

**Abstract:**

India is known as an agricultural country. Agriculture sector is very important in Indian economy. If the share of agriculture sector in the gross national income of any country is high then that country is known as agriculture dominant country. Even today more than half of India's population depends on agriculture. Although industrialization has increased in India since independence, the share of agriculture has not decreased much. But if there is a crop loss in India in a year, the entire economy becomes unbalanced. However, since India's economic development is largely dependent on agriculture, it is true that the importance of agriculture will remain high. Considering the development of developed countries, those countries first developed their agricultural sector and then started industrialization. This means that if India wants to develop, it is necessary to develop the agriculture sector first. But even with the beginning of 21st century, Indian agriculture sector is facing many problems and agriculture is facing many challenges in the era of globalization.

**Keywords:** National Income, Economic Development, Employment Generation, Foreign Exchange, Industry Supplement

**Introduction:**

Agriculture is a major occupation in the Indian economy. Agriculture is of unique importance as it is a means of livelihood in the rural areas of the country. Although the share of agriculture sector in the country's gross national income has been gradually declining, 64% of the country's population is directly and indirectly dependent on agriculture and similar occupations. The share of agriculture sector in the Indian economy was 55.1% in 1951 and has declined to 13.9% in 2013. This decline is not due to the decline in importance of the agricultural sector or as a result of agricultural policy, but rather due to the rapid economic growth of industry, service sector production and the non-agricultural sector. The position of the agriculture sector in the economy of India is like a backbone. Just like a strong backbone supports the body, the agriculture sector also supports the economy in various ways. It supports the economy as a whole by providing means of livelihood to the family's dependent on agriculture and by supplying agricultural produce i.e. food. If there is a break in this work, if farm families do not get enough income, it affects the entire economy. That is why agricultural development strengthens the economy.

After independence, the Indian economy was predominantly agricultural. That is, nearly

70 percent of the country's workforce depended on agriculture for their livelihood, so the population working in industries and services was comparatively less. Although the proportion of people dependent on agriculture was high, the agricultural sector did not have the power to produce enough food grains and generate enough income for the farmer. In the pre-independence period, the sector remained underdeveloped due to indifference at the government level to reform agriculture. Therefore, almost 50 percent of the people of the country were below the poverty line at that time and these people were mainly from rural areas. In the later period, however, various schemes and economic planning initiated at the government level encouraged the growth of agriculture and increased the production of food grains. In the last 75 years we have moved from scarcity to abundance. This progress is certainly palpable. But looking at the graph of progress it should be remembered that the measure of agricultural progress is not only the level of food grain production. People who depend on agriculture still face many challenges. Even today, agriculture is seen as a hopeless business. The average yield per hectare of many crops is very low compared to other countries. At what stage of development has Indian agriculture reached in the post-

independence era, what challenges is it facing and what measures have to be taken to overcome all the challenges and move forward.

**Importance of agriculture sector in Indian economy:**

India's economy is agrarian. The pre-independence dependence on agriculture has now reduced. Development in the agricultural sector helps the development of industry and service sectors of the country.

**1) Share in National Income-**

At the time of independence, the share of agriculture and allied sectors in GDP was more than 50 percent and then it declined. A decline in the share of agriculture in GDP is indicative of a positive, structural change in the economy. In developed countries the share of agriculture sector is less than three to four percent.

**2) Employment generation –**

Considering the 20th century, the proportion of the population working in agriculture and agribusiness in India was between 70 to 80%. Now this ratio is around 60%. Agriculture is the largest source of employment in the Indian economy. Therefore, agriculture has a very important place in the economy.

**3) Contribution to Foreign Trade –**

India's agricultural exports over the years include tea, coffee, spices, tobacco, cashew nut, vegetable oil, etc. Exports of fruits and flowers have increased significantly in the last two decades. The share of agriculture in the country's total international trade was around 70 to 75%. Thus, dependence on agriculture is a sign of underdevelopment. In the process of economic development, it is expected that the share of agriculture sector in international trade will decrease and the share of industry and service sector will increase.

**4) Food supply –**

As the population growth rate is high in a country like India, the demand for food grains also increases rapidly. In such a case, if agricultural production and productivity does not increase, the nation faces a big crisis. In many developing countries of the world, due to scarcity of food grains, it has to be imported.

**5) Supply of Raw Materials-**

Agriculture has a significant contribution to the development of India's industrial sector. Textile mills, sugar, jute mills, dairy oil, plants, paper, hides, tobacco processing, tea, coffee, cocoa and rubber etc. are based on agricultural sector. Also, small and cottage industries in rural areas are dependent on agriculture sector. The raw material required in the industrial sector is mainly obtained from the agricultural sector. That is, the speed of industrialization depends on agricultural development.

**Challenges facing Indian agriculture sector:**

Indian economy is called agrarian economy. In India, large areas are cultivated by a large population. But compared to developed countries, Indian agriculture is backward. Even with the beginning of the 21st century, agriculture in India does not seem to have developed much. In the era of globalization, the agriculture sector has many options. At the same time, there are many challenges. Without accepting the challenges facing Indian agriculture and accepting the available options, the development of Indian agriculture and of course, India is not possible.

**1) Increasing productivity:**

India's agricultural productivity is very low as compared to other developed countries. Agricultural productivity is measured per hectare and per person. Productivity of both these types is low in India. Agriculture cannot really develop without increasing productivity. Agricultural productivity in India is low due to small size of agricultural sector, fragmentation, lack of mechanization etc. The table below shows India's agricultural productivity compared to other countries.

**Crop wise productivity of India compared with other countries:**

The challenge facing the agriculture sector in India is to provide modern resources to the farmers. The use of hybrid seeds, chemical fertilisers, pesticides, sophisticated implements, etc. greatly increases the production and quality of agriculture. India lacks such agricultural resources. Using this resource India can become self-sufficient in food grains. The challenge of providing these tools is facing the agriculture sector.

Rice		Wheat		Oilseeds		Cotton	
Country	Productivity	Country	Productivity	Country	Productivity	Country	Productivity
Egypt	9.8	England	7.7	Germany	4.0	China	11.1
America	7.8	France	7.5	America	2.6	Brazil	10.9
Korea	6.7	China	4.2	Argentina	2.5	America	9.5
Japan	6.4	World	2.8	Brazil	2.4	Pakistan	7.6
World	3.9	India	2.7	World	1.8	World	7.3
India	2.9	Pakistan	2.3	India	0.8	India	4.6

Looking at the above chart, it seems that India lags far behind the developed nations as well as the world average productivity in terms of productivity of major crops. The world average productivity of rice is 3.9 while India's productivity is 2.9. Productivity of other crops is also low. India's agriculture sector has the disadvantage of increasing India's low productivity.

## **2) Agricultural labour:**

Availability of agricultural labour for agriculture in India is a challenge. The attitude of the young generation in India towards agriculture has changed. Also, there has been a significant increase in the wages of agricultural workers. Therefore, the production cost of agriculture has increased. Due to increased migration of lakhs of people from rural to urban areas in India, the availability of agricultural labor in rural areas has decreased. Also uneducated labor reduces agricultural productivity. Also, as seasonal employment is available to farm laborers in many places, farm laborers have rushed to the city.

## **(3) Markets:**

Market access is the most important challenge facing the agricultural sector in India. Although farmers in India produce, they have to sell their goods through middlemen. So they get less price for their goods. From agricultural marketing, agricultural products enter the market through large chains. So commission is charged at every level. In some places, the farmers cannot afford to sell their produce in the market due to the far distance. Also, in many places, the farmers are cheated by the traders through weight measurement etc.

In today's era of globalization, Indian farmers have to compete with foreign goods while

selling their produce in the domestic market. Indian farmers are unable to compete with the developed countries as the price of agricultural produce is possibly lower. Also, due to the low quality of Indian agricultural products, there is less demand for them from abroad.

## **4) Eternal development:**

The challenge of sustainable development of agriculture is facing the Indian agriculture sector. In sustainable development, it is necessary to think about the future of agriculture instead of thinking about the present. Sustainable development considers how agricultural products will last for the present generation as well as for future generations. Farming in India is only about the present. Therefore, it is also necessary to consider how the agricultural production will increase in the future. In this, it is necessary to take the support of ecological theory while doing agriculture. Due to the excessive use of chemical fertilizers and pesticides in agriculture, there is a risk of reducing the productivity of the agricultural sector in the future.

## **5) Suicide of farmers:**

In India, the suicide rate of farmers is high in the agricultural sector. The challenge for the agriculture sector is to stop this trend. After 1990, farmer suicides started in India. Suicide rate of farmers in last few years given in the table below.

years	Suicide of farmers
2010	15,964
2011	14,027
2012	13,754
2013	11,772
2014	12,360

According to the above table, the pattern of suicide of farmers can be seen. Even in states like Maharashtra, which are considered

progressive, the suicide rate of farmers is high. Farmer suicides have increased due to crop damage, indebtedness, low prices.

**6) Availability of credit:**

In the agricultural sector, farmers require loans for purchase of seeds, implements, fertilizers and other purposes for agricultural improvement. But availability of credit to farmers in India is not easy. According to NSSO survey, 59.8% of the total credit taken by farmers in India was provided by institutional sources in 2012. Whereas 40.2% of loans were provided to farmers from non-institutional sources. This means that the farmers still do not get full credit from the government institutions and the farmers have to take loans from moneylenders, landlords, traders, brokers, middlemen, friends and relatives. A large amount of farmers are being exploited from this sector.

**7) Irrigation:**

There is a shortage of irrigation facilities in India. Agriculture in India is dependent on rainwater. In India, water is supplied for agriculture through wells, canals, dams, pipes, etc., but their number is very less. In India, the water level has gone down in this state. Due to this, the problem of drinking water has arisen. Therefore, the challenge of supplying water for agriculture throughout the year is facing agriculture. This problem can be solved by constructing the projects that are currently half-baked. In the case of a crop like sugarcane, it is time to rethink today.

**8) Natural calamities:**

Today, the Indian agricultural sector is facing a natural calamity. Every year natural calamities like flood, rain, drought, cyclone, hail are facing agriculture. The challenge of overcoming them is facing the agriculture sector. These natural calamities can be avoided by proper planning.

**7) Fragmentation of agricultural land/small holding areas:**

The challenge facing the agriculture sector is to stop the fragmentation of agricultural land in India. Due to Inheritance Act in India, agricultural land is fragmented into smaller pieces with population growth. Modern farming is not possible in small holding areas. Therefore, the use of machinery in

agriculture is reduced thereby reducing the productivity of agriculture.

**10) Government apathy:**

The challenge of the government's indifference is facing the agriculture sector in India. No special efforts are made by the government to solve the problems of the farmers. Even the amount allocated for farmers in the government budget is not fully spent. In the 2005-06 budget, a provision of Rs 1405 crore was made for the agriculture sector, of which only Rs 1202.9 crore was spent. In the 2007-08 budget, there was a provision of Rs 2222.4 crore for the sector but only Rs 1195.78 crore was spent. Also, the minimum guaranteed price given to farmers by the government is very low.

**11) Research in agriculture:**

The challenge facing the agriculture sector in India is to provide modern resources to the farmers. The use of hybrid seeds, chemical fertilisers, pesticides, sophisticated implements, etc. greatly increases the production and quality of agriculture. India lacks such agricultural resources. Using this resource India can become self-sufficient in food grains. The challenge of providing these tools is facing the agriculture sector.

**The next step in agriculture:**

By providing subsidies for agriculture in the traditional way and by implementing a guaranteed price policy, protection is provided to maintain the farmer's income. But besides this, increasing investment in agriculture is important for future progress. For that there is no alternative to bring about fundamental reforms by making appropriate and timely laws. For example, it has become the need of the hour for farmers, especially smallholder farmers, to come together in a formal/informal manner (such as Farmer Producer Companies or Organizations) to purchase inputs at low prices and sell produce at maximum prices. Its importance has been recognized at the level of economists, agronomists and policy makers. But at the same time, strengthening and modernization of existing government institutions like Agricultural Produce Market Committees is also important.

Farmers need to get better services from private or government organizations related to agriculture. It is also important through



## ***Agriculture Development towards Sustainability***

these organizations to make the farmer family enterprising through training and skill development, to encourage the supply of quality agricultural produce, to get suitable markets and market prices for the supply of agricultural produce where there is demand within the country and abroad. There is a need to strengthen the supply chain to reach the agricultural produce from the farmer to the final consumer and put in place mechanisms to increase the share of the wholesaler in the cost of the commodity and reduce the middlemen. There has been a need to use new technologies and digital media to reach out to maximum number of farmers, from soil testing to farmer training and crop marketing, to provide farmers with comprehensive information on the market for agricultural commodities. Strengthening this backbone of the economy by supporting agro-processing industries and various types of agri-businesses, start-ups and micro-enterprises as well as non-agricultural employment generation thereby reducing the burden of employment generation on agriculture would be a preferable way forward.

### **Conclusion:**

Agriculture is a major economic sector of the Indian economy and a source of huge employment. By adopting a strategic provision for rapid economic development through agri-business, if India's agriculture is to be made profitable and migration of people from rural areas to cities is to be avoided, government investment should be made with the main objective of promoting rural life and encouraging them to live in rural areas. , development of education and technical training, rural irrigation and energy development, village industry, forest-based industry and agro-processing industry, Storage of agricultural produce, training in sustainable marketing-management processes, determination of cost-effective value of agricultural produce and efforts by the agriculture department to ensure that the value falls into the pocket of farmers, appropriate participation of farm laborers and farmers in all process-technological-research, cost savings for small farms in large farms Special financial subsidies etc. should be resorted to for group farming for

20-25 farmers to fall into his hands. Also, the economic policy of the central government and the state governments in such a way that the rural society based on agriculture and agriculture will remain economically self-sufficient and happy, the eternal development of the agricultural sector is very necessary for the Indian economy to achieve a vigorous state and to make the country an economic superpower.

### **References:**

1. <https://www.nitinsir.in/indian-agriculture/>
2. <https://mr.vikaspedia.in/agriculture/best-practices/sustainable-agriculture/>
3. <https://www.wikipedia.org>
4. <https://www.sudharak.in//8753/07/2022>
5. <http://punereseearch.com/media/data/issues/>



**Impact of Technology on Agriculture: A Brief Study**

**Dr. Vanmala R. Tadv**

Assistant Professor Dept. of Geography Milind college of arts, Aurangabad

Corresponding Author- **Dr. Vanmala R. Tadv**

**Email-[vanmalartadv1978@gmail.com](mailto:vanmalartadv1978@gmail.com)**

**DOI- 10.5281/zenodo.7476402**

---

**Abstract:**

Over the last four decades agriculture has witnessed and experienced the dramatic transformation itself. An Agricultural practices and method evolving throughout the time to adopt new and modern kind of technologies and their application so many economical surveys concluded that, agriculture sector has been developed as the backbone of the nation's economy namely China , India, U.S.A. Brazil etc. But the high demand of food becomes a challenge cause of circumscriptions in its supply due to the earthly and Anthropogenic reasons, e.g. changing climate and Increasing population. But still the agriculture and it's allied sectors experienced continues revolution of technology in every decade. Increment in an employment rate, sustainability in food production, reduction in time consumption and available labour becoming the possible task cause of adaptation of technology in the agriculture. High embarkation of technology resulted significant positive and negative impacts on the agriculture. Recently agriculture shifted from the traditional purposes to market purposes and becoming the part of an entrepreneurship. Agriculture in the previous decades rely on the nature's dependency, but the human efforts mark the dependency slightly lower with the help of technology. Technology brings positive and negative impacts on agriculture ,with future discussed in the proposed research paper

**Key words:** Agriculture, Technology, sustainability, HYV, hydroelectricity, advancement, traditional methods

---

**Introduction:**

There was the phase in which agriculture practices used for the traditional basis. For example, people gathering and doing work together. Crops like paddy, Corn, Cotton, Wheat and Pulses were grown with the help of traditional methods. Their farming primarily depends on the natural help like rainfall, favourable climate etc. Very basic and simple instrument like Axe, shovel, Rake, Gardening fork, plough, Spade, Scythe, Sickle, etc. were used for transportation of goods and other agricultural products. With the brain power, later on human beings evolves the techniques for the agricultural betterment and advancement , which later pushed the mankind to build dams which provides the better and convenient irrigational facilities and other services too, like hydroelectricity etc. Inventions in agriculture, gradually shifting the traditions agriculture methods into the modern one. The very convenient water supplies into the farm fields becomes easy task for the mankind. Just because of the technology. But what does the technology means, in very simple language technology is an application of what we have learned about the scientific knowledge for the practical purposes.

Technology improves the standard of living and open ups new opportunities that we can take the full advantage for the building the platform of our betterment.

In agriculture, technology impacted very amazingly during the previous decades. It impacted negatively along with positive impacts. HYV seeds were introduced globally through green revolution in sixties , advanced and multipurpose research centres and institutions were established at every possible places and this achievement further resulted into the creation of modern and advanced agricultural horizons. Technological marvels such as harvesters, tractors, etc. totally gives the speedy wheels to agriculture development and lifted the agriculture from slow profitability to growing profitability. But with the positive impact the agriculture experiencing the negative impacts too, such as low soil standard , harmful water runoff, environment pollution and many more too. We can say that gradually technology brought so many unimagined changes in the agriculture across the world.

***Agriculture Development towards Sustainability*****Methodology:**

Primary data, Secondary data and internet resources are used and analysed for writing this article.

**Discussion:**

The proposed article will discuss the impact of technology on an agriculture. Technology has many negative and positive impacts on the agriculture. Technology is raising as the massive platform of advancement in the agriculture. Technology build that kind of possibilities by which peasants can increase efficiency can enhanced farming standards and make labour power available at low cost, but along with this kind of positive impacts agriculture markets negative impacts by technology and we must not have to neglect them. Technology has that kind of capability to change and bring new way to grow crops and pulses sustainably. Technology can also shift the agriculture from traditional to sustainable by replacing the old and harmful farming practices. Technology in last decades was only limited from the data and its collection, but with the timely innovations and discoveries technology brighten as an enhanced and improved tool for the agriculturalists to modify the existing traditional farming into the modern farming. Technology give an easy access that peasants operate and investigate their farming related concerns. Technological marvels help to boost the farming. We can clearly notice that the technology makes present day farming much effective and far efficient.

Technology helps peasants to cultivate their crops and pulses in much diversified methods, comprising use of technology to enhance the irrigational mechanism and its systems. Technology develops the agro- Information across the globe at very convenient process. Technology can be used to plan the crop management more decisive and exact. Technology gives better visions to the peasants for the knowledge to cure the diseases on crops. Peasants understand the appropriate amount of crop medicine and it become much helpful for disease control. Technology helps agriculturalist and Scientist to invent and discover the new variety of seeds, which actually experienced during the phase of

green revolution by introducing HYV Seeds. Crop managing and farming planning becomes very handy now a days. Technology helps for observing and monitoring the growth and development of plants in labs and also helps to conjecture ideal conditions for development of every single plant. Using the flying drone technology, Observation and monitoring becomes the easy task to notice everything and every moments in the field of crops. Availability of the farm products on an online platform becomes possible due to internet and its allied services.

We can say that technology can build the farming very convenient and replace the traditional agriculture into the sustainable agriculture. This are all positive impact of technology on agriculture. Now, time to discuss the negative impact of technology On agriculture.

Technology has impacted negatively on an agriculture along with the positive impacts. There are certain negative impacts on agriculture, that we experienced. Technology in the agriculture, that we experienced. Technology in the agriculture sector has contributed to high use of herbicides in the crop fields and engaged the pesticides into the food chain which later becomes the subject of concern. Technology gives an easy access for the manufacturing companies and industries to produce the processed and packing food which later develops the health problem after their contamination, such as IBD (Inflammatory bowel disease) obesity heart disease etc. Technology and its implementation into the farming become an expensive task. Farming related machineries becomes much costlier when they need the maintenance, so this thing impacts on the Income and expenditures of the peasants very badly. The most disastrous impact that the technology has given to mankind is the work loss. Traditional farmers in the villages loses their work. They ultimately loses their economic and financial equilibrium. Technology reduces their daily wages and makes their working days of work very less and ultimately this situation makes poor peasant to earn less.

Technology also contributed to loss of the natural habitat. Recently we have read much news on the animals death cause by Electric

***Agriculture Development towards Sustainability***

fencing around the farm fields. An adaptation of the technology in agriculture at high amount can be easily observed by using technology on every labour related agriculture activities can directly reduce labour- intensive methods and ultimately thing impacts on labours.

Sometimes technology increases the farming expenses which ultimately hikes the prices of agricultural goods and services. An application of agricultural goods and services and application of agrochemicals impacted badly on the biodiversity use of agrochemicals on excessive amount will make the water stream polluted contaminated and if this contamination continuous farther more than the agrochemicals nutrients from the water runoff led to the 'Eutrophication' event. Heavy vehicles like tractors, tracked tractors, Harvesters etc. works on fuel so the burning of fuels releases the greenhouse gases into the atmosphere and causes the environmental pollution. Environmental pollution led towards the acid rain in the certain regions. Technology is becoming the most influential factor for the pollution.

So we can say that along with the positive impacts technology pointed negative impacts on agriculture, too. However, technology and its application in the agriculture and its allied sectors is becoming the double edged sword.

**Observation:**

Developing technological aspects in an agricultural sector are producing sustainable benefits.

Changing technological dimensions in agriculture will develop the agriculture sector progressively but gradually.

Technology will shift the agriculture and its allied sectors from traditional practices to Sustainable practices.

Along with the positive benefits technology also marking the negative impacts.

Adverse effects on the agriculture by the technology can be mitigate through the revised and eco- friendly agricultural practices.

**References:**

1. Background\_on\_Agricultural\_Practices\_and\_Food\_Technologies

2. Layton, G., 2013. Gm foods will be vital in feeding the future world. Accessed online on the 9th November 2013.
3. Christian Bauckhage, K. K., Albrecht, 2012. Agricultures Technological makeover. Per- vasive Computing 12 (3), 4–7.
4. livestock program? NC Cooperative extension 1, 2.
5. Smith, T., 2013. Optimizing use of gender-sorted semen within timed a. ai-program. Angus Productions Inc.
6. Tillman, D., Cassman, K. G., Matson, P. A., 2002. Agricultural sustainability and improved production practices. insight review articles, 671–676.

Websites:

<https://www.thebetterindia.com/124944/micro-soft-indian-farmers-crop-productivity/>

<http://www.mahindra.com/news-room/press-release/Mahindras-new-startup-dials-in-to-rural-India-with-TRRINGO-com>

**Aquaculture and Apiculture**

**Dr. Vaishali S. Panchwate ( Tinkhede )**

Assistant Professor, Department of Zoology, Mahatma Fule Arts, Commerce and Sitaramji  
Chaudhari Science Mahavidyalaya Warud, Dist-Amravati, Maharashtra (India)

Corresponding- **Dr. Vaishali S. Panchwate**

Email - [vaishalitinkhede@gmail.com](mailto:vaishalitinkhede@gmail.com)

DOI-10.5281/zenodo.7476415

---

**Aquaculture, Types of Aquaculture , Benefits of Aquaculture, Importance of Aquaculture**

Since seventy percent of the world's surface is covered in water, humans have realized its importance as a resource. For this reason, one of the areas heavily exploited regarding the use of water as a resource is aquaculture, especially in the production of food as opposed to using the terrestrial land.

**“Aquaculture is the process of rearing, breeding and harvesting of aquatic species, both animals and plants, in controlled aquatic environments like the oceans, lakes, rivers, ponds and streams.”**

It serves different purposes, including food production, restoration of threatened and endangered species populations, wild stock population enhancement, the building of aquariums, and fish cultures and habitat restoration.

---

**Here are the various types of aquaculture, as well as their importance**  
*According to Wikipedia,-“Aquaculture (less commonly spelled aquiculture), also known as aquafarming, is the farming of fish, crustaceans, molluscs, aquatic plants, algae, and other organisms.*

Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions, and can be contrasted with commercial fishing, which is the harvesting of wild fish. Mariculture refers to aquaculture practiced in marine environments and in underwater habitats.”



**Types of Aquaculture**

There are different types of aquaculture –  
Depending on Hydrobiological Features  
Depending on the Motive of Farming  
Depending on Special Operational Techniques

Various types of cultural practices are carried out in each of these divisions.

**1. Mariculture**

Mariculture is aquaculture that involves the use of seawater. It can either be done next to an ocean, with a sectioned off part of the ocean or in ponds separate from the ocean, but containing seawater all the same. The organisms bred here range from molluscs to seafood options like prawn and other shellfish, and even seaweed.

Growing plants like seaweed are also part of mariculture. These sea plant and animal species find many uses in manufacturing industries such as in cosmetics and jewelry where collagen from seaweed is used to make facial creams. Pearls are picked from molluscs and made into fashion items.

**2. Fish Farming**

Fish farming is the most common type of aquaculture. It involves the selective breeding of fish, either in freshwater or seawater, with the purpose of producing a food source for consumption. Fish farming is highly exploited as it allows for the production of a cheap source of protein. Furthermore, fish farming is easier to do than other kinds of farming as fish are not care-intensive, but only requiring food and proper water conditions as well as temperatures. The process is also less land-intensive as the size of ponds required to grow some fish species such as tilapia is

much smaller than the space required to grow the same amount of protein from beef cattle.

### **3. Algaculture**

Algaculture is a type of aquaculture involving the cultivation of algae. Algae are microbial organisms that share animal and plant characteristics. They are sometimes motile like other microbes, but they also contain chloroplasts that make them green and allow them to photosynthesize just like green plants.

However, for economic feasibility, they have to be grown and harvested in large numbers. Algae are finding many applications in today's markets. Exxon mobile has been making strides in developing them as a new source of energy.

### **4. Integrated Multi-Trophic Aquaculture(IMTA)**

IMTA is an advanced system of aquaculture where different trophic levels are mixed into the system to provide different nutritional needs for each other. Notably, it is an efficient system because it tries to emulate the ecological system that exists in the natural habitat.

The IMTA makes use of these intertropical transfer of resources to ensure maximum resource utilization by using the waste of larger organisms as food sources for the smaller ones. The practice ensures the nutrients are recycled, meaning the process is less wasteful and produces more products.

### **5. Inland Pond Culture**

This usually involves inland artificial ponds of about 20 acres in size and about 6-8ft deep. It is common to see aeration systems connected to the pond, to introduce air into the ponds. This enhances the supply of oxygen and also reduces ice formation in the winter season.

In China, over 75% of the farmed freshwater fish are produced in constructed ponds, and nearly all of the farmed catfish are raised in ponds in the U.S.

### **6. Recirculating Systems**

This involves a closed set of chambers (units) where fish is kept in one and water treatment kept in another. It is highly dependent on the power supply, as water has to be pumped constantly through the fish chambers. As water flows through the treatment chamber, particulate matter is

filtered out and air introduced. This closed system controls the salinity, temperature, oxygen and anything that can cause harm to the fish.

It is an environmentally friendly system because very little new water is introduced to replace water that evaporated. The residue from the filters is also disposed of in a responsible manner.

### **7. Open-net pen and Cage Systems**

Open-net pen and Cage systems are often found offshore and in freshwater lakes. Mesh cages of between 6 and 60 cubic feet (pens) are installed in the water with the fish inside it. With a high concentration of fish in the pens, waste, chemicals, parasites and diseases are often exchanged in the immediate water environments.

The fish also attract predatory animals (bigger fish), which are often entangled in the nets. This system uses public water; therefore, environmental regulation and some authorization protocols must be respected.

### **8. Flow-through / Raceway**

This is a system made of long units stocked with fish. The units have feeding stations attached to them. Water is diverted from flowing water and fed into the raceway units flowing downstream. Down the end of the unit, waste is collected and disposed of. Raceways are common for culturing trout.

### **Benefits of Aquaculture**

#### **Economic Benefits**

#### **1. Alternative Food Source**

Fish and other seafood are good sources of protein. They also have more nutritional value like the addition of natural oils into the diet, such as omega 3 fatty acids. Also, since it offers white meat, it is better for the blood to reduce cholesterol levels as opposed to beef's red meat.

Fish is also easier to keep compared to other meat-producing animals as they are able to convert more feed into protein. Therefore, its overall conversion of a pound of food to a pound of protein makes it cheaper to rear fish as they use the food more efficiently.

#### **2. Alternative Fuel Source**

Algae are slowly being developed into alternative fuel sources by having them produce fuels that can replace contemporary fossil fuels. Algae produce lipids that, if harvested, can be burned as an



alternative fuel source whose only by-products would be water when burnt. Such a breakthrough could ease the dependency of the world on drilled fossil fuels as well as reduce the price of energy by having it grown instead of drilling petroleum. Moreover, algae fuel is a cleaner and farmable source of energy, which means it can revolutionize the energy sector and create a more stable economy that avoids the boom-bust nature of oil and replaces it with a more abundant fuel source.

### **3. Increase Jobs in the Market**

Aquaculture increases the number of possible jobs in the market. It provides both new products for a market and creates job opportunities as labor is required to maintain the pools and harvest the organisms grown. The increase in jobs is mostly realized in third world countries as aquaculture provides both a food source and an extra source of income to supplement those who live in these regions.

Aquaculture also saves fishermen time as they do not have to spend their days at sea fishing. It allows them free time to pursue other economic activities like engaging in alternative businesses. This boosts entrepreneurship and provides more hiring possibilities and more jobs.

### **4. Reduce Sea Food Trade Deficit**

The seafood trade in America is mainly based on trade from Asia and Europe, with most of it being imported. The resultant balance places a trade deficit on the nation.

Aquaculture would provide a means for the reduction of this deficit at a lower opportunity cost as local production would mean that the seafood would be fresher. It would also be cheaper due to reduced transport costs.

### **Environmental Benefits**

#### **1. Creates a Barrier Against Pollution With Mollusc and Seaweed**

Molluscs are filter feeders, while seaweed acts a lot like the grass of the sea. Both these organisms sift the water that flows through them as brought in by the current and clean the water. This provides a buffer region that protects the rest of the sea from pollution from the land, specifically from activities that disturb the sea bed and raise dust.

Also, the economic benefits of molluscs and seaweed can create more pressure from

governments to protect their habitats as they serve economic importance. The financial benefits realized provides an incentive for the government to protect the seas in order to protect seafood revenue.

### **2. Reduces Fishing Pressure on Wild Stock**

The practice of aquaculture allows for alternative sources of food instead of fishing the same species in their natural habitats. Population numbers of some wild stocks of some species are in danger of being depleted due to overfishing and uncontrolled exploitation. The use of unsustainable fishing methods such as bottom trawlers is also reduced.

Aquaculture provides an alternative by allowing farmers to breed those same species in captivity and allow the wild populations to revitalize. The incentive of less labor for more gains pushes fishers to convert to fish farmers and make even more profit than before.

It also allows the control of the supply of the fish in the market, giving them the ability to create surplus stock or reduce their production to reap the best profits available.

### **3. Low Environmental Impact**

In some cases, aquaculture can benefit the environment. Where filter-feeding shellfish, such as oysters, are cultured in-situ, water quality in ponds and lakes can improve.

Fish and shellfish can also be farmed using methods that do not harm the environment, and that helps meets the growing demand for seafood by supplementing wild harvests. Especially for offshore systems, the bio-security systems, cameras and surveillance infrastructure, as well as trained inspectors, ensure that farms are complying with environmentally safe practices. This helps to reduce diseases transfer in the waters and so on.

### **4. Water Usage**

Aquaculture systems often take advantage of harvested runoffs, stormwater and surface water. This reduces the dependency on other sources of water supply. In addition to this, ponds maintain soil moisture in their vicinity, thereby conserving natural resources.

## **Importance of Aquaculture**

### **1. Health Benefit**

All over the world, the demand for seafood has increased because people have learned that seafood are healthier and help fight cardiovascular disease, cancer, alzheimer's and many other major illnesses. Now seafood has become part of regular diets.

### **2. Sustainable Use of Sea Resources**

Aquaculture provides alternatives for fishing from the sea. An increase in demand for food sources and globalization has led to an increase in fishing. Aquaculture is currently estimated to account for approximately 13 percent (10.2 million tons) of world fish production.

Yet, this has led fishermen to become selfish and overfish the desired or high-demand species. Through aquaculture, it provides both an alternative and opportunity for wild stocks to replenish over time.

### **3. Conservation of Biodiversity**

Aquacultures also protect biodiversity by reducing the fishing activities on the wild stock in their ecosystems. By providing alternatives to fishing, there is a reduced attack on the wild populations of the various species in the sea. Reduced action of fishing saves the diversity of the aquatic ecosystem from extinction due to overfishing.

### **4. Increased Efficiency, More Resources for Less Effort**

Fish convert feed into body protein more efficiently than cattle or chicken production. It is much more efficient, meaning that the fish companies make more food for less feed. Such efficiency means that less food and energy is used to produce food, meaning that the production process is cheaper as well. It saves resources and even allows for more food to be produced, leading to secure reserves and less stress on the environment. Aquacultures will add to wild seafood and make it cheaper and accessible to all, especially in regions where they depend on imported seafood products.

### **5. Reduced Environmental Disturbance**

By increasing aquaculture, fish farming in specific, there is a reduced need for the fishing of the wild stock. As an outcome, it puts less stress on the ecosystem and equally reduces human interference.

Actions of motorboats and other human influences such as the removal of viable

breeding adult fish are all stresses put on the aquatic ecosystems, and their discontinuation allows the ecosystem to flourish and find their natural balance

## **Apiculture**

Types,

Products Obtained From Apiculture,

The life cycle of a honey bee

Factors Affecting the Process of Apiculture,

Disease and Danger of Honey Bee

Importance of Apiculture & Beekeeping

“Apiculture is the practice of keeping bees and manufacturing honey and beeswax.”

OR

“ The raising and care of bees for commercial or agricultural purposes.”

The term apiculture is generally defined –“ the cultivation of bees of the genus apis, which are honeybees. The honey bees contribute greatly to the preservation of nature by collecting flower pollen, bee pollen, etc.”

## **Meaning of Apiculture**

Apiculture or beekeeping is defined as rearing, caring, and managing honey bees to obtain honey, wax, and other useful substances. In Apiculture, an area is selected for the commercial maintenance of bees in artificial beehives, and such areas are called apiaries. Nectar is collected by honey bees naturally from flowers and stored in their hives. Beehives are a source of wax, which is used in a variety of medicinal preparations in addition to honey.

## **Types of Honey Bees**

Honey bees are social insects that live in colonies in hives. There is only one queen in the colonies of honey bees, thousands of female worker bees, and hundreds of male drones.

Each of these bees performs different tasks. Queen bees are the most important and powerful bees within the colonies.

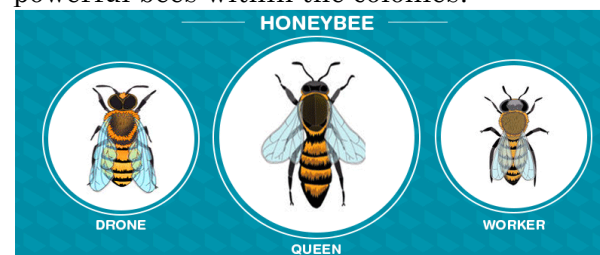


Fig: Types of Honey Bees

## Agriculture Development towards Sustainability

The members of honey bee colonies can be divided into three types of casts such as

1. **Queen Bee** is known as the mother of the colony and all the work inside the hive revolves around her. She lives up to 22 to 55 years and lays around 2000-2000 eggs. These eggs can be fertilized or unfertilized. **Drones** emerge from **unfertilized eggs** and both queen and worker bees emerge from **fertilized eggs**.
2. **Drones** are the male members that fertilize the young queens. These are smaller but stouter than the queen.
3. **Workers Bees** are the female members that cannot reproduce. They are known to be the most active members of the colony. The functions of worker bees change with age, they live up to 33 to 12 months. For the first half of their life, they perform indoor duties as scavengers, nurse bees, etc. And the second half of their lives they perform the outdoor duties as scout bees and forager bees.

### Common Varieties of Bees

There are indigenous and exotic varieties of bees that are used for the commercial production of honey and wax in India.

#### Some of the Indigenous Varieties of Honey Bees are:

1. *Apis cerana indica* (Indian bee)
2. *Apis dorsata* (Rock bee)
3. *Apis florea* (Little bee)

#### Some Exotic Varieties of Honey Bees:

1. *Apis mellifera* (European or Italian bee)
2. *Apis adamsoni* (South African bee)
3. *Apis mellifera* (Italian bee) is commonly used to increase the yield of honey due to the following features:

1. It has a good honey collection capacity.
2. Gentle in nature.
3. Able to protect itself from enemies.
4. The prolific queen is with less swarming.

### Products Obtained From Apiculture

As we all know honey is the main product obtained from Apiculture. We also get some other beneficial byproducts during beekeeping practices. Continue reading to know more about these products:

#### 1. Honey –

**Honey** is a sweet and edible fluid that contains nutrients like sugar, water, vitamins, minerals, amino acids, enzymes, and even some amount of pollen. Minerals that are present in honey are **calcium, iron, manganese and phosphate**. Vitamins that are found in it are **Pantothenic acid, Biotin, Pyridoxine, Choline, Ascorbic acid, Thiamine, Riboflavin and Niacin**. Flowers from which nectar is gathered affects the flavour and odour of honey. Honey is also an energy-rich food

#### 2. Bee Wax –

**Bee Wax** is the secretion of worker bees by their **wax glands**. It has a very high melting point. Bee wax is useful for humans in numerous ways, such as manufacturing cold creams, cosmetics, shaving cream, ointments, lipsticks, polishes, etc.

3. **Propolis and Balms** are other important products of Apiculture. These can be used in repairing the comb. Propolis, also known as **bee glue**, is produced by mixing saliva and beeswax with exudate gathered from tree buds or sap flows.

4. Propolis is used to close the gaps in the beehive. Its colour is dark brown but can vary depending on its botanical nature. They get sticky above 20°C and become hard and brittle at lower temperatures.

5. Worker honeybees produce a milky secretion called **Royal jelly**. Royal jelly contains proteins, vitamins, sugar, fats, water, salts and amino acids. Bees use this product to nurture queen bees and hence named as royal jelly.

6. Royal jelly has medicinal properties like honey and can be used to make many homoeopathic and ayurvedic medicines.

7. **Bee Venom** is the poison made by bees that makes the bee stings painful. Bee venom also has medicinal properties like other products such as it is used to cure rheumatism, arthritis, Parkinson's disease, etc.

#### How is Nectar Changed into Honey?

1. Flowers of the plant secrete a sweet substance called nectar to attract insects or other vectors for pollination.

2. Honey bees suck this viscous secretion from the flowers and pass it to their honey sac where it gets mixed with some acid secretion.
3. In the honey sac, sugar (sucrose) of the nectar is converted into dextrose and

levulose by the action of an invertase enzyme.

4. After regurgitation, the treated nectar finally changes into honey which is stored in hexagonal cells of hives for future use.

#### The life cycle of a honey bee



aste	Egg	Larva	Pupa	Total	Adult longevity
Queen	3 days	5 days	7-8 days	15-16 days	5 years
Drone	3 days	4-5 days	11-12 days	18-20 days	2-4 months
Worker	3 days	5-7 days	13-14 days	21-24 days	3-6 months

The life cycle of a honey bee

Worker	Queen	Drone
5,000-50,000 per colony, sterile female, developed from fertilized eggs, have sting used to defense, small size, 1115 mm in length, longevity 36 months. All are a worker.	Only one queen per colony, mother of the colony, sexual female developed from fertilized eggs have sting used to kill the rival queen. Large-sized, 1520 mm in length, can lay eggs 10003000 per day. It can preserve more than two crore sperm. Mate once in life, longevity 35 years. No works, only reproduce.	Less in number per colony, bisexual male, developed from unfertilized eggs, no sting, medium-large sized, 1317 mm in length. Mate only once and then died, longevity 24 months, No work only feeding, Fly in the air when bright light.

#### Factors Affecting the Process of Apiculture

Apiaries are established for the commercial production of honey. To obtain good quality and higher yields of honey the following points are taken into consideration in the process of apiculture:

1. **Pasturage:** The taste of honey mainly depends upon crop, flora or pasturage available for the nectar and pollen collection. Flora of honey bees includes a variety of flowering plants such as mango, coconut, almond, etc.
2. **Beehive:** A beehive is a box raised over a stand. The box has a wire gauze with a

multi-frame honey chamber for laying eggs and collecting honey. Langstroth, Newton and Jeolikote are three types of artificial beehives in India.

3. **Apiary Location:** It involves setting up beehives to allow maximum nectar and pollen collection in desirable locations. Localities rich in vegetation and flowering plants are chosen as an apiary location. Each hive should face east. Water is an important aspect and must be available nearby.
4. **Honey Flow and Seasons:** The yield of honey is also dependent upon the duration for which abundant flora is available. The honey flow period is the total time taken by honey bees to collect nectar and pollen. An abundance of flowers must be available to obtain a large quantity of honey.
5. **Swarming (Reproduction):** Swarming is a natural phenomenon where all bees move from one place to another. Swarming is usually done in spring for reproduction in honey bees. The queen leaves the old hives with some workers and drones and moves to a new shelter. The maintenance cost of hives is high, and low yield is seen due to frequent transfers.
6. **Selection of a variety of honey bee and site selection for beekeeping:** Less swarming variety such as *Apis mellifera* (Italian bee) with other desirable characteristics is selected. The location with a longer honey flow time and good pasturage give more yield.

#### **Disease and Danger of Honey Bees**

Most commonly honey bees are infected by bacteria, fungi and protozoa diseases, for example:

1. Bacterium *Bacillus apiscepious* infects the blood of bees causing septicemia.
2. An example of fungal diseases is Brood foul disease by *Schizomycetes*.
3. Examples of protozoan pathogens that cause infection to bees are *Nosema apis* and *Vahlkampfia mellifica*.
4. Wasps, wax moths, and mites are common enemies of bees.
5. Some birds such as king crows, blue tits, sparrows etc use bees as their meal.

#### **Protective Measures from Common Insects**

1. Wasps are often controlled manually.
2. Wax moths are controlled by exposing bees to the sun while they are present in beehives.
3. Some devices are also used to scare away the bee-eater birds.

#### **Importance of Apiculture & Beekeeping**

There are many agricultural-based countries in the world. We have many flowers in the field, on roads, and even in the jungle, full of nectar. If we make a little effort, we collect honey from these flowers to bring our economic solvency and develop our national wealth. However, through rearing honey bees, we can get two things-

Honey.

Wax.

#### **Uses of honey**

Surprisingly, honey has many uses and benefits, which are as follows-

##### **Use as food:**

About 80 chemical constituents identified in honey have high food value.

Honey play a significant role for children, and older people.

honey is an excellent food for hard laborers and players.

We can regain lost energy very quickly by using honey.

Honey helps reduce constipation, bloating, and gas.

Substituting raw honey for white sugar can help in weight management.

##### **Use as medicine**

Consumption of raw honey can reduce the risk of developing diabetes and supports the effects of diabetes medication.

It can help reduce cholesterol and decrease coronary artery disease risk.

Raw honey makes the brain function optimally by strengthening the heart and improving blood circulation.

Raw honey can help reduce seasonal allergies if sourced locally.

The consumption of honey promotes beneficial antioxidant agents, stimulates antibodies, and combats harmful microbial activity.

Honey can help improve urinary tract infections due to its antibacterial properties.

##### **Use as cosmetics**



We can use it as an affordable face cleanser to fight acne and is gentle on sensitive/all skin types.

A spoonful of raw honey mixed with olive oil and a squeeze of lemon works as a hydrating lotion.

Raw honey can cleanse and restore the health of hair and scalp.

The raw honey hair mask can help boost shine.

**In agriculture:**

Honey bee plays a significant role in agriculture by pollination.

**Solve the unemployment problem:**

Many people can solve their unemployment problem by involving themselves in apiculture.

**Miscellaneous uses:**

Used in manufacturing different drinks.

Prepare bacterial media.

Poisonous bait.

**Uses of wax**

Wax is used for various purposes. Some are given below-

Candle industry, where wax is the main ingredient.

Pharmaceuticals, especially for making capsules.

One of the best benefits of using beeswax on the skin is moisturizing and softening.

Cosmetic industry; face cream, lipstick.

Furniture industry.

**Used for Making electric insulators.**

Apiculture has been undertaken on a commercial basis as a business due to the enormous benefits of honey and beeswax. Some important uses of honey and other apiculture products are mentioned below:

1. Honey is found to be quite useful in the treatment of various disorders of humans related to digestion, dysentery, vomiting and stomach or liver ailments.
2. Honey is considered as a blood purifier, a cure against cough and cold, sore throat, ulcers of the tongue, stomach and intestine.
3. Bee wax is used in cosmetics, creams and ointments.
4. Royal jelly is taken as an invigorating tonic.
5. Propolis is a health supplement with antibiotic properties.

6. Bee venom is employed as a cure for rheumatism, arthritis and certain central nervous system diseases.

7. AIDS virus can be destroyed by honeybees venom as it contains some mixture of proteins.

8. Pollination depends on honeybees leading to an increase in the yield of several plants.

**Health Conditions Of Elderly People: A Sociological Study**

**Rajnikant Chandrappa<sup>1</sup> Dr. Shanta B. Astige<sup>2</sup>**

<sup>1</sup>Research Scholar Department of Studies and Research in Sociology  
Gulbarga University, Kalaburagi

<sup>2</sup>Associate Professor and Research Guide Department of Sociology Principal of Govt. First  
Grade College, Kamalapur, District Kalaburagi

Corresponding Author- **Rajnikant Chandrappa**

Email. [rajemsociology@gmail.com](mailto:rajemsociology@gmail.com)

DOI- 10.5281/zenodo.7476423

---

**Abstract**

The primary focus of the present study is to analyse socio-economic conditions of elderly living in old age homes of Hyderabad-Karnataka region (Kalyan-Karnataka Region). Due to physical weakness, psychological worries and depression, most of the old aged people face the problem of poor health. Such habits include alcoholism, smoking, chewing tobacco and such others. These habits result in poor health of old aged people. Of course, some of the old aged people are luck to possess good health conditions and few may be unlucky to get poor health. Health conditions are major concern or problem faced by most of the old aged people. The old age people require support and help during ill health. There is need for support preferably from their own family member. Hence, the primary data collected on the health conditions of the old aged people living in old age homes are analysed, interpreted and discussed as under.

**Key Words:** Elderly people, Health Condition's, Habits, ill health and etc.

---

**Introduction**

The ageing population is both a sociological and medical problem. It makes a greater demand on the health services of a community. In a rapid growing world, healthy ageing is vital for the countries. It is a pre-requisite for economic growth. Discoveries in medical science and improved social conditions during past few decades have increased the span of life. The situation becomes all the more difficult when one finds one left alone without anyone to take care of. Indeed, the loneliness and neglect associated with old age is a rather recent phenomenon. It is

the outcome of breakup of the tradition of joint family system. Growing urbanization and fast-moving modern life have contributed to the problem. Furthermore, the erosion of moral values has also aggravated the situation. Earlier, when life was simpler and values were more 'valuable', the elderly held an enviable place in family and society. However, with the changes in the structure and functions of family, many elderly people lost their space in family and had to move to old age homes as their final haven (Vanitha, 2014).

During their old age, one of the important problems faced by all the people is health problem. Due to physical weakness, psychological worries and depression, most of the old aged people face the problem of poor health. Of course, some of the old aged people are luck to possess good health conditions and few may be unlucky to get poor health. Health conditions are major concern or problem faced by most of the old aged people. Hence, the primary data collected on the health conditions of the old aged people living in old age homes are analysed, interpreted and discussed as under.

#### **Review Of Literature**

**Nirmal Brahmabhatt and Shah (2019)** have stated that, old age is a big challenge to human life with respect to health needs as well as psychosocial needs. This study revealed the five common presenting symptoms of the elderly to be joint pain (47.40%), impaired vision (39.20%), insomnia (28.00%), weakness (23.20%), and impaired memory (23.20%). Health problems of elderly population are of much concern as per this study. The major health problems found in the elderly were cancer, anaemia, diabetes, cataract, hypertension, coronary heart disease, asthma, and osteoarthritis. Majority of the elderly people felt neglected by their family members. Two-thirds of old-age homes were having facility for regular health check-up. Majority of the elderly

were having hypertension and joint pain as the most common presenting complaints among all.

**Anu, et al (2020)** determined the oral health status and treatment need of an elderly population residing in old-age homes in Tamil Nadu. The authors did a cross-sectional study among people 65 years and older, residing in affordable and non-affordable old-age homes in Tamil Nadu. A total of 600 elderly people (332 from private, self-financed and 268 charitable old-age homes) were clinically examined and assessed using the WHO basic oral health proforma, 2013. The data obtained were entered into Microsoft Excel 2013 computer program, and then exported to the data editor page of SPSS version 16 for statistical analysis. The mean decayed, missing and filled teeth (DMFT) of the total study population were 22.21. On assessing the periodontal status, it was observed that only 36.9% of the elderly had healthy gingiva. Dental erosion (20.9%) was comparatively more prevalent than dental fluorosis (1.2%), dental trauma (3%) and oral mucosal lesions (11.7%) among the study population. The prevalence of denture wearers was 24.5%. On statistical analysis, the values for DMFT and denture status were significantly different ( $p < 0.05$ ) between those in private and charitable old-age homes. The overall oral health status of the elderly was poor. The

requirements of oral healthcare needs are higher among the elderly living in charitable homes than those in private, self-financed homes.

**Zhao, et al (2021)** have investigated the factors associated with the willingness for old-aged care and the demands for health care among elders, which might provide a reference for the establishment of health care strategies. A cross-sectional study was conducted via questionnaires among 1553 randomly selected residents aged 65 or older from Chongqing, China during 2016. Data of demographics, and demands for old-age care and health care services were collected. Descriptive analysis was used to examine the characteristics of the respondents. A chi-squared test and multiple logistic regressions were performed to explore the relevant factors associated with the preference of old-age care among older people in Chongqing. We found that 85.4% of the respondents were willing to select home-based care: family old age care (55.9%), and its combination form for old-age care: family old age care plus community old age care (29.5%) old age care. Multivariable logistic regression analysis showed that willingness to choose family old age care for old-age care was associated with lower monthly income, more children, worse commercial insurance, better health status, and shorter distance to their children. Older adults had the demands for health-related

services, including regular check-up, regular health seminars, establishment of health files. Hospital was the most acceptable provider for care services, and there was a preference for long-term care and emergency call among the elders. The majority of older Chinese prefer the family old age care and its combination form with community old age care for old-age care, and demand for a variety of health-related services. Home- and community-based care with sound and perfect medical and health mechanism should be the main pattern of old-age care system in China.

#### **Objectives Of The Study:**

The present study is mainly aimed to explore the health conditions of old aged living in old age homes of Hyderabad-Karnataka region and particularly the study is made:

1. To know the health conditions of elderly people;
2. To explore the personal habits of elderly people;
3. To explain the present health conditions of the elderly people;
4. To understand the persons taking care during ill health in old age home

#### **Methods**

Snowball Sampling method has been followed while selecting the samples. Totally 300 old aged people living in selected old age homes were selected. The selection of the old aged people in the old age homes in Hyderabad-Karnataka region is shown in the following table.

**5. Table No. 3.1. Selection of Samples**

District	No's of Old Age Homes	Total Samples Surveyed		Total
		Male	Female	
Kalaburagi	07	40	33	73
Bidar	07	36	29	65
Koppal	02	29	26	55
Bellary	06	35	30	65
Raichur	02	22	20	42
Total	24	162	138	300

As disclosed in the above table, total 24 old age homes were surveyed and total 162 elderly men and 138 elderly women were interviewed. Hence, the present study is limited to the primary data collected from 300 elderly people living in 24 old age homes.

**Results:**

Few of the people at their old age have some habits and they give the reason

of mental worries to practice such habits. Such habits include alcoholism, smoking, chewing tobacco and such others. These habits result in poor health of old aged people. The collected primary data on the personal habits of the old aged people is analysed, interpreted and discussed as under.

**Table No. 1. Personal Habits**

Particulars	No's of Elderly People Surveyed	Percentage
Alcoholism	--	--
Smoking	07	2.33
Chewing Tobacco	22	7.33
Any Other	--	--
None	271	90.34
Total	300	100

It is found that, almost all that is, 271 (90.34%) of all the old aged people don't have any habits, but only 22 (7.33%) have habit of chewing tobacco and 07 (2.33%)

have smoking habits. As the bad habits spoil personal health, it is suggested to old aged people to quit such habits.

**Table No. 2. Feel Lucky in Getting Good Health**

Particulars	No's of Elderly People Surveyed	Percentage
Yes	183	61.00
No	117	39.00
Total	300	100

Majority that is, 183 (61.00%) of all the old aged people have agreed that they feel lucky in getting good health conditions

compared to other elderly people whereas, 117 (39.00%) have not agreed to the same.



As revealed from the above discussion, majority of the old aged people feel that they are lucky in getting good health and it shows that, some of their friends of their

similar age have poor health conditions. Hence, the primary data collected on their present health status is shown in the following table.

**Table No. 3. Present Health Status**

Particulars	No's of Elderly People Surveyed	Percentage
Always Fit & Fine	96	32.00
Fit & Fine with Occasional Problems	136	45.33
Fit & Fine with Major Health Problems	41	13.67
Always Poor	27	9.00
Total	300	100

Above table made it clear that, the health conditions of only 96 (32.00%) of all the old aged people is always fit and fine, that of 136 (45.33%) of the elderly is fit and fine with occasional health problems, the health conditions of 41 (13.67%) of the old

aged people is fit and fine with major health problems such as Diabetes, Blood Pressure, etc, which needs regular medication and care and health conditions of 27 (9.00%) of the elderly people is always poor as their health is critical.

**Table No. 4. Persons Taking Care During Ill Health in Old Age Home**

Particulars	No's of Elderly People Surveyed	Percentage
Spouse	95	31.67
Friends & Inmates	33	11.00
Old Age Home Staff	83	27.67
Nobody & Self	65	21.66
Any Other	24	8.00
Total	300	100

It is found that, during their ill health, 95 (31.67%) of the respondents have stated that their spouse is taking care, 33 (11.00%) of them have remarked that, their friends and inmates of old age homes are taking their care during their illness, 83 (27.67%) of the respondents have agreed that the staff working in old age homes are looking after them during ill health, 65 (21.66%) of the elderly people have mentioned that, none of the persons

are taking their care during their ill health and they are caring themselves and 24 (8.00%) of the respondents have expressed that the other people such as distant relatives are taking their care during their ill health. Even though, in some cases, spouses are taking care of old aged people, still others are not having such persons who care like family members such as friends, inmates, old age home staff and so on.

**Suggestions**

1. It is suggested to managements of old age homes to organize regular health check-up camps at least once in a week and health awareness campaigns for elderly at least once in a month.
2. It is noted that, the workers and staff in old age homes must be service oriented and as such, they must have to care elderly in old age homes with dedication and affection.
3. It is suggested to elderly people to get benefits from social welfare schemes for elderly such as Sandhya Suraksha Pension scheme, Widows' Pension scheme, concessional travel, etc from the Government.

**Conclusion**

The old age is age of poor health. Hence, it is noted that, health conditions of elderly people are so important. In this context, even though almost all of the elderly people don't have bad personal habits still, a few of them have bad habits of smoking and chewing tobacco. It is found that, majority of the elderly people feel that, they are lucky in getting good health compared to others and only some of them are feeling ill health. Further, the present health status of some of elders is fit and fine with major health problems such as diabetes, blood pressure, depression, cardio-vascular problems, respiratory problems, etc and only few of them are always facing critical health

problems. Majority of them are always fit and fine with occasional or rare minor health problems. During their illness, as stated by one-third of all the elderly people, their spouses are taking their personal care and nearly one third of them have agreed that, they are cared by old age home staff. Some of them are going for self-care during their illness. Few of them are cared by their friends and inmates during their ill health. On the physical health problems faced by elderly people, it is noted that, two-thirds of them are facing various health problems such as cardio-vascular problems, respiratory disorders, Musculo-skeletal problems, blood pressure, diabetes, vision, dental, deafness, severe weakness, psychological problems such as depression, tension, feeling of insecurity and so on. Only one-third of all the elderly people are not feeling such health problems now. Few of the elderly people are also facing more than one or many of the physical health problems. In old age homes, there is frequent health check-up of elders is going to be taken. In this context, almost elderly people are going for regular or occasional health check-up. To maintain their health, almost elderly people are engaged in morning walking, yoga, meditation, physical exercises, sports with inmates and friends. Except some of the old aged people, majority of them are following food and dietary practices such

as eating green vegetables and fruits, consume healthy drinks, given up sugar, salt and oily food and so on to maintain their health and well-being.

**Reference**

1. Anu, V, et al (2020): Institutionalized Ageing Population in Tamil Nadu. ***The National Medical Journal of India***, 33(2), 2020, pp. 83-85.
2. Athira, B and Mary Elizabeth (2021): Effectiveness of Yoga on Psychological Well-being of Senior Citizens in Selected Old Age Homes of Kerala. ***International Journal of Health Sciences and Research***, 11(1), January 2021, pp. 174-180.
3. Banker, Kavita, et al (2011): Study of Health Profile of Residents of Geriatric Home in Ahmedabad District. ***National Journal of Community Medicine***, 2(3), October-December 2011, pp. 378-382.
4. Nirmal Brahmabhatt and Shah, Tejas A (2019): A Cross-Sectional Study of Health and Psycho-social Problems among Elderly People Living in Old Age Homes of Ahmedabad and Gandhinagar Districts, Gujarat, India. ***International Journal of Medical Science and Public Health***, 8(11), 2019, pp. 944-950.
5. Zhao, Rongrong, et al (2021): Factors Associated with Willingness to Choose the Way for Old-Age Care: A Population-Based Cross-sectional Study in Chongqing, China. ***Inquiry: The Journal of Health Care Organization, Provision and Financing***, 58, 2021, pp. 1-8.

**देशाच्या आर्थिक विकासात कृषी व्यवसायाची भूमिका**

प्रा. डॉ. जे. एस. सवाईथूल

सहयोगी प्राध्यापक, श्रीमती केशरबाई लाहोटी महाविद्यालय, अमरावती

Corresponding Author- प्रा. डॉ. जे. एस. सवाईथूल

Email- [jayasawaitul74@gmail.com](mailto:jayasawaitul74@gmail.com)

DOI- 10.5281/zenodo.7476504

**सारांश**

जगातील अत्यंत प्राचीन व्यवसाय म्हणजे कृषी व्यवसाय असून आजही तो मोठ्या प्रमाणात केला जातो. जागतिक स्तरावर जवळजवळ दोन-तृतीयांश लोकांचा मुख्य व्यवसाय कृषी आहे. भारतासारख्या देशात सुमारे 70 टक्के लोक कृषीवर निर्भर असून राष्ट्रीय उत्पन्नात कृषीचा वाटा फार महत्वाचा आहे. देशातील एकूण निर्यातीपैकी 17 टक्के निर्यात कृषी क्षेत्रातून केली जाते. साखर उद्योग, ताग उद्योग, खाद्य तेल उद्योग, कापड उद्योग, चहा, कॉफी, रबर, मसाल्याचे पदार्थ, अन्नधान्यावर प्रक्रिया उद्योग अशा अनेक उद्योगांना कृषी व्यवसायातून मदत केली जाते. आज राष्ट्रीय उत्पन्नातील 24 टक्के उत्पन्न हे कृषी व्यवसायातून प्राप्त होते. भारतातील राष्ट्रीय उत्पन्नातील वाटा विकसित देशांच्या तुलनेत बराच मोठा आहे. देशात कृषी व्यवसायाच्या अनेक समस्या आहेत. वाढती लोकसंख्या, आर्थिक धोरणक्षेत्राचा अभाव, उत्पादकता, पाणीपुरवठ्याच्या अपुऱ्या सोयी, तांत्रिक ज्ञानाचा अभाव, भांडवलाचा अभाव, जमिनीचे तुकडीकरण इत्यादी. विविध समस्यांना तोंड देण्यासाठी योजना काळात अनेक प्रयत्न झाले आहेत. संशोधन, प्रशिक्षण आणि विस्तार यामध्ये सलगता ठेवून देशाच्या अर्थव्यवस्थेत परिणामकारक बदल झालेले दिसतात. प्रस्तुत प्रकरणात कृषी व्यवसायाचे स्वरूप, व्याप्ती, वैशिष्ट्ये, घटक याबरोबरच देशाच्या आर्थिक विकासात कृषी व्यवसायाची भूमिका किंवा महत्त्व यांचा अभ्यास करण्यात आला आहे.

**प्रस्तावना –**

कृषी व्यवसायाला आर्थिक विकासाचा पाया मानला जातो. कृषी शिवाय अन्य क्षेत्राचा विकास लवकर होऊ शकत नाही. औद्योगिकीकरण, निर्यात, अन्नधान्याचा पुरवठा, रोजगार निर्मिती इत्यादी कृषी व्यवसायावर अवलंबून असतात. कृषिप्रधान अर्थव्यवस्थेचे रूपांतर औद्योगिक अर्थव्यवस्थेमध्ये होण्यासाठी कृषीचे निर्वाहपर स्वरूप बदलून तिला व्यापारी स्वरूप यायला हवे. यासाठी केवळ तांत्रिक सुधारणा जसे, सिंचन, खते, नवीन बियाणे, सुधारित अवजारे इत्यादी तर व्हायलाच हव्यात परंतु त्यासोबतच शेतकऱ्यांच्या दृष्टिकोनातही बदल होणे आवश्यक आहे. अज्ञानी, दैववादी आणि असहाय शेतकरी सुधारणांसाठी प्रेरित होणे कठीण असते आणि म्हणूनच शेतकऱ्यांच्या दृष्टिकोनात बदल व्हायला हवा.

**कृषी व्यवसायाची संकल्पना**

कृष या धातूपासून कृषी हा शब्द तयार झाला आहे. या शब्दाचा मूळ अर्थ नांगरणे असा आहे. जमीन नांगरून बी पेरणे आणि त्यातून उत्पादन घेणे म्हणजे कृषी होय.

कृषी हा मानव करत असलेल्या व्यवसायांपैकी सर्वात जुना व प्राथमिक व्यवसाय आहे. मानवाला आवश्यक असणारे

अन्न आणि इतर वस्तू मिळविणे, याकरिता जमिनीची मशागत करून योग्य त्या वनस्पती जीवनाची वाढ करणे म्हणजे कृषी व्यवसाय करणे होय.

केवळ कृषीतून उत्पादन काढणे म्हणजे कृषी व्यवसाय नव्हे, तर कृषी व्यवसायात पशुपालन, कुक्कुटपालन, रेशीमउद्योग, फलोद्यान, मधुमक्षिकापालन, शेळी-मेंढीपालन, मासेमारी इत्यादी अनेक उद्योगांचा समावेश होतो.

शेतमालाच्या उत्पादनाबरोबरच, उत्पादनासाठीची आदाने, नैसर्गिक व रासायनिक खते, बी-बियाणे यंत्रे, अवजारे इत्यादी अनेक घटकांचा समावेश कृषी व्यवसायामध्ये होतो. लागवडीपूर्व आणि लागवडीनंतर कृषीसाठी उपयोगात येणारी जमीन, अशा जमिनीमध्ये पिके घेणे, जमिनीचा कस वाढविण्यासाठी प्रयत्न करणे या सर्वांचा समावेश कृषी व्यवसायात होतो.

**थोडक्यात कृषी व्यवसायात**

धान्य किंवा बागायत पिकांची लागवड करणे जसे, गहू, ज्वारी, बाजरी, तांदूळ

लागवड पूर्व मशागतीची कामे करणे जसे, नांगरणी, वखरणी

पशुपालन जसे, गाय, म्हैस, शेळी, मेंढीपालन  
कुक्कुटपालन जसे, कुक्कुटपालन केंद्र उभारणी  
मधुमक्षिका पालन जसे, मधु संकलन  
मत्स्यव्यवसाय जसे, गोड्या पाण्यातील मासेमारी  
रेशीम उद्योग जसे तुतीची लागवड, रेशीम किड्यांची  
जोपासणा  
फलोद्यान पिकांची लागवड करणे जसे, आंबा, काजू, नारळ,  
चिकू, पपई  
कृषी साठी आवश्यक खतांचा पुरवठा करणे जसे, सेंद्रिय,  
रासायनिक  
कृषी साठी यंत्रे आणि अवजारे यांचा वापर करणे, इतर  
अनेक आनुषंगिक उपक्रमांचा समावेश होतो.

#### **कृषी व्यवसायाचे स्वरूप**

व्यवसायातील नैसर्गिक बंधने लक्षात घेवून मानव  
कृषी व्यवसाय योग्य त्या जागी करित असतो. वाळवंटी  
प्रदेशातसुद्धा कृषी व्यवसाय केला जातो. पण प्रतिकूल  
परिस्थितीत कृषी आर्थिक दृष्टीने परवडत नाही. यासाठी  
पिकांची लागणारी योग्य परिस्थिती जेथे आढळते, तेथेच  
त्या पिकांची लागवड केली जाते. मानवाला स्थैर्य मिळवून  
देण्यात कृषी व्यवसायाचे मोठे स्थान आहे. स्थानांतरीत कृषी  
मानवाच्या प्रारंभिक अवस्थेत केली जात होती. स्थायी  
कृषीला विकास प्रक्रियेबरोबरच सुरवात झाली. याबरोबरच  
मानवाने भटक्या अवस्थेतून स्थिर अवस्थेत प्रवेश केला,  
जनावरांची निर्मिती झाली. कृषीच्या मशागतीसाठी  
जनावरांची जोपासना करण्यात आली. पशुपालन  
व्यवसायाला सुरवात झाली. उदरनिर्वाहाच्या कृषीवरून  
सखोल कृषीस सुरवात झाली. अन्न, वस्त्र आणि निवाऱ्याची  
गरज पूर्ण करण्यासाठी लोकसंख्या वाढीबरोबर कृषीच्या  
विकासाकडे लक्ष दिले गेले. कृषी व्यवसायाकडे शास्त्रीय  
दृष्टीने पाहिले जाऊ लागले. गहू, तांदूळ, बाजरी, ज्वारी,  
नाचणी या उपभोगाच्या पिकांबरोबरच रबर, चहा, कॉफी,  
उस, ज्यूट आणि फलोद्यान पिकांना महत्त्वपूर्ण स्थान  
मिळाले. काही पिकांकडे निर्यात आणि परकीय चलन  
मिळवून देणारी पिके म्हणून पाहिले जाते. पाश्चिमात्य  
राष्ट्रात व्यापारी कृषी ही संकल्पना उदयास आली.

#### **कृषी शास्त्रातील विविध शास्त्रे आणि व्याप्ती**

कृषी व्यवस्थापनशास्त्र फोर्स्टरच्या मते कृषी व्यवस्थापन  
शास्त्र म्हणजे मनुष्यबळ, भांडवल यांचे संयोजन तसेच

तांत्रिक ज्ञान आणि कौशल्य यांचा वापर करून जास्तीत  
जास्त निव्वळ नफा मिळविण्यासाठी मार्ग व साधने यांचा  
अभ्यास होय. शेती व्यवस्थापनशास्त्रात शेतकऱ्याला कृषी  
संबंधित अचूक निर्णय घेण्यासाठी मदत होते.

#### **कृषी अर्थशास्त्र**

कृषी अर्थशास्त्रात उत्पादन, विपणन, वितरण, कृषी  
वित्तपुरवठा, किंमत चढ-उतार, कारणे, परिणाम,  
उपाययोजना, कृषी पतपुरवठा, स्रोत यांचा अभ्यास केला  
जातो.

#### **उद्यानविद्या व फलोद्यान**

उद्यानविद्या विभागाचा फलोद्यान हा उपक्रम आहे.  
कृषीशास्त्राच्या या शाखेत फळे, फुले, भाजीपाला इ. चा  
अभ्यास केला जातो.

#### **पशुवैद्यकीय शास्त्र**

कृषीला पूरक व्यवसाय पशुसंवर्धन व दुग्ध व्यवसाय हा आहे.  
पशु वैद्यकीय शास्त्रात पशुच्या विविध जाती, त्याचे  
शरीरशास्त्र, उत्पादकता, आहार, आरोग्य, विविध आजार  
आणि उपचार पद्धती, कृत्रिमरेतन पद्धती, पशुवंश  
सुधारण्यासाठीच्या पद्धती इत्यादी सर्व विद्यांचा समावेश  
होतो.

#### **कृषी कीटकशास्त्र**

विविध प्रकारच्या कीटकांचा प्रादुर्भाव पिकामध्ये असतो.  
यासाठी उपाययोजनेचा अभ्यास कृषी शास्त्रातील  
कीटकशास्त्रात केला जातो.

#### **वनस्पतिशास्त्र**

वनस्पतीची बाह्य आणि अंतर्गत रचना, पुनर्उत्पादन,  
रोगराई, खते यांचा अभ्यास कृषी शास्त्रातील  
वनस्पतीशास्त्रात केला जातो. तसेच वनस्पतींच्या जाती,  
उपयोग, संवर्धन, संरक्षण यांचादेखील अभ्यास यात केला  
जातो.

#### **मत्स्यव्यवसाय**

मासेमारी व्यवसायास चालना देण्यासाठी माशांच्या प्रमुख  
जागा, व्यवसायासाठी लागणारे जाळे, मासे टिकवण्याच्या  
पद्धती, गोड्या पाण्यातील मासेमारी प्रकार, आधुनिक तंत्र  
यांचा अभ्यास मत्स्यव्यवसाय यात केला जातो.

#### **कृषी हवामानशास्त्र**

कृषी ही एक जैविक प्रक्रिया आहे. जमिनीत बियांची रुजवण  
करण्यापासून ते वृक्षाची वाढ होताना त्या प्रदेशातील जमीन  
व हवामान, पाऊस यांचा पिकावर होणारा परिणाम याचा  
अभ्यास कृषी हवामान शास्त्रात केला जातो.



**कृषी रसायनशास्त्र**

जमीन, पाणी, खते या कृषीसंबंधित महत्वपूर्ण घटकांचा अभ्यास कृषी रसायनशास्त्रात केला जातो.

**कृषी अभियांत्रिकी**

कृषी अभियांत्रिकीमध्ये कृषीतील वाहतूक, इमारत, बांधकाम, साठवणूक प्रक्रिया, जमिनीची बांध बंदिस्ती, जलसिंचन, यंत्रे-अवजारे इत्यादी अनेक विषयांचा अंतर्भाव केला जातो.

**कृषी व्यवसायाचे घटक**

नैसर्गिक घटक : हवामान, जमीन, प्राकृतिक रचना

आर्थिक घटक : बाजारपेठ, दळणवळण, वाहतूक, भांडवल, मनुष्यबळ

सामाजिक आणि धार्मिक घटक : वैज्ञानिक दृष्टिकोनाचा विचार, सामाजिक चालीरीती, वारसा हक्क

राजकीय घटक : कृषी व्यवसायाला पोषक धोरणे आणि योजना

तांत्रिक घटक : यंत्रे व अवजारे, सुधारित बी-बियाणे, खते, अत्याधुनिक सुधारित कृषी तंत्र, जलसिंचन, स्वामित्व

**कृषी व्यवसायाची वैशिष्ट्ये**

**निर्वाह पातळीवरील कृषी -**

कृषी व्यवसायाकडे देशातील बहुसंख्य शेतकरी केवळ उदरनिर्वाहाचे साधन म्हणून पाहतात. कुटुंबाचे पोषण व्हावे एवढे सिमीत उद्दिष्ट या व्यवसायात ठेवले जाते.

**व्यक्तिगत पातळीवरील व्यवसाय -**

भारतीय कृषी व्यवसाय हा वैयक्तिक पातळीवर केला जातो. शेतकऱ्याच्या शेतजमिनी स्वतःच्या मालकीच्या असतात. किती उत्पादन घ्यावे, कसे घ्यावे, बाजारात किती विकावे हे सर्व निर्णय शेतकरी स्वतः घेतात.

**निसर्गावरील अवलंबन -**

भारतीय कृषी एक परिकल्पना मानली जाते. निसर्गाने चांगली साथ दिली तर पीक हाती लागते. अन्यथा शेतकऱ्यांचे अतोनात नुकसान होते.

**उत्पादन घटकांचे विशेष वैशिष्ट्ये -**

कृषी व्यवसायात भूमी हा उत्पादन घटक अन्य घटकांच्या तुलनेत वैशिष्ट्यपूर्ण आहे. भूमी या घटकाचा पुरवठा सिमीत आहे. निसर्गाने मानवाला उपलब्ध करून दिलेल्या जमिनीतच उत्पादन घ्यावे लागते. भूमीची प्रत सुधारून

उत्पादकता वाढविता येते. चांगल्या प्रतीची बि-बियाणे, खते याद्वारे जमिनीच्या प्रतीत सुधारणा शक्य असते.

**मंदगतीने होणारे उत्पादन-**

कृषी उत्पादनाची प्रक्रिया ही जैविक आहे. निसर्गाच्या विरोधात जाऊन पीकांचे उत्पादन घेता येत नाही. पीक लागवड कालावधीपासून ते उगवण, वाढ, परिपक्वता यासाठी विशिष्ट कालावधी जातो. निसर्गातील अनेक बदलांचा या प्रक्रियेवर परिणाम होत असतो. म्हणून कृषी उत्पादनाचा वेग अन्य उद्योगांच्या तुलनेत मंद असतो.

**धोका आणि अनिश्चितता -**

कृषी व्यवसायात कारखान्यातील उत्पादनाप्रमाणेच धोका आणि अनिश्चिततेवर नियंत्रण ठेवणे कठिण असते. विशिष्ट कालावधीतच उत्पादन होत असल्याने आवश्यक तेव्हा पुरवठा होऊ शकत नाही. निसर्गावर उत्पादनाचा अनिश्चितपणा निर्भर असतो. पूर्वअंदाज कृषी उत्पादनातील अनिश्चिततेमुळे लाभदायक ठरतीलच असे सांगता येणे कठिण असते.

**कृषी व्यवसायात स्थिर खर्चाचे प्रमाण अधिक असते -**

स्थिर व्ययाचे प्रमाण कृषी व्यवसायात मोठे आहे. जमीन, जनावरे, यंत्रे, पाणीपुरवठ्याची साधने, ट्रॅक्टर, जलसिंचनाची साधने यासाठी येणाऱ्या खर्चाचे प्रमाण मोठे आहे. उत्पादनात बदल होताना स्थिर खर्चात बदल शक्य होत नाही. परिणामतः भांडवलाचा खर्च वाढत जातो.

**कृषी व्यवसायात वैयक्तिक लक्ष देण्याची गरज असते -**

कृषी व्यवसायासाठी योग्य वेळापत्रक विचार करून ठरवावे लागते. हवामान, पर्जन्यवृष्टी यावर वारंवार लक्ष ठेवून निर्णय घ्यावे लागतात. आवश्यक तेव्हा निर्णय बदलावे लागतात.

**सामाजिक घटकांचा प्रभाव -**

कृषी व्यवसायावर आर्थिक घटकांप्रमाणेच सामाजिक घटकांचा प्रभाव देखील मोठा आहे. एका विशिष्ट जातीय वर्गाकडे देशातील जमिनीची मालकी असलेली दिसते. शेतकरी स्वामित्वाचा लहानसा तुकडादेखील सोडण्यास तयार नसतो. परिणामतः आर्थिक क्षेत्राचा अभाव असल्याचे जाणवते.

**घटत्या उत्पादन फलाचा अनुभव -**

कृषी व्यवसायात घटत्या उत्पादन फलाचा सिद्धांत लागू होतो. उत्पादनाच्या सर्व घटकांचे प्रमाण स्थिर ठेवून एका घटकाचे प्रमाण वाढविल्यास सरासरी उत्पादनात घट होत

जाते. जमिनीचा पुरवठा सिमीत असल्याने ठराविक पातळीनंतर खताच्या पुरवठ्यात सातत्याने वाढ केली, तर उत्पादनात अल्पकाळातच घटत्या दराने उत्पादन वाढ होते.

**प्रमाणीकरणाचा अभाव -**

भूमीची प्रत प्राकृतिक रचनेचा विचार करता सर्व ठिकाणी वेगळी आहे. जमिनीचा पोत, निसर्ग, हवामान, कृषी करण्याचे तंत्र, साधनाची उपलब्धता यामुळे सारख्याच दर्जाचे उत्पादन मिळणे अशक्य असते. त्यामुळेच कृषी प्रमाणीकरण आणि प्रतवारी करणे कठीण जाते.

**कृषी व्यवसाय एक पायाभूत व्यवसाय आहे -**

कृषी एक पायाभूत व्यवसाय आहे. या व्यवसायातून अन्नधान्य, दूध, अंडी, मांस यासारख्या पायाभूत गरजा पूर्ण होत असल्याने जगातील विकसित देशासह सर्व देशात ह्या व्यवसायास महत्त्वाचे स्थान आहे.

**किंमत बदलाबरोबर उत्पादनात बदल अशक्य -**

कृषी उत्पादन ही जैविक प्रक्रिया आहे. उत्पादनात बाजारातील किमतीत होणाऱ्या चढ-उताराबरोबर वाढ करणे शक्य नसते. पिकांच्या किमती वाढत असताना उत्पादनात वाढ करण्यासाठी पिकांना योग्य हंगाम आणि कालावधी देणे आवश्यक असते. त्यामुळे किमतीतील बदलाबरोबर उत्पादन बदल शक्य होत नाही.

**देशाच्या अर्थव्यवस्थेत कृषी व्यवसायाचे महत्त्व**

कृषी क्षेत्राला देशाच्या आर्थिक विकासात महत्त्वपूर्ण स्थान आहे. कृषी व्यवसायाकडे देशातील लोकसंख्येच्या प्राथमिक गरजा पूर्ण करण्यासाठी, औद्योगिक विकासासाठी, कच्च्या मालाचा पुरवठा करणारे एक क्षेत्र म्हणून पाहिले जाते. देशाच्या अर्थव्यवस्थेत कृषीला किती महत्त्व आहे हे पुढील बाबींवरून स्पष्ट होते.

**उपजीविकेचे प्रमुख साधन**

ग्रामीण भागात देशातील एकूण लोकसंख्येपैकी 74 टक्के लोक राहतात. अशा लोकांची प्रत्यक्ष-अप्रत्यक्ष उपजीविका कृषी आणि संलग्न व्यवसायावर अवलंबून आहे. कृषीतून येणाऱ्या उत्पादनावर शहरी भागात राहणाऱ्या 26 टक्के लोकांची उपजीविका अवलंबून आहे.

**रोजगारीचे प्रमुख साधन**

देशातील कृषी क्षेत्रात 65 टक्के लोक काम करतात. आपल्या उपजीविकेसाठी त्यांना कृषी व्यवसायावर अवलंबून राहावे लागते. कृषी क्षेत्रातून रोजगारी उपलब्ध होत असली तरी

लोकांच्या राहणीमानाचा दर्जा उंचावलेला नाही. हंगामी बेरोजगारांच्या स्थलांतरासारख्या समस्या कृषी क्षेत्रात आहेत. स्वयंरोजगारीच्या संधीचा अभाव, व्यावसायिक व तांत्रिक शिक्षणाचा अभाव, एकत्र कुटुंब पद्धती, वैज्ञानिक दृष्टिकोनाचा अभाव इत्यादी अनेक कारणांमुळे कृषी व्यवसायावर ग्रामीण भागातील वाढती लोकसंख्या अवलंबून आहे.

**परकीय चलनाची उपलब्धता**

देशाच्या विकासासाठी आवश्यक असणारे तंत्रज्ञान, वस्तू आणि सेवा परकीय देशातून प्राप्त करण्यासाठी निर्यात वाढवणे आवश्यक आहे. विकसित देशातील आधुनिक तंत्रज्ञान मिळवण्यासाठी शेतमालाची निर्यात करण्यास भारतासारख्या कृषि प्रधान देशात मोठ्या संधी आहेत. परकीय चलन अन्नधान्य, चहा, साखर, तंबाखू, तेलबिया, मसाल्याचे पदार्थ, फळफळावळ इत्यादींच्या निर्यातीद्वारे प्राप्त होण्याची संधी आहे.

**पशुधनासाठी चाऱ्याची उपलब्धता**

पशुकरिता चाऱ्याची उपलब्धता आवश्यक असते. उत्पादित कृषी मालाबरोबरच कृषी उत्पादनाद्वारे चाऱ्याची निर्मिती होते. पशुपालन व्यवसाय पशुधनाबरोबर उभा राहतो. दुग्धव्यवसाय, दूधप्रक्रिया उद्योगातून रोजगार निर्मितीसाठी चालना मिळते.

**सरकारी उत्पन्नाचे प्रमुख साधन**

देशातील कृषी व्यवसायाला सरकारी उत्पन्नाचे प्रमुख साधन म्हणून महत्त्वाचे स्थान आहे. कृषीक्षेत्र, उद्योगक्षेत्र आणि सेवाक्षेत्र यांचा देशाच्या राष्ट्रीय उत्पादनात समावेश होतो. सरकारला कृषीवर लावण्यात येणाऱ्या वेगवेगळ्या कराद्वारे उत्पन्न मिळते. केंद्र आणि राज्यातून जमीन महसूल, शेतसारा, पाणीपट्टी, मुद्रांकशुल्क, जमीन विक्रीकर यांसारख्या विविध मार्गांनी कृषीतून उत्पन्न मिळत असते.

**लोकांना अन्नधान्याचा पुरवठा**

कृषी क्षेत्रात देशातील लोकांना अन्नधान्याचा पुरवठा करण्यासाठी मोठ्या प्रमाणात पिके घेतली जातात. यात गहू, तांदूळ, ज्वारी, बाजरी, कडधान्य, तेलबिया इत्यादी अन्नधान्यांचा समावेश होतो. हरित क्रांतीमुळे उत्पादन वाढ कृषीक्षेत्रात झालेल्या सकारात्मक बदलातून मोठ्या प्रमाणावर झाली.

**राष्ट्रीय उत्पन्नात कृषी क्षेत्राचा वाटा**

राष्ट्रीय उत्पन्नात देशातील कृषी क्षेत्राचा वाटा मोठा आहे. सन 1950-51 मध्ये राष्ट्रीय उत्पन्नातील कृषी क्षेत्राचा वाटा

55.3 टक्के इतका होता. 2008-2009 मध्ये हे प्रमाण 17.1 टक्के इतके होते. राष्ट्रीय उत्पन्नाबरोबर इतर देशाची तुलना केल्यास हे प्रमाण मोठे आहे.

### राजकीय आणि सामाजिक दृष्टीने महत्त्व

सामाजिक हिताच्या दृष्टीने स्वतःसाठी महत्तम लाभ मिळवण्याच्या अनुषंगाने कोणत्या वस्तूचे उत्पादन किती प्रमाणात करावे आणि हे उत्पादन कोठे विकावे हा प्रत्येक शेतकऱ्याचा वैयक्तिक प्रश्न असतो. परंतु सामाजिक दृष्टिकोन विचारात घेऊन वेगवेगळ्या प्रकारची धोरणे सरकारकडून राबविली जातात आणि त्या धोरणांचा सामाजिक क्षेत्रावर प्रभाव पडतो. देशातील कृषी ही शेतकऱ्याच्या दृष्टीने त्यांचा भावनिक प्रश्न आहे. तर सरकारच्या दृष्टीने राष्ट्रीय उत्पन्न प्राप्त करून देणारा एक स्रोत आहे.

### औद्योगिक विकासाला साहाय्यभूत

कृषी क्षेत्रातून उद्योगाला लागणारा कच्चा माल उपलब्ध होतो. कापूस, ऊस, तेलबिया इत्यादी अनेक कृषी क्षेत्रातील आदानावर उद्योग अवलंबून असतात. हातमाग व्यवसाय, तांदूळ आणि भगरमिल यांसारखे लहान उद्योग कृषी क्षेत्रावर अवलंबून असतात. केवळ कृषी क्षेत्रातील कच्चा मालातून फळाचे रस, पापड, चहा, कॉफी, साबण, तेल, मिठाई, फरसाण इत्यादी अनेक उद्योग उभे राहतात. कृषी उत्पादन वाढल्याने शेतकऱ्यांची शक्ती वाढते. यातूनच औद्योगिक उत्पादनात मागणी वाढते.

### संरक्षणाच्या दृष्टीने महत्त्व

भारताच्या पश्चिमेला पाकिस्तान, उत्तरेला चीन, पूर्वेला बांगलादेश आणि दक्षिणेला श्रीलंका हे देश आहेत. या देशातील वर्तमान राजकीय परिस्थिती आणि तेथील सामाजिक संघर्ष विचारात घेतला, तर भारताला स्वसंरक्षणासाठी मोठ्या प्रमाणात लक्ष केंद्रित करावे लागते आहे. सीमारेषेवरील जवानांमध्ये भारतीय सीमारेषांचे संरक्षण करण्याची जबाबदारी असली तरी संरक्षणाच्या दृष्टीने बरेच मोठे क्षेत्रफळ हे कृषीसाठी उपयोगात आणले जात नाही, म्हणजेच संरक्षणाच्या दृष्टीने बरेच मोठे कृषी क्षेत्र हे खर्ची पडले आहे.

### आर्थिक नियोजनात महत्त्व

देशाच्या आर्थिक विकासासाठी देशातील उपलब्ध नैसर्गिक साधनसंपत्तीचा उपयोग करून घेताना आर्थिक नियोजन केले जाते. आर्थिक नियोजनात निश्चित केलेली काही उद्दिष्टे हे कृषी क्षेत्राशी निगडित असतात. त्यामध्ये कृषीची उत्पादकता वाढविणे, कृषीक्षेत्रात आधुनिकीकरण आणणे,

कृषी मूल्यधोरण तयार करणे, कृषीसाठी वित्तपुरवठा करणाऱ्या संस्थांच्या कार्यपद्धतीत बदल करणे, कृषी आधुनिकीकरण करणे, कृषी मालाची साठवणूक करण्यासाठी वखार महामंडळे स्थापन करून वखार व्यवस्था करणे, कृषी साठी पाणी पुरवठ्याचे स्रोत म्हणून मोठे प्रकल्प, मध्यम प्रकल्प, लघु प्रकल्प, विहिरी, नलिका, बंधारे, तलाव, कालवे इत्यादीच्या अनुषंगाने धोरणे तयार केली जातात. कृषीवर अवलंबून असणाऱ्या शेतमजुरांसाठी एकात्मिक ग्रामीण विकास कार्यक्रम, जवाहर रोजगार योजना, सामुदायिक विकास कार्यक्रम राबविले जातात. कोरडवाहू कृषी चा विकास करण्याच्या दृष्टीने कोरडवाहू कृषी चे तंत्र, एकात्मिक विकास, बहुपीक पद्धती संकरित बियाणांचा कार्यक्रम, पाणलोट क्षेत्र विकास कार्यक्रम आणि अवर्षणप्रवण क्षेत्रविकास कार्यक्रमांसारखे विकास कार्यक्रम राबविण्यासाठी आणि कृषी क्षेत्राचा विकास होण्यासाठी आर्थिक नियोजनात कृषी क्षेत्रास प्राधान्य दिले जाते.

### आर्थिक स्थिरता

कृषीची भूमिका देशातील जनतेला आर्थिक स्थिरता प्राप्त करून देण्यासाठी अत्यंत महत्त्वाची आहे. भारत हा ग्रामीण भागात भारत असून शहरी भागात इंडिया आहे. असे अनेकांचे मत आहे. त्यामुळे ग्रामीण आणि शहरी वातावरणामध्ये मोठ्या प्रमाणात फरक जाणवतो, असे असले तरी आर्थिक स्थिरता ग्रामीण भागातील जनतेला प्राप्त करून देण्यामध्ये कृषीव्यवसायाची भूमिका महत्त्वाची आहे.

### आर्थिक विकासाकरिता महत्त्व

व्यक्तींच्या मूलभूत गरजा अन्न, वस्त्र, निवारा असून त्यापैकी अन्न ही गरज कृषी क्षेत्राद्वारे पूर्ण केली जाते. कृषी क्षेत्रातून उद्योगासाठी लागणारा कच्चा माल हा उत्पादित केला जातो. अनेक देशाचे कृषी उत्पादन आंतरराष्ट्रीय बाजारपेठेत निर्यात होते आणि त्यामुळे देशाला विदेशी चलन मिळते. देशातील अनेक उद्योग कृषी उत्पादनामधील गहू-रवा, तांदूळ-पोहे, ऊस-साखर/गूळ, ताग-ज्यूट, तेलबिया-तेल, कापूस-वस्त्र इत्यादी कृषी उत्पादनावर अवलंबून आहेत. त्यामुळे देशाच्या आर्थिक विकासात कृषी व्यवसायाचे महत्त्वाचे स्थान आहे.

### अन्यक्षेत्राच्या विकासाला चालना

कृषी क्षेत्राच्या विकासाबरोबर वाहतूक-दळणवळण, गोदाम व्यवसाय, बँक व्यवसाय, विमा व्यवसाय, प्रक्रिया उद्योग, कृषी अवजारे, पंपसेट, औषधे, रासायनिक खते, विपणन

व्यवस्था इत्यादी यांच्या क्षेत्रातील रोजगारीच्या संधी मध्ये वाढ होते.

## **निष्कर्ष**

देशाच्या आर्थिक, सामाजिक विकासात कृषी व्यवसायाचे महत्त्व नाकारता येणार नाही. औद्योगिक प्रगतीसाठी कृषी विकास अनिवार्य आहे. अर्थव्यवस्थेतील प्रत्येक क्षेत्राचा कृषी व्यवसायाबरोबर प्रत्यक्ष आणि अप्रत्यक्ष संबंध जोडला गेलेला आहे.

## **संदर्भ**

1. Talathi J. M., Naik V.G. & Jalgaonkar V. N.  
- Introduction to Agricultural Economics and Agribusiness Management – Ane Books Pvt. Ltd. Publisher (2019)
2. Agrawal A. N. – Indian Economy Problems of Development & Planning, New Age International Publisher (2009)
3. Acharya S. S. & Agarwal N. L.- Agricultural Marketing in India, Oxford and IBH Publishing Company, 1987
4. Diwase Smita - Indian Agriculture and Agribusiness Management, KRISHI Resource Management Network (2017)
5. Panigrahy S.R., kumar Sanjiv & Singh Ritambhara – Objective Agribusiness Management, 3<sup>rd</sup> Ed., Scientific Publishers (2019)
6. <https://www.mpscacademy.com/2017/02/national-income-and-methods-to-measure-t.html>
7. <https://oglww.com/agri-business/>

**The Role Of Water Resource Management In Agriculture Sustainability**

**Dr.Nagde Daivashala Shivaji**

Head, Dept of Geography

Shahid Bhagatshing College, Killari

Tq Ausa, Dist: Latur

Corresponding Author- **Dr.Nagde Daivashala Shivaji**

Email- daivashalanagde@gmail.com

**DOI-10.5281/zenodo.7509336**

---

**Introduction :**

No life on earth can exit without water scientist estimate that there is over 1 billion cubic kilometer of water on this earth. Which covers nearly 3 /4 of the earths surface in the form of oceans , rivers, lacks, snow ,glaciers and groundwater. Through the same and inordinately huge amount in actual fact less than 1% is fresh and usable found in lacks, pounds, rivers and groundwater. Of the remaining 97% found in ocean and 2% is locked up in glaciers and ice caps .only one percent is available for use.

Water is natural resource fundamental to life, livelihood food security and agriculture development. It is also scarce resource. India has pure than 17% words population but has only four percent of world's land area . As per percent estimate India receiver on average annual prescription of about 4000 Billion cubic metre (BCM )which is its basic water resource . out of this after consider the natural evaporation transportation only about 1869 billion cubic metres is average annual natural flow through rivers and aquifers. Due to l spatio- temporal variation and estimated 690 BCM of surface water in utilization.

Water is most important for life for, climate, for agriculture, for industry, for power generation, for scarcity and water management. In the agriculture field without water we can't image the development in agriculture. Food cannot be i culture is the without water vegetables are 80 to 90%, milk about 87%. Agriculture is the major consumer of water in India so the role of water management is very important in agriculture sustainability.

---

**Aims and Objectives :**

1. To know the sources of water.
2. Who study the irrigation and management of water in India.
3. To study the necessity of water in India.
4. To collect water and preserve it.
5. Use water springly.
6. To help understand new policies and updates or agriculture water policy.
7. Recycle waste water for reuse.

Water is an essential resource for all life the planet of the water resources on earth only three percent of it is fresh and thirds of freshwater is locked up in ice caps and glaciers of the remaining one percent this in minecrite and much ressonal rain fall in monsoon deluges and floods cannot easily be used. At present about 0.08% of all the worlds' water is exploited by mankind in ever increasing demand for sanitation drinking manufacturing leisure and agriculture.

Much effort in water resource management is directed at optimizing the use of water and in minimizing the environmental impact of water use on the natural environment. Successfully

management of any resource requires accurate Knowles of the resource available the uses to with it may be put the competing demands for the resources measures to and processes to land use the significance and worth of competing and mechanisms to translate police decision into action on the ground. For water as a resource this is particularly difficult since sources of water can cross many national boundaries and the uses of water include many that are difficult to sassing financial value to the may also be difficult to many in terms. Expels include rare species or ecosystems or the very long term value of ancient groundwater resources.

Agriculture is the largest user of the world's freshwater resources consuming 70 present. As the world's population rises and constimes more food industries and urban development expand and the emerging befoul crops trade also demands a share of freshwater resources water scarcity is becoming an important issue. An assessment of water resource management in agriculture was conducted in 2007 by the international water management institute in Srilanka to



see if the world had sufficient water to provide food for its growing population. Water management became necessity. People need water to drinking for industries and to make it available proper water management and distribution is required the following points should be considered.

Son water. Every drop of water must be sowed and water should not be wasted: Crops which require has less water must be cultivated.

Rain water harvesting the maximum amount of rain water must be preserved which is essential for farming. Increasing of water hodies- from 1995 the development of this started which includes tree plantation, smadams to store water Use of drip and sprinkle irrigation water should be provide to the roots so that more production is gained less water through drip and sprinkle irrigation. Harvesting ground water to crop with water scarcity ground water level must be increased by refilling wells tube wells and other ground water sources 9.638% Water management by involvement of people Agricultural scientist convergent and ground servants should be involved in water management programmer Water literacy programme the view towards water should be changed. Importance of water should March 1995.

understood by everyone and water in must be sparingly used and conserved. Hence it becomes necessary literate all people about water management?

Planning of crops - some crops like sugarcane, banana and fruit trees require abundant amount of water these should be replaced be crops requiring minimum amount of water. Water should be given by given drip irrigation and sprinkle irrigation. Development of traditional sources of water conservation by building bund small, mediums, projects all these schemes must be implemented to preserve and conserve water.

**Conclusion :**

Water is a voluble treasure for mankind. This freshwater is not available in abundance. There sharp full in freshwater in the world. To crop with the water crisis water literacy must be uncalculated in common people and a step should be taken in the direction of water revolution.

**References :**

1. Water management- professor H. M. Desharda.
2. Geography of agriculture- Saudi A. B. 2012.
3. Geography of Maharashtra -K. A. Khatib.
4. Www water management.
5. Health and Environment -Handbook

**शेती व्यवसाय समोरील प्रमुख समस्या व उपाय योजना:-**

**डॉ. अंभुरे एस. डी.**

इतिहास विभाग कै. रमेश वरपूडकर महाविद्यालय सोनपेठ

Corresponding Author- डॉ. अंभुरे एस. डी.

Email- -shivajiambhure0104@gmail.com

DOI- 10.5281/zenodo.7509348

**प्रस्तावना:-**

भारत हा कृषिप्रधान देश आहे. प्राचीन काळापासून शेती व्यवसायाला फार महत्त्व आहे. आज सुद्धा 75 टक्के लोक शेती व्यवसाय करतात. भारतात. कोरडवाहू शेतीचे प्रमाण अधिक आहे. त्यामुळे शेती ही निसर्गावर अवलंबून आहे कारण कधी जास्त पाऊस तर कधी कमी पाऊस पडतो. यातच शेती बाबतीत सरकारची ठोस अशी भूमिका नाही किंवा शेतीमालाला हमीभाव नाही. आज समाजात जागृती झाल्यामुळे संपूर्ण समाज शिक्षण घेऊन नोकरी किंवा इतर व्यवसाय निमित्ताने शहराकडे राहण्याचा कल वाढला आहे. त्यामुळे शेतमजुरांचा देखील फार मोठा प्रश्न आहे. शेतकऱ्यांची आर्थिक स्थिती हलाकीची झाल्यामुळे शेती मधील अवजारे, खत, बियाणे हे योग्य वेळी घेणे शक्य होईना. यातच खत, बियाणाचे द फार किमती वाढल्या आहेत आणि आजही आपण शेतीकडे, व्यवसाय म्हणून पाहत नाहीत जगाच्या तुलनेत शेतीसाठी सुविधा खूपच अपुऱ्या आहेत. याचा परिणाम शेतकऱ्यांसमोर अनेक समस्या निर्माण झाल्या आहेत त्यामुळे शेती व्यवसाय करणे आव्हान निर्माण झाले आहे.

**शोध निबंधाचे उद्देश:-**

शोधनिबंध लिहिण्यासाठी खालील उद्देश निर्धारित करण्यात आले आहेत

भारतीय शेती व्यवसायाचा अभ्यास करणे

भारतीय शेती व्यवसायातील समस्यांचा अभ्यास करणे

शेती व्यवसायातील समस्या सोडविण्यासाठी उपाययोजना शोधणे

**संशोधन पद्धती:-**

वरील शोध निबंध तयार करण्यासाठी दुय्यम साधन सामग्रीचा वापर करण्यात आला आहे त्यासाठी विविध संदर्भ ग्रंथ, मासिके, दैनिक वर्तमान अग्रलेख, इंटरनेट, इत्यादी साधनांचा वापर करण्यात आला आहे

**गृहतीके:-**

शेती व्यवसाय निसर्गावर अवलंबून आहे शेती व्यवसायासाठी शासनाची उदासीनता दिसून येते शेतकऱ्यांना अनेक समस्यांचा सामना करावा लागतो

**शेती व्यवसाय समोरील समस्या:-**

भारतातील उत्पादनक्षम शेतीपैकी बहुतांश शेती ही कोरडवाहू आहे दरवर्षी शेतीत कोरड्या व ओल्या दुष्काळाच्या रूपाने हमखास फटका बसतो. दिवसेंदिवस वाढत चाललेल्या प्रदूषणामुळे ऋतुचक्रात अनियमता बदल होत आहेत याचा परिणाम अवकाळी पाऊस, वादळ, वारे, गारपीट, भूकंप, पिकावर पडणारी रोगराई, मी शेती व्यवसायासाठी अतिशय घातक संकट आहेत ही अस्मानी किंवा नैसर्गिक संकट कधी येतील हे कळत नाही कळाल तर ती थांबवता येत नाहीत ती संकटात थांबण्यासाठी शेतकरी पूर्णतः हतबल ठरतो.

**शेतीचे बदलते स्वरूप:-**

देशाची झपाट्याने वाढणारी लोकसंख्या त्या

लोकांनी राहण्यासाठी बांधलेल्या घरामुळे

शहर झपाट्याने वाढत. आहेत याच वेगाने जमीन कमी होत आहे उत्पादन वाढीसाठी माणूस पडित जमीन वहीची खाली आणत आहे त्यामुळे जनावरांचा चारण्यासाठी कूरणे उरली नाहीत परिणामी शेतकऱ्यांना गाई, म्हशी, सांभाळणे शक्य होईना. शेतीकडे पूर्वीसारखी जनावर नसल्यामुळे आणि आहेत त्या नाही खाण्यासाठी सकस चारा मिळत नसल्यामुळे त्यांच्यापासून मिळणारे शेणखत कमी झाले आहे. जमीनीला खत मिळत नसल्यामुळे सुपीकता कमी होत आहे. रासायनिक खते फार मोठ्या किमतीत विकत घ्यावे लागत आहेत. रासायनिक खतातील भेसळ सुपीकता कमी होण्यास कारणीभूत ठरत आहे.

**शेतकऱ्यांची आर्थिक स्थिती व शेती व्यवसाय:-**

भारतातील ग्रामीण शेतकरी बहुतेक अज्ञानी व अडाणी असल्यामुळे तो धर्मकारणात व लग्नकार्यात फार मोठ्या प्रमाणात खर्च करत असतो विशेष म्हणजे ऊन पाऊस वादळ वारे कशाची पर्वा न करता कुटुंबाला सोबत घेऊन दिवस-रात्र बैलासारखा शेतावर राबराब करणारा शेतकरी सावकार. आडत्या व व्यापाराच्या उधारी उसनवारी परत करून नेमक्या पेरणीच्या वेळी आर्थिक दृष्ट्या कंगाल बनलेला असतो पेरणीसाठी पुरेशी भांडवल नसल्यामुळे व्यापाऱ्याकडून खत-बी- बियाणे उद्धार पेरणी करतो दुष्काळामुळे दुबार पेरणी करण्याची वेळ आल्यानंतर तो आर्थिक दृष्ट्या पूर्ण खचून जातो पेरणी करावी तर भांडवल नाही सोडून द्यावी तर उदरनिर्वासाठी दुसरे साधन नाही अशा विविध अवस्थेत सापडलेल्या शेतकऱ्यांना कात्रीत पकडून उदा उत्पादित माल याच व्यापाऱ्याला विक्री करण्याच्या अटीवर त्यांच्याकडून व्याजाने पैसे घेतो सुगी आल्यानंतर सर्वप्रथम व्यापारी आपली रक्कम व्याजासह

कापून घेऊन उरले तेवढेच पैसे शेतकऱ्यास देतो त्याच पैशात कुटुंब चालून मुलीचे लग्न. मुलाचे शिक्षण या सर्व अधिकारावे लागतात आणि आशा अनेक कारणामुळे शेतकऱ्याकडे शेतीसाठी भांडवल नसते हे एक फार मोठी शेतकऱ्यासमोर समस्या आहे.

**बँका व पतसंस्थांचा शेतकरी विषयी नकारार्थी दृष्टिकोन:-**

कुठलाही व्यवसाय\* भांडवल असल्याशिवाय चांगल्या प्रकारे करता येत नाही त्यामुळे प्रत्येक व्यवसाय करणाऱ्यांना विशिष्ट बँका व पतसंस्था कर्जवाटप करीत असतात हे कर्ज वाटप करीत असताना बँका व पतसंस्था यांचा शेतकऱ्यां विषयी नकारार्थी दृष्टिकोन असतो. कारण कर्मचारी व्यापारी. कारखानदार. यांना विशेष सवलती देऊन खर्च मागील तेवढे कर्ज मिळते परंतु शेतकऱ्यांना कर्ज मिळत नाही मिळाले तर जागोजागी आडवणुक करून त्यांच्याकडून पैसे घेऊन मगच कर्ज मंजूर करतात व्यापारी कारखानदार व्यापार कारखाना यांच्या तोटा दर्शून कर्ज भरीत नाहीत तरी बँका त्यांची वसुली करीत नाहीत उलट एखाद्या शेतकऱ्याने कर्जाची परतफेड केली नाही तर बँक त्यांच्या वारसा कडून कर्ज वसूल करते भारतामध्ये सुद्धा अनेक मोठाले उद्योजक फार मोठी रक्कम उचलून भारताबाहेर पळून गेलेले आहेत पतसंस्थांचा शेती आणि शेतकऱ्यांच्या विषयी नकारार्थी दृष्टिकोन पक्का ठरलेला आहे त्यामुळे शेतकऱ्यासमोर ही एक मोठी समस्या आहे

**शेतकऱ्यांचे व्यापाऱ्याकडून होणारे शोषण:-**

भारतामध्ये कुठल्याही शेती मालाला हमीभाव नाही. ज्या मालाला हमीभाव मिळाला आहे त्याची वेळेवर खरेदी खरेदी होत नाही. त्यामुळे शेतकऱ्यांना आपल्या घरगुती गरजा भागण्यासाठी व्यापारी सांगतील त्या किमतीत आपला माल विकावा लागतो शेतकऱ्यांचा माल विकल्यानंतर त्या मालाला भाव येतो तेव्हा शेतकऱ्यांचा माल त्यांच्या हातातून गेलेला असतो त्यातच शेतकऱ्यांनी व्यापाऱ्याकडून कर्ज घेतलेले असते कर्ज फेडण्यासाठी तो लवकर माल विकतो हमीभाव नसल्यामुळे ही एक शेतकऱ्यासमोर मोठी समस्या आहे

**शेत मजुरांची कमतरता व त्यांची मानसिकता:-**

शेती व्यवसाय हा बऱ्याच प्रमाणावर शेतमजुरावर अवलंबून राहतो. त्यामुळे शेती कामासाठी मनुष्य बळ मोठ्या प्रमाणात लागते .३०-३५ वर्षांपूर्वी भारतात औद्योगीकरण झालेले नव्हते. दळणवळणाच्या सुख सुविधा नव्हत्या. समाज शिक्षण घेत नव्हता. त्यामुळे बरेच लोक ग्रामीण भागात राहत असत. तेव्हा मजुरांची कमतरता नव्हती परंतु आज प्रत्येक जाती धर्मातील लोक शिक्षण घेत आहेत औद्योगीकरणामुळे शहरीकरण वाढले याचा परिणाम शेतीमध्ये शेतमजूर संख्या कमी झालेली आहे दुसरे म्हणजे

शेतमजुरांची अशी मानसिकता झाली आहे की आपल्याला शहरांमध्ये जास्त पैसा मिळतो मुलांना पण शिकविता येते ग्रामीण भागात त्यांना उदासीनता वाटते ही त्यांची मानसिकता झाली या त्यांच्या मानसिकतेमुळे शेतामध्ये काम करणाऱ्यांची संख्या कमी झालेली आहे ही एक शेतकरी समोरील फार मोठी समस्या आहे

**शासनाचे शेतीविषयक उदासीन धोरण:-**

भारत हा कृषिप्रधान देश असूनही आणि भारतात शेती हा प्रमुख व्यवसाय असून सुद्धा शासनाचे या व्यवसायाकडे विशेष लक्ष नाही. भारतातील शेती ही निसर्गावर अवलंबून असल्यामुळे दुष्काळाच्या काळात शेतकऱ्यांच्या मदतीसाठी शासन धावून येत नाही त्याचबरोबर शेतकऱ्यांसाठी धान्य साठवण्यासाठी कुठलीही गोदाम नाहीत. किंवा हमीभाव देण्याकडे त्यांचे लक्ष नाही तसेच त्यांच्या आयात- निर्यात धोरणामुळे शेतकऱ्याला फार मोठा फटका बसतो काव्य खोदणे जलसिंचन करणे हे शासनाचं कर्तव्य असते परंतु जे काय थोड्या प्रमाणात जलसिंचन होत आहे त्यामध्ये सुद्धा फार मोठा भ्रष्टाचार होत आहे बरेच शेत तळे कागदोपत्रीच आहेत अशा प्रकारे शेतकऱ्या विषयी शासनाचे जे उदासीन धोरण आहे ते एक शेतकऱ्यासमोर फार मोठे समस्या आहे

**शेतीमालावर प्रक्रिया करणाऱ्या उद्योगाचा अभाव:-**

महाराष्ट्रात वेगवेगळ्या भागात वेगवेगळ्या विशिष्ट धान्य पिकविले जाते यामध्ये मराठवाडा विदर्भात कापूस किंवा सोयाबीन पिकाचे फार मोठे उत्पन्न काढल्या जाते परंतु कापूस व सोयाबीन वर प्रक्रिया करणारे कुठलेच उद्योग नाहीत ऊस भरपूर निघतो तिथे साखर कारखाने कमी आहेत जे आहेत ते व्यवस्थित चालत नाहीत बहुतेक साखर कारखाने राजकीय पुढाऱ्यांनी विकून खाल्ले आहेत किंवा त्यांनी स्वतंत्र खाजगी विकत घेतले आहेत त्यामुळे शेतकरी फार मोठ्या प्रमाणात अडचणीत येतो शेतकऱ्यांना आपला माल कुठे विकावा हेच कळत नाही शेतीमालावर प्रक्रिया करणारे उद्योग नसल्यामुळे शेतकऱ्यां पुढे फार मोठ्या समस्या निर्माण होतात.

**शेतकऱ्यांमधील अज्ञान:-**

कुठलाही व्यवसाय यशस्वीरित्या करायचा असेल तर तो व्यक्ती सुशिक्षित असला पाहिजेत. परंतु भारतातील आजही फार मोठ्या प्रमाणात शेतकरी अडाणी व अज्ञानी आहेत त्यांना शेती व्यवसायाची योग्य नियोजन लावता येत नाहीत किंवा शेतीमा लाचे मार्केटिंग करता येत नाही त्यामुळे वर्षभर राबवून त्याला जेवढे पैसे मिळत नाहीत तेवढे व्यापाऱ्याला एका दिवसात पैसे मिळते मिळतात त्यामुळे शेतकऱ्यांचं अज्ञान सुद्धा शेतकऱ्यासमोरच एक मोठे समाज होऊन बसली आहे

**खर्च अधिक व उत्पादन कमी:-**

भारतातील शेतीची उत्पादक क्षमता विकसित देशाच्या तुलनेत फार कमी आहे अमेरिकेत 2001 मध्ये प्रति हेक्टर भारताची उत्पादकता ७२१० किलो ग्रॅम तसेच जपानमध्ये ६६६० किलो ग्रॅम चीनमध्ये ६३५० किलोग्रॅम तर भारतात 2640 किलो ग्रॅम आहे भारतामध्ये २७४० किलो ग्राम आणि भारतात हमीभाव नसल्यामुळे शेतकऱ्यांचा खर्च जास्त होतो परंतु त्या प्रमाणात त्यांच्या मालाचे पैसे होत नाहीत यामुळे उत्पादन झाले असले तरी उत्पादनापेक्षा खर्च जास्त होत आहे ही एक फार मोठी समस्या आहे

**शेती व्यवसाय समोरील उपाय:-**

शेतीमालाची साठवणूक करण्यासाठी पुरेशा प्रमाणात व्यवस्था करण्यात यावी.

शेतकऱ्यांना पीक विमा उतरण्यासाठी अधिकाधिक प्रमाणात प्रोत्साहित करावे पिकाचे नुकसान झाल्यास संबंधित शेतकऱ्यांना तात्काळीन पिक विमा देण्याची व्यवस्था असावी जेणेकरून पिक विमा साठी शेतकऱ्यांची विश्वास अहर्ता वाढेल शेती पदवीधर तरुणामार्फत कृषी संलग्न व्यवसाय केंद्राची स्थापना करून त्यांच्या मार्फत शेती अवजारे, खते, कीटकनाशके, यांचे विक्री प्रतिनिधी आणि शेतकऱ्यांना हवी ती माहिती देण्याची जबाबदारी शासनाने घ्यावी शासनाने हमीभावाची जास्तीत जास्त काळजी घ्यावी जेणेकरून शेतकऱ्यांची व्यापार लूट करणार नाहीत सिंचन क्षेत्र वाढविण्यासाठी व पाणी टंचाईवर मात करण्यासाठी भारत सरकारने नद्या जोड प्रकल्पाची मांडलेली कल्पना हाती घ्यावी तसेच शेतकऱ्यांना शेतीला पाणी देण्यासाठी ठिबक सिंचन सारखे आधुनिक तंत्रज्ञानाचा वापर करण्यासाठी मार्गदर्शन व्यापक प्रमाणात करावी त्यासाठी शेतकऱ्यांना आर्थिक सहाये द्यावे शेतकऱ्यांना आधुनिक शेती तंत्रज्ञानाचे प्रशिक्षण देण्याची व्यवस्था करावी शेतीमालासाठी किंवा शेतीचे धान्य खरेदी विक्री करण्यासाठी उत्तम बाजारपेठ निर्माण करावी तेव्हा शासनाने शेतीमालाचा किमान भाव निश्चित करावा

**समारोप:-**

वरील लेखांमधून आपण भारतातील शेतकऱ्यांच्या समस्या त्यांच्या पुढील आव्हाने व उपाययोजनाचा थोडक्यात अभ्यास केला आहे यावरून असे दिसून येते की भारतातील शेती व्यवसाय हा अर्थव्यवस्थेचा आधारस्तंभ आहे यासाठी शासनाने शेती विकासाकडे विशेष लक्ष देणे गरजेचे आहे शेती व्यवसायात निर्माण होणाऱ्या अडचणी सोडविण्यासाठी शासकीय स्तरावर प्रयत्न होणे आवश्यक आहे शेती व्यवसाय संबंधित आधुनिक तंत्रज्ञानाचा अधिक प्रसार करून शेतकऱ्यापर्यंत हे तंत्रज्ञान पोहोचणे

अत्यावश्यक आहे बहुतांश वेळा ग्रामीण भागातील निरक्षर शेतकऱ्यांना काही वेळा तर ग्रामीण संस्थेतील जनप्रतिनिधींनी व सरपंच यांनी शासकीय योजनांची माहिती करून देणे आवश्यक आहे

**संदर्भ ग्रंथ**

- १) डॉ.सतीश ठोंबरे--कृषी घटक कैलास पब्लिकेशन औरंगाबाद
- २) यादव आनंद-ग्रामीण साहित्य स्वरूप आणि समस्या - मेहता पब्लिशिंग हाऊस पुणे
- ३) मुंदेकर श्रीराम-ग्रामीण साहित्य प्रेरणा आणि प्रयोजन- दिलीप राज प्रकाशन पुणे
- ४) चंदनशिव भास्कर-माती आणि नाती-निर्मल प्रकाशन नांदेड

**Environmental Friendly Impact of Jute and Related Problems with Jute Retting Process in Nadia District , West Bengal**

**Dr. Ranjita Roy Sarkar**

Assistant Professor & H.O.D

Department of Geography

Kalipada Ghosh Tarai Mahavidyalaya, Bagdogra, West Bengal

Corresponding Author- **Dr. Ranjita Roy Sarkar**

Email: ranjitaroysarkar@gmail.com

DOI- 10.5281/zenodo.7509376

---

**Abstract**

More opportunity and prospects in the natural fibre sector in recent days is created due to the increased concern of protection of nature . Jute is a natural fibre. In the Ganges delta region comprising Bangladesh and India Jute plants mostly grow. Here in this paper the main aim is to find out the environmental benefits of jute as a natural fibre. The impacts of Jute production on environment in Nadia is evaluated in this paper. The fertility of land is increased in jute production, it also preserve the ozone layer by absorbing CO<sub>2</sub> and clean the air by emitting O<sub>2</sub>. The jute has various uses in different fields like it is used as vegetable, geo-textile, biogas, biodegradable products which have impact on the environment . One of the important responsible factors for quality of jute fibre is its retting process . The study mainly provide information about the problems of different jute retting processes. The Data on jute retting process were collected through personal interview of jute growers. The majority farmers who are involved in jute cultivation use the traditional method and time consuming approach of retting in ponds/canals. The quality of the jute fiber is hampered by traditional method, fish cultivation and pollutes the environment as it decomposes bio-mass. The farmers are now more interested on ribbon retting process for minimizing the problems of jute retting process,. Therefore a low cost ribbon retting technique is essential for getting quality jute fiber, and farmers could able to produce high quality jute. The recommended issues are scientific method of cultivation is to be used, law must be implemented for using jute rather synthetic, to make jute policy, to enhance the application area of jute, awareness must be developed to make Jute as environment friendly fibre, and research institutions must be developed etc.

**Keywords:** Jute retting, Water shortage, Environment, Ribbon retting, and Quality fiber and extraction process. But the environment is polluted due to biomass decomposition due to retting process. Objectives

---

**Introduction**

The main objectives of the study were to identify the disadvantages of present jute retting process and to investigate the present status of jute retting process at the selected area in Nadia District. The impacts of Jute production on environment in Nadia is to be analysed and to provide the recommendations for development of jute production as a environment friendly plant in Nadia.

**Study Area** The Nadia district of West Bengal is selected as the study area , which is surrounded by Bangladesh in the East and Bardhaman District in the West, Murshidabad district to the North and South 24 Pargana and Hoogly in the South. The latitudinal extension of Nadia district is 22 53" N to 24 11" N latitude and longitudinal extension is 88 09" E to 88 48" E longitude.

Nadia covered an area of 3927 sq km. According to Oldhum (1870) Nadia is a part of Ganga Brahmaputra Delta. Major soils

**Introduction**

Jute, as a natural fiber is a biodegradable and eco friendly. Jute protects the environment and maintain the ecological balance and for this it has greater advantage over synthetics. Many colourful carpets, cordage, blankets, industrial fabrics are manufactured by jute fibre. For getting good quality of jute fibre it is necessary to practice a suitable retting process of jute. In jute retting process the fibre are extracted when plants are decomposed through joint action of water and aquatic microorganisms like bacteria. The quality of fibre like strength, color, luster etc are influenced by the retting process with some other factors.



The quality and cost of fibre produced depend on the retting of Nadia district are deep loamy soils and deep clayey loamy soils. Nadia fall under new alluvium agro- climatic

zone. Bhagirathi, Jalangi and Mathabhanga are the main rivers. Nadia enjoys the tropical monsoon type of climate with hot humid summer and mild winter.

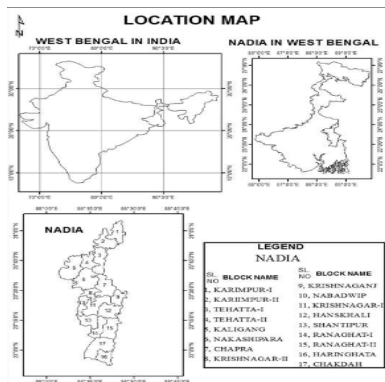


Figure 1 : Location map of the study area

## Methodology

Both secondary and primary data is used. Secondary data collected from Website of Jute Corporation of India, Website of Ministry of Textiles, Directorate General of Commercial Intelligence and Statistics (DGCI&S), Kolkata etc Then the data have been analyzed with the help of different statistical techniques. The study has used percentage, mean, growth, etc. for analysis of data and drawing inferences. Environment friendly Impacts of Jute in Nadia Jute fibre has many positive impact on the environment. The products of jute fibre is environment friendly and its better than the synthetic fibres. jute has also an indirect role on economy. The green leaf of jute is used as vegetable and dry leaf increase soil fertility. The leaf and root of jute act as pesticide. The stick of jute is used as fuel which reduce the dependency on wood. Jute absorbs carbon dioxide from the air and ozone layer is prevented from destruction.

**Table 1: Estimated amounts of N, P, and K in fibre, sticks and Leaves as % of total dry weight of products**

Type of product nutrients	Dry fibre (%)	Dry sticks (%)	Dry leaves (%)
N	0.43	0.21	3
P <sub>2</sub> O <sub>5</sub>	0.19	0.09	.37
K <sub>2</sub> O	1.65	0.75	2.2

Source: Directorate General of Commercial Intelligence and Statistics (DGCI&S), Kolkata

## 1. Jute Plant purifies the air

Carbon dioxide (CO<sub>2</sub>) is absorbed and Oxygen (O<sub>2</sub>) is emitted by jute plant and thus the air is purified. Table 1 shows that an average of 7302.38 thousand tones CO<sub>2</sub> is absorbed and 5309.91 tones O<sub>2</sub> is emitted to the air per year by jute plants.

## 2. Fertility of land

The fertility of the land is increased by the rotten leaf and root of the jute in the land. The table -1 shows that the jute plants have 423.4 thousand tone root and average 956.38 thousand tone leaf per year which are rotten and mix with the soil. The fertility of land is increased by giving Urea, TSP, Zipsam, Dolomite, Ferrous Sulfate, MP, Magnesium Sulfate, Zink sulfate to the soil. Figure-1 also shows the trend of root and leaf of Jute is steady over the periods with slight fluctuation. From Table -1 it is depicted that the jute fibre, stick, dry leaf emits the N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O of its percentage.

## 3. Biological Efficiency

Jute fibre crop is fast-growing and takes only 4 to 5 months to mature. Whereas the production of wood plant necessitates at least

## ***Agriculture Development towards Sustainability***

10 to 14 years from the plantation to harvest. If jute is used in place of wood to make paper pulp it will reduce the cost of production. The cutting down of trees are reduced by using huge amount of jute sticks which are used for pulp, paper and household fuel which indirectly preserve the nature.

### **4 Impact of other crops**

Small amount of fertilizers are needed for cultivation of jute plants and jute plant leave root and leaf which increase the production of other crops and thus reduces the need of fertilizers.

### **5 Vegetable**

Jute leaf which is used as vegetable has also the quality of nutrition and herbal medicine. Vitamin-c, iron, calcium is provided by jute leave and it used for herbal medicine for gastric, dysentery, fever, etc. (Dr. Mahbubul Islam, 2011). The demand of vegetable can be fulfilled as it grows all over the country.

### **6 Geo- textile**

To prevent the erosion of landscape for engineering field at lower cost Geo-textiles are used. The synthetic will remain in the soil for long periods of time although it has the characteristics of degradation. As a cheap and environment friendly products it can be used for river embankments, road construction, dam etc..

### **7 Biogas emission**

During retting the emission of Methane has been estimated to be 1-2 m<sup>3</sup> kg<sup>-1</sup> of solid material, which while computation gives an average of 1.428 kg methane per kg of jute fibre (International Jute Study Group, 2020). Methane can be used for household purpose also.

### **8 Biodegradability**

Jute products can be disposed with an environment friendly way as they are 100 percent biodegradable and recyclable.. For this, Jute can hold the priority over the synthetic fibre. Retting practice In Stem retting which is the traditional retting method the complete plant stem is immersed in sufficient water. Where as in Ribbon retting which is a particular method of retting based on a mechanical pre treatment of plant stalks which allowed reducing the requirement of water. The level of environmental pollution and the length of retting time is reduced to almost one-fourth in comparison to traditional method.

Problems of different jute retting processes  
Fiber quality

The inherent characteristics of Jute fibre's strength, versatility, and eco-friendly can directly provide technical and industrial requirements through its appropriate functional end uses. Jute fiber are of low quality when it is Dark color fiber and black spot is there. As there is no control on the natural retting process fiber quality might not be the same evrywhere. So getting assurance regarding good quality fiber through traditional method is not possible. Low quality of jute fiber is produced in the study area because of bad qualities of water like: dark black colored water, muddy water, and lower level or insufficient water. It is also found in some cases that fiber strength is decreased due to over retting or under retting as jutes are stacked by bundles of 20-30 plants in each bundle. Retting process time One of the important factors to produce quality fiber is the Stem-water ratio. All crops cannot be stacked at a time due to the shortage of water during retting period of jute. For this traditional process takes more time for retting. In study area, it is seen that farmers piled green jute for long time after harvesting and looked forward to availability of sufficient water. While Ribbon retting reduces time by 4-5 days from traditional retting and reduces requirement of water also.

Impact on environment  
There is decomposition of huge amount of biomass in stagnant water in traditional process, which causes pollution around environment. Different microorganisms like bacteria and fungi are grown at green jute in the water of pond/canal/river during the process of jute retting which becomes harmful for fish cultivation. Disgusting odor is felt which pollute the local environment in open water retting in pond/canal/river.

4 Impact on fish cultivation  
Commercial fish cultivation has achieved popularity in recent years in the study area, because farmers do not allow jute retting on their ponds or ditches. Bad stench to the fish body creates a great problem which reduces the price of the cultivated fish due to stem retting of jute in pond/ditch..

Uncontrolled process  
In traditional retting process in

***Agriculture Development towards Sustainability***

ponds/canals/rivers there is no control over volume of water, quality of water, and temperature. Coarse fibres are formed due to Under-retting and over-retting gives dazed and weak fibers. Croppy fibers of extremely low value are produced from Incomplete submergence.

**Conclusions**

The present study has provided information about the present status of jute retting process and different jute retting process problems. Farmers use muddy water and small canal with insufficient water for traditional retting of green jute due to the shortage of water in harvesting period,. In traditional jute retting process problems like environment pollution, fish cultivation, bad quality fiber, and time consuming etc. are seen. Therefore in the water scarcity area the traditional retting process of jute is not feasible. Ribbon retting with artificial polythene tank is needed which will be the appropriate technology. The application area of jute need to be enlarged, ie, jute should be used in new areas like agro-textile, geo-textile, technical textile as well as home textile to increase its production. Government rules on restriction of manufacturing and marketing of polythene products should be strictly maintained to increase jute production. Diversified Jute products should be developed and should be made familiar to people . The protection of environment is a vital issue in the world. For environment friendly features the demand of jute should be raised instead of synthetic fibres. All this factor will motivate to conduct this research for benefit to the country and the mankind as whole.

**References**

1. Alam, A. (1993) 'Jute Retting and Environment,' in Improved Retting and Extraction of Jute and Kenaf: Proceedings of Regional Workshop held at Research Institute for Tobacco and Fibre Crops, Malang, Indonesia, 1-6 February 1993. Rome: Food and Agriculture Organization of the United Nations; and Dhaka: International Jute Organization, pp. 362-371.
2. Alim, M. A & others (2002). Effect of Fresh Jute leaves on Soil and late Jute seed Production. Journal of Biological Science.2 (1):18-20.
3. Altieri, M.A. and Merrick, L.C. (1987) 'In Situ Conservation of Crop Genetic Resources through Maintenance of Traditional Farming Systems,' Economic Botany 41(1): 86-96.
4. Bos, H.L. (2004). The Potential of Flax Fibres as Reinforcement for Composite Materials, PhD Thesis, Technical University of Eindhoven, the Netherlands: available at [www.tue.nl/bib](http://www.tue.nl/bib).

**Significance of Legal Framework for Sustainable Agriculture in India**

**Arafatali Saiyed,<sup>1</sup> Akil ali Saiyed<sup>2</sup>**

<sup>1,2</sup>Faculty of Law, Gokul Global University, Siddhpur (Gujarat)

Corresponding Author- **Arafatali Saiyed**

**Email-** prof.saiyed@gmail.com

**DOI- 10.5281/zenodo.7509406**

---

**Abstract**

Out of three essentials of human life : Roti, Kapda aur Makaan, i.e. food, clothing and housing, first two are the produce of agriculture. Classically housing was also based on agriculture products. Conventional items meant for education, i.e. paper, pencil, rubber, etc. are agriculture products. Agriculture in India is one of the rapidly growing sector, generating handsome revenue over the last few years. There is considerable growth of investment in agriculture sector that has lead the growth of the sector. Structured and strategic endeavour by the Government of India has produced satisfactory results and increased the investment in agriculture sector. Various schemes such as National Mission for Sustainable Agriculture (NMSA), Pradhan Mantri Fasal Bima Yojana (PMFBY), and Pradhan Mantras Krishi Sinchai Yojana (PMKSY) introduced for the welfare of all stake holders of agriculture has made overall development of the sector. There have been significant awareness among farmers regarding all sorts of agriculture activities, be it weather condition, climatic impact, organic farming, irrigation as well as agriculture management. This paper aims to signify the importance of the law and policy that plays vital role in promotion and development of sustainable agriculture.

---

**Keywords:** Sustainable Agriculture, Legal Framework, Farmers' Law

---

**Introduction**

Agriculture is one of the oldest activity and profession in the world. Not only human being but all the creature on the earth survives through agriculture. Agricultural activities in India traces back in Indus civilization. In addition to the food, i.e. vital element of life, it also provides employment and ease of life. Agriculture is quite important sector in the economy of any country. Through the foreign exchange and spawning job opportunities, agriculture plays principal role in economic system. Over and above the food requirement, agriculture also yield raw material for many industries. There is huge potential in forestry, animal husbandry, fisheries, food as well as cash crops for the development of the country. However, this potential needs to properly channelize to get the desired growth and prosperity. Nashir Akinola defined agriculture as both a science and an art or rather a technology for the exploitation of the primary, secondary and tertiary products of photosynthesis. In addition to planting, and harvesting, agriculture also includes forestry, fisheries, animal husbandry, food and cash crop, supply chain, etc. The agriculture industry consist of companies and firms which are involved in cleaning, processing, packaging and storing every kinds of agriculture produces. These products are

classified as fibres, foods, raw materials, etc. Fish farming, cattle and animals, dairies, etc. are also included in agriculture industry. There is a considerable size of mechanical industries engaged in manufacturing of farm equipment.

**Sustainable Agriculture**

Various authors, legislations and policy papers have defined sustainable agriculture in their own way. Neil Hamilton (1993) has is defined as developing agricultural practices which protect the environment while preserving the economic profitability of farmers. The basis of the concept is that no agricultural system can be successful in either the short or long term unless it is designed to sustain the resources necessary for its operation. These resources include both physical resources, of soil, air, and water, and also human and social resources of farm families, rural communities, and the economic structure necessary for an agrarian system to function. Keeping the combined concern for an environment and economics of farming activities, the goal of sustainable agriculture along with profitability can be harnessed. The Leopold Center under Iowa Code defines sustainable agriculture as 'the appropriate use of crop and livestock systems and agricultural inputs supporting those

## ***Agriculture Development towards Sustainability***

activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land.' Agriculture activities and practice are carried out in the environment. It also maintains the eco-system and ecology of the place.

### **Need for Legal Regulation**

Agriculture law includes various legal provisions and regulations concerned to the production and selling of agriculture goods. It deals with legal matters related to seeds, water, irrigation, fertiliser, pesticides, packing, processing and transportation of agriculture materials. One of the fundamental prerequisites for the achievement of sustainable development is broad public participation in decision making of which farmers is one. Integrated agricultural development which involves consciously formulated, systematic and multi-sectoral programme to attain the integration of the people in the mainstream of income groups in a country is essential for national policy. Agricultural practice and development activities take place on the environment. The environment therefore represents a complex system of interconnections (Sands, 2003). The interconnections between the environment and agricultural practices cannot be treated as discrete (Goodie, 1993). This interconnection poses legal challenges as to how to develop and apply a comprehensive and effective set of legal requirements aimed at preventing environmental damage when engaged in agricultural practice. Agriculture-led development is fundamental to sustainable national development as it helps to reduce hunger, poverty, burden of food import as well as the generation of economic growth and the opening of new way to an expansion of exports. The agricultural sector can be likened to the chicken that lays the egg for the development of any nation, the neglect of which is capable of rendering life to be meaningless. (Erhun, 2019). Uncontrolled expansion of agriculture poses threat on forests and wetlands. Application of pesticides causes damage to fauna and flora as well as soil erosion. Chemical insecticides and artificial spray pollute the air and environment. Air pollution also occurs due to conventional practice of burning natural vegetation and husks.

### **Need for Promotional Policy**

Every country planning to achieve goals of sustainable development in various sector has to first focus on the sustainable agriculture. Sustainability begin from the ground and agriculture being activity of ground is the most important to realise sustainable development in any other sector. Sustainable agriculture integrates sustainability of environment as well as social need of the nation. The legal policy about agriculture-infrastructure, agri-finance, agri-insurance, etc. affects directly farmers in the every nook and corner of the country. Farmers and farming also depends upon the various rights of farmers as individual and professional laid down in constitution as well as statues passed by legislature. Every state has separate land laws governing the affairs of the land acquisition, maintenance, fragmentation and transfer. Well-designed policy and proper legal provisions are instrumental in promotion and development of sustainable agriculture system for any country.

### **Legal Framework and Policy in India**

As per the Constitution of India, Agriculture is the subject matter of the state. The state governments are primarily responsible for the growth and development of agriculture sector as well as designing perspective plans for their respective states. State is also responsible to ensure effective implementation of the programmes/schemes. Nevertheless, central government also supplements the efforts and actions of the state governments through various schemes as well as programmes. Some of the scheme are Pradhan Mantri Fasal Bima Yojana, National Bee and Honey Mission, FPOs Scheme, Pradhan Mantri Krishi Sinchai Yojana, etc. The center also provide share in budget, institutional credits, Agri Infrastructure Fund, Agri Infrastructure Fund, etc. Central government also has control on fixing MSP (Minimum Support Price), procurement from farmers, soil health card as well as Neem coating on Urea.

Government has taken several steps for increasing investment in agriculture sector such as promotion of scientific warehousing infrastructure for increasing shelf life of agricultural produce; setting up of Agri-tech Infrastructure Fund for making farming



## ***Agriculture Development towards Sustainability***

competitive and profitable; developing commercial organic farming, enhanced institutional credit to farmers etc. Government is implementing various schemes for supply of farm inputs, like seeds, fertilizers, agricultural machinery and equipment, irrigation facilities, institutional credit, etc., at subsidized rates to the farmers in the country. Government has recently taken several steps for increasing investment and growth in agriculture sector which include creation of Long Term Irrigation Fund (LTIF), Micro Irrigation Fund for water use efficiency, promotion of commercial organic farming, etc.

Government of India has launched the Central Sector Scheme of financing facility under Agriculture Infrastructure Fund (AIF) to boost Agriculture Infrastructure relating to post harvest management and community farming assets. Under this scheme entities such as farmers, agri entrepreneurs, startups, Central/ State agency or local body sponsored public private partnership projects etc. can take benefit for setting up eligible infrastructure projects. Under Rashtriya Krishi Vikas Yojana (RKVY) Scheme of Ministry of Agriculture, grants-in-aid is given to state governments on the basis of the projects approved in State Level Sanctioning Committee Meeting (SLSC). States can take up projects for the development of Agriculture and allied sector in Public Private Partnership (PPP) for Integrated Agriculture Component.

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme is being implemented with a view to provide income support to all landholding farmer families across the country, to enable them to take care of expenses related to agriculture and allied activities as well as domestic needs. Further, Government of India has launched the Aatmanirbhar Bharat Abhiyan (ABA) to strengthen Infrastructure, Logistics, Capacity Building, Governance and Administrative Reforms for Agriculture.

### **Conclusion**

Apart from the legal framework and policies, the foremost driver of sustainability is education and research. Every policy and legal provision remain on paper only unless they are properly implemented and executed which requires awareness of the

same among the stakeholders. Farmers shall not change their practice of farming to protect the environment unless they have information and knowledge regarding the new techniques and practices that yield better. Sustainable agriculture does not deal merely with soil, crop, water or price but also concern farmers, their families and rural communities.

Sustainable agriculture promotes the coherent, practicable, rational and comprehensive use of the environment in such a manner that it remain live-able for next generations also. Sustainable farming requires conservation of resources, social support and economic viability as well as safe for an environment. Therefore, there has to be strict compliance of the legal provisions and regulation. Through the legal sanctions and directives, farming can be practised for increased produced, economically profitable, socially equitable without damaging the environment.

### **References**

1. Neil D. Hamilton, Feeding Our Future: Six Philosophical Issues Shaping Agricultural Law, 72 Neb. L. Rev. 210, 239 (1993).
2. Iowa Code § 266.39(1) (1997)
3. Neil D. Hamilton, The Role of Law in Promoting Sustainable Agriculture : Reflections on Ten years of Experience in the United States, Drake Journal of Agricultural Law, Vol. 3, (1998) pp. 423-431.
4. Erhun O. Mercy, A Legal Framework for Sustainable Agricultural Practice in Nigeria, Vo. 15, No. 10 (2019) pp. 19-32.
5. Akinola, B. A. Sustainable food security and its rural developmental challenges in Nigeria. Boser Publishers Nig. Ltd. (2015).
6. Ajala, O. Evolution of agricultural policies and laws in Nigeria. In R. T. Ako & D. S. Olawuyi (Eds.), Food and agricultural law: Readings on sustainable agriculture and the law in Nigeria. Ado-Ekiti: Afe Babalola University Press. (2015).
7. Goodie, A. The nature of the environment (3rd edn.) (1993).

***Agriculture Development towards Sustainability***

***ISBN: 978-93-94819-16-0***

***Pub. Date: 30 Nov. 2022***

***Volume: I***

8. Sands, P. Principles of international  
environmental law. Cambridge,  
(2003)

United Kingdom: Cambridge  
9. University Press

**Sustainable Agricultural Growth in India -Issues and Challenges**

**Dr Beenu Singh**

Assistant Professor Economics, Email-beenuasingh@hotmail.com

B.M.Ruia Girls' College Gamdevi Mumbai 400007

Corresponding Author- **Dr Beenu Singh**

Email- [beenuasingh@hotmail.com](mailto:beenuasingh@hotmail.com)

DOI- 10.5281/zenodo.7509423

---

**Introduction-**

What are the measures for sustainable agricultural growth in India. Sustainability is a practice that is free from all the ill effects of past and present agricultural systems. Sustainable agriculture involves the use of most preferable energy sources like hydropower, wind farms or solar power which are eco-friendly. You can use the solar panels for heating systems and also for run pumping. In addition, hydroelectric power derived from river water can be used for various agricultural machinery. Sustainable agriculture practitioners seek to integrate three main goals into their work: a healthy environment, economic profitability, and social and economic equity. Food processors, distributors, producers, retailers, consumers and waste managers can play a role in ensuring a sustainable agricultural system. In addition, it is helpful in reducing greenhouse gas emission and conserving energy. Sustainable Agriculture is farming in a way that allows for more effective use of natural resources, reduces the environmental impact of agriculture, and increases capacity for climate change and climatic variability adaptation without endangering the ability of present or future generations to meet their own needs. Understanding ecological services may serve as the foundation of sustainable agriculture.

**Objective-**

what is sustainable agriculture

What are sustainable agricultural methods

What are the benefits of sustainable agricultural methods

what are the issues regarding sustainable agricultural growth

- Sustainable agriculture is the practise of producing enough food to meet current needs without jeopardising future generations' ability to meet their own needs, such as by depleting soil fertility or irreversibly harming the environment.
- It combines three major objectives: environmental health, economic profitability, and social equity.
- It is regarded as a method of farming that uses manure, rotates the crops, uses little tillage, and relies as little as possible on artificial fertilizers, pesticides, and antibiotics.
- It is a well-balanced system of managing renewable resources, such as soil, wildlife, forests, crops, fish, livestock, plant genetic resources, and ecosystems, without compromising their productivity or ability to provide ecosystem services or food for present and future generations.
- Sustainable agriculture must stop soil erosion and land degradation. It must use biological and cultural techniques to

replace nutrients and manage weeds, pests, and illnesses.

- The biggest problem endangering agriculture's sustainable development is the degradation of natural resources.

**Definitions-**

Sustainable

Agriculture is farming in sustainable ways meeting society's present food and textile needs, without compromising the ability for current or future generations to meet their needs.

It can be based on an understanding of ecosystem services. There are many methods to increase the sustainability of agriculture. When developing agriculture within sustainable food services, it is important to develop flexible business process and farming practices.

Agriculture has an enormous environmental footprint, playing a significant role in causing climate change, are responsible for one third of the anthropogenic GHG emission, water scarcity, water pollution, land degression, deforestation and other processes, it is simultaneously causing environmental changes and being impacted by these changes. Sustainable agriculture consists of environment friendly methods of farming that allow the production of crops or livestock without damage to human or

## ***Agriculture Development towards Sustainability***

natural systems. It involves preventing adverse effects to soil, water, biodiversity, surrounding or downstream resources—as well as to those working or living on the farm or in neighbouring areas. Elements of sustainable agriculture can include permaculture, agroforestry, mixed farming, multiple cropping, and crop rotation.

**Sustainable agriculture methods-** There are many promising practices in Sustainable Agriculture-

1. Crop rotation
2. Permacultures
3. Cover Crops
4. Soil Enrichment
5. Natural Pest Predators
6. Bio intensive Integrated pest Management
7. Polyculture Farming
8. Agroforestry
9. Biodynamic Farming
10. Better water management
11. Floating Farming
12. Contour Farming
13. Conservation Agriculture
14. Precision Farming
15. System of rice intensification
16. Organic Farming
17. Crop rotation and intercropping
18. Rain water harvesting and artificial Recharge of Ground water

### **1. Crop Rotation**

Crop rotation is the most preferable technique of sustainable agriculture. However, its purpose is to avoid the consequences of planting the same crop in the same soil for consecutive years. This helps to combat pest problems, as many pests prefer specific crops. In addition, rotation breaks the insect's reproductive cycle. During rotation, farmers can plant certain crops that supplement the plant's nutrients. Rotation breaks the reproduction cycles of pests. During rotation, farmers can plant certain crops, which replenish plant nutrients. However, these sustainable crops minimise the need for chemical fertilisers.

### **2. Permaculture**

Permaculture is a food production system designed for smart farming to reduce waste of resources and increase production efficiency. Also, these design techniques consist of growing grain without tillage, herb

and plant spirals, keyhole and mandala gardens, hooglyculture garden beds, sheet mulching, each plant serving multiple purposes.

### **3. Cover Crops**

Many farmers choose to plant crops in one field at all times and never leave it barren; also, this may cause unintended consequences. The farmer can achieve his goals of preventing soil erosion, enhancing soil quality and also suppressing the growth of weeds through plant cover crops like clover or oats. The cover crop's use also reduces the need for chemicals like fertilisers.

### **4. Soil Enrichment**

Soil is a central component of the agricultural ecosystem. Good soil can help increase yields as well as produce stronger crops. It is possible to maintain and also helpful in enhance soil quality in several ways. Some examples include the release of crop residues into the field after harvest and also include the use of composted plant material or animal manure.

### **5. Natural Pest Predators**

To maintain effective control of pests, it is a core factor to view the farm as an ecosystem instead of a factory. For example, many animals and birds are natural predators of agricultural pests. Therefore, manage your farm so that it can harbour populations of these insect predators. However, chemical insecticides can lead to the indiscriminate killing of insect predators.

### **6. Bio intensive Integrated Pest Management**

Integrated Pest Management is an approach dependent on biological instead of chemical methods. The IMP also stresses on the importance of crop rotation to tackle pest management. Once the pest problem is identified, IPM will ensure that chemical solutions are used only as a last resort.

### **7. Polyculture Farming**

Polyculture farming technique is similar to crop rotation which tries to follow natural principles to get the best yield. Therefore, it engages in growing multiple crop species in one region. Also, these species generally complement each other and help bring out a greater variety of products on the same plot while fully utilising the available resources. The high biodiversity makes the polyculture

sustainable farming system more flexible to seasonal fluctuations..

#### **8. Agroforestry**

Agroforestry has become a strong tool for farmers in arid regions with soils prone to desertification. Also, it engaged in the growth of trees and shrubs among crops or grazing land and agriculture. And it is forestry practices for long-lasting, productive and diverse land uses when approached sustainably.

#### **9. Biodynamic Farming**

Biodynamic farming incorporates holistic and ecological growing practices based on the “anthropology” philosophy. In addition, it focuses on implementing practices like composting application of animal manure, supplementary crops or rotating cover crops. Also, these practices generate the soil fertility necessary for food production.

#### **10. Better Water Management**

The foremost step in water management is the choosing of the right crops and also local crops are selected which are suited to the weather conditions of the area. In addition, crops that do not require a lot of water should be selected for dry areas.

**11. Floating Farming-** Floating agriculture is a way of utilizing areas which are waterlogged for long periods of time in the production of food .The technology is mainly aimed at adopting to more regular or prolonged flooding.The approach employs beds of rotting vegetation ,which act as compost for crop growth.

**12. Contour Farming-**Contour farming is the practice of tilling ,planting ,and other farming operations performed on or near the contour of the field slope. This method is most effective on slopes between two and ten percent .Tillage and planting operations follow the contour line to promote positive row drainage and reduce ponding.

**13. Conservation Agriculture-**Conservation agriculture is a farming system that can prevent losses of arable land while regenerating degraded lands. It promotes maintenance of a permanent soil cover ,minimum soil disturbance and diversification of plant species.

**14. Precision Farming-** Precision agriculture is the science of improving crop yields and assisting management decisions using high technology sensor and analysis

tools. Precision farming is a new concept adopted thought the world to increase production ,reduce labour time and insure the effective management of fertilizers and irrigation processes .

**15. System of rice intensification-**The system of rice intensification is the farming methodology aimed at increasing the yield of rice produced in farming. It is a low -water, labour intensive method that uses younger seedlings singly spaced and typically hand weeded with special tools.

**16. Organic Farming** – Organic farming is an agricultural system that uses fertilizers of organic origin such as compost ,manure ,green manure and bone meal and places emphasis on techniques such as crop rotation and companion planting .Biological pest control ,mixed cropping and the fostering of insect predators are encouraged.

**18. Rain water harvesting and artificial Recharge of Ground water-** Rain water harvesting is the simple process or technology used to conserve rainwater by collecting storing, conveying and purifying of rain water that runs off from rooftops ,parks, open grounds ,etc. For later use .The process of rain water harvesting involves the collection and the storage of rainwater with the help of artificially designed systems that run off naturally or man-made catchment areas like the rooftop ,compounds ,rock surface ,hill slopes, artificially repaired impervious or semi -pervious land surface.

#### **Benefits of Sustainable Agriculture**

- **Environmental Protection:** Sustainable agriculture places a strong emphasis on techniques and procedures that raise soil productivity while reducing negative effects on the environment, including the air, water, biodiversity, and climate.
- **Saving Energy:** It emphasizes minimizing the usage of petroleum-based products and other inputs and substituting them with those derived from renewable resources.
- **Food Security:** It aims to ensure that the basic dietary needs of the present and future generations are satisfied, both in terms of quantity and quality.
- **Economic Profitability:** It not only provides a sustainable rise in agricultural output, but also lessens the sector's



## Agriculture Development towards Sustainability

susceptibility to perilous social and economic elements, such as sharp price swings, and other risks.

- **Economic and Social Equity:** It aims to provide those working in the agriculture value chain with stable employment, a living wage, and respectable living and working conditions.
- **public health protection:** Sustainable agriculture promotes public health protection, as it promotes less use of chemicals. Natural farming promotes organic farming which helps to protect public health of common man.
- **prevents pollution-** It aims to prevent pollution as real time monitoring on air parameters and air distribution systems to enhance air quality.
- **Stop air pollution-** Sustainable farming discourages the use of machinery, WHO (2002) estimates that 1.6 million people die each year globally, so it's very important for agricultural sector to adopt sustainable agricultural policies.
- **Stop soil erosion-** By eliminating tillage managing irrigation systems to reduce runoff, and planting more plants or mulch, it stops soil erosion.
- **Cost Reduction-** Instead of using pesticides and other harsh chemicals and synthetic fertilizers manure and organic waste can be turned in to fertilizers, it reduces cost of farming.
- **Biodiversity-** Applying earth-friendly and sustainable farming practices like crop rotation helps enrich the soil and prevents disease and pest outbreaks.
- **economically beneficial for farmers –** It is cost effective farming solution. Hydroponics system allows farmers to maximise garden space and stack the so farmer can grow more and plant all around.

With small farming and sustainable agricultural it develops social equality, Improves food production, improve environmental health, high production benefits and low-cost production, optimized resources uses and conservation and reduce environmental damage.

### Sustainable Agriculture - Principles

- **Environmental Sustainability:** Sustainable environmental practices include safeguarding, recycling, replacing, and sustaining the natural resource base, which includes the land (soil), water, and animals.
- **Economic Sustainability:** Economic sustainability is achieved through enhancing crop rotation and soil management, which increases yields.
- **Social Sustainability:** Maintaining social justice and cultural unity is essential for achieving social sustainability.

### Sustainable Agriculture - Different Methods

- **Crop Rotation:** Crop rotation is the methodical planting of various crops in the same growing space over a period of years, in a specific order. It contributes to the preservation of soil nutrients, the reduction of soil erosion, and the prevention of pests and diseases in plants.
- **Planting Cover Crops:** Cover crops are planted in bare soils that could otherwise remain there throughout the lean seasons. By preventing erosion, restoring soil nutrients, and controlling weeds, these crops safeguard and improve soil health, lowering the demand for pesticides.
- **Biointensive Integrated Pest Management (IPM):** It focuses on the use of crop rotation to prevent pest issues, the reintroduction of disease-fighting, naturally occurring microorganisms into plants and soil, and the discharge of beneficial organisms that feed on pests. There is no use of chemical pesticides.
- **Agroforestry:** It entails the development of trees and shrubs alongside agricultural or grazing land. For long-lasting, fruitful, and varied land use, agroforestry systems can mix both agricultural and forestry techniques.
- **Permaculture:** The term "permaculture" refers to a planned system of farming and habitation that tries to emulate the interdependencies and sustainability of natural ecosystems. The goal of permaculture is to maximize the use of

## Agriculture Development towards Sustainability

land so that it can be used productively for food production or personal subsistence by future generations.

- **Organic Farming:** Organic farming is a farming method that focuses on cultivating the land and raising crops in a natural manner. It aims to keep the soil alive and healthy by using organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials, as well as beneficial microbes (biofertilizers), to release nutrients to crops for increased sustainable production in an environmentally friendly, pollution-free environment.
  - **LEISA (Low External Input Sustainable Agriculture):** Low-synthetic insecticides and fertilizers are used. By placing more focus on cultural practices, IPM, and the use of agricultural resources and management, yields are maintained.
  - **Zero Budget Natural farming:** Natural farming on a "Zero Budget" means that no credit is used and that no money is spent on input purchases. Natural farming entails using only natural methods and no chemicals.
  - **Biodynamic agriculture:** In biodynamic farming, the farm is viewed as a living system. The integration of animals to form a closed nutrient cycle, the impact of agricultural planting dates in relation to the calendar, and awareness of spiritual forces in nature are all highly valued components of the system.
  - **Conservation Agriculture:** Permanent organic mulch cover, a longer crop rotation, and a significant reduction in tillage are all components of this agricultural technique.
- Sustainable Agriculture - Challenges**
- **Organic Farming and Food Security:** As the world's population continues to expand, there is growing concern about our ability to support the current level of population. Switching to organic farming often results in a substantial decline in yields when compared to intensive farming. As a result, organic farming will need to be integrated with other sustainable

production techniques in order to feed the globe in its current state.

- **Feasibility of Conservation Agriculture for Soil Management:** Since conservation agriculture does not include ploughing, it calls for modifications to weed control practices, the use of herbicides, and specialized equipment for sowing. The adoption of conservation agriculture by smallholders in developing nations is difficult. As a result, this practice has been mostly centered in North America, Europe, and Australia.
- **Issues with Small Land Holdings:** A lot of academics and environmentalists argue that cultivation based on small holdings is more environmentally friendly and sustainable than intensive, industry-based production models. However, smallholders can also harm the soil and the ecosystem due to a lack of knowledge and access to contemporary sustainable farming methods. These practices are not only typical of industrial or intense large agricultural operations.
- **Debate on High Yield Variety (HYV) Seeds Usage:** High-yielding hybrid seeds are recognized to be risky for both human and environmental health, as well as being unsustainable economically for farmers. However, given the growing worry about food security, these seeds are vital to boost output.
- **Use of Chemical Pesticides:** It might not be possible to totally abandon chemical pesticides given the rising frequency of insect infestations and resulting crop loss. Less toxic substances should be utilized instead of excessive amounts of chemical pesticides.
- **Rising Population and Degraded Ecosystems:** Growing populations and damaged ecosystems have made intensive, conventional farming (using HYV seeds and chemical fertilizers) and deforestation more resilient.
- **Lack of Capital:** Large portions of the agricultural community (small and medium farmers) lack the funds necessary to make the switch to sustainable agricultural production.
- **Lack of Access to Information & Technology:** There is a lack of access to

## *Agriculture Development towards Sustainability*

information and technology to enhance agriculture practices, processing, and marketing of agricultural products.

- **Lack of Economic Incentives:** Farmers are uncertain of the benefits of switching to sustainable farming due to a lack of economic incentives.
- **Lack of Public Policy & Infrastructure:** Public policies and fundamental infrastructure are insufficient to encourage the use of sustainable agriculture methods.
- **Drop in yields in initial years:** As farmers shift from “conventional” farming that involves use of synthetic chemical nutrients and plant protection measures to sustainable agricultural practices, which depend on natural inputs, crop yields tend to drop in the initial years. New practices are emerging to ensure multi-season and diversified cropping, which would reduce the economic impacts of a yield drop. However, these are still in the nascent stage.
- **Increased drudgery :** Sustainable practices increase the workload of farmers considerably. There is increased drudgery in collecting materials for preparing natural nutrients and natural plant protection materials. Sustainable farming may increase the workload on women and older workforce. Agriculture is already rapidly relying on women and older labourers. Thus, the burden of drudgery falls heavily on them when households adopt sustainable practices. Currently there are no systems in place for collective manufacturing of these materials. And it's a moot point if the efforts to promote more sustainable practices which are more labour-intensive lead an already-reluctant young man to enthusiastically take up farming.
- **Availability and access to necessary materials :** Natural nutrients and plant protection materials require animal waste, cow urine, leaves of certain plants and trees and other “waste” vegetative matter. Increasing mechanisation has resulted in smaller animal herds in villages, leading to scarcity of animal waste. Such is this scarcity, that cow urine markets are emerging in many

regions. In vast tracts of dry land in the country, vegetation is scarce. So the availability of leaves or other plant protection materials is a problem. Even vegetation for mulching is becoming hard to find. Increasing dairy production means that farmers use every possible piece of crop residue tends as dry fodder. Only the regions with extreme crop intensity experience the problem of surplus crop residue. And, for reasons explained later, farmers in these regions are the least likely to shift to sustainable practices .

- **Overall food sufficiency :** For decades, the national priority to achieve food security has driven the agriculture policy. However, we realised this goal at the cost of extremely unsustainable farming practices in the granaries of Punjab, Haryana, Western UP and North Rajasthan. If there's a large-scale shift to sustainable farming, or even a shift away from their paddy-wheat-paddy crop cycles, the current food surplus could evaporate in a few years. The essential foodgrain requirement has reduced over the years. This is mainly due to the reduction in manual labour from mechanisation, easier modes of transportation and other such conditions.
- **Political economy :** Even if the contours of this balancing act were understood and converted into actionable policies, the daunting compulsions of the political economy of very perverse policies that currently haunt Indian agriculture would need to be understood. While groundwater needs to be conserved and recharged, unchecked subsidies on farm electricity lead to extremely irresponsible water-drawl from aquifers. Subsidies on chemical fertilisers are both very expensive to the economy and deleterious to the goal of sustainable agriculture. Yet there is no way any government can actually reduce them. Efforts so far have been only to check misdirection of these subsidies. Most sensible economists will agree that the best way to help farm households is through direct income transfer schemes. Neither minimum support price on crops or waiver of loans

## ***Agriculture Development towards Sustainability***

or subsidies on inputs make economic sense.

### **Sustainable Agriculture in India-Government Initiatives**

- **National Mission on Sustainable Agriculture:** One of the eight objectives listed in the National Action Plan on Climate Change (NAPCC) is the National Mission on Sustainable Agriculture. Its goal is to increase agricultural productivity, particularly in rainfed regions, by emphasizing integrated farming, managing soil health, and coordinating resource conservation.
  - **Paramparagat Krishi Vikas Yojana (PKVY):** The PKVY program intends to encourage commercial organic production by involving a group of farmers certified in organic farming (cluster farming).
  - **Network Project on Organic Farming of ICAR:** The Network Project on Organic Farming of the ICAR aims to compare the performance of significant agricultural systems that are peculiar to a given place under organic and conventional farming and evaluates the agronomic effectiveness of various production methods.
- Other Initiatives
- **Sustainable Sugarcane Initiative (SSI):** The Sustainable Sugarcane Initiative is a strategy for increasing sugarcane yields by using fewer seeds, less water, and the best possible use of fertilizers and land.
  - **System of Rice Intensification (SRI):** This agro ecological methodology alters how plants, soil, water, and nutrients are managed to increase the yield of irrigated rice. It is a time-consuming, low-water approach that uses younger seedlings spread apart. In the Indian Cauvery delta region, a variation of SRI known as the Kadiramangalam System of Rice Intensification is used.

### **Strategies for Making Agriculture More Sustainable**

- **Appropriate production systems:** A shift in agricultural policy to match the agro-ecological resources is critical for sustainability. For example, in arid and semi-arid areas, promote dry land agriculture rather than input-intensive farming, and promote less water-

intensive crops such as pulses and millets. Similarly, crops that require a large amount of water, such as rice, can be relocated to other regions that are relatively more water-rich.

- **Polycultures and Crop Rotation:** Shifting farmers from monocultures to polycultures and crop rotation can reduce the need for fertilisers and pesticides. Such diverse systems are likely to be more productive, labour intensive, and provide enhanced ecosystem services, making them much more sustainable.
- **Emphasis on nurturing the soil:** Greater emphasis on soil nurturing rather than plants will provide greater benefits in terms of sustaining yields, improving ecosystem health, and carbon sequestration.
- **Promotion of Zero Budget Natural Farming:** Initiatives such as Zero Budget Natural Farming, with low external input and production costs, could help restore ecosystem health and diversify smallholder farmers' livelihoods.
- **Reducing food waste and promoting sustainable consumption patterns:** To reduce food waste, more investments are needed in post-production infrastructure, such as storage space in rural areas, as well as improved harvesting techniques and transportation.
- **National Mission on Sustainable Agriculture (NMSA):** In 2021, the Government announced that the National Mission on Sustainable Agriculture (NMSA) will make agriculture more productive, sustainable and lucrative. The National Mission on Sustainable Agriculture (NMSA) has a vision, "NMSA will cater to key dimensions of 'Water use efficiency', 'Nutrient Management' and 'Livelihood diversification' through adoption of sustainable development pathway by progressively shifting to environment-friendly technologies, adoption of energy efficient equipment, conservation of natural resources, integrated farming, etc." NMSA's vision also states, "NMSA aims at promoting location specific improved agronomic practices through soil health management, enhanced water



use efficiency, judicious use of chemicals, crop diversification, progressive adoption of crop-livestock farming systems and integrated approaches like crop-sericulture, agro-forestry, fish farming, etc.”

**Case Study-**

Within a year of using natural agricultural methods, villagers noticed a number of positive impacts. Previously reported health issues vanished. Farms practicing non-pesticide management boasted higher profits and fewer expenses. Sourcing, grinding and mixing natural repellents like neem seeds and chili peppers also created more jobs in the village. As farmers cultivated more land, technology like backpack sprayers helped them tend to crops more efficiently. Residents reported an overall improvement in their quality of life, from health to happiness to finances. As word spread, more and more farmers decided to shun chemicals. In 2004, Punukula became one of the first villages in India to declare itself completely pesticide-free. The village council even went so far as to request that pesticide salesmen stop soliciting. Soon, other towns and villages in Andhra Pradesh started practicing natural farming.

In the Krishna District of the state, Narala Rajashekhar Reddy became an organic farmer two years ago after observing his fellow villagers' health problems, which he attributed to chemical pesticides. Rajashekhar supports his household of eight financially by selling items from a makeshift shop in his home. He studied organic farming techniques from morning agricultural television shows and YouTube videos. Currently, only two crops (chili and cotton) grow in his village, but his goal is to start growing vegetables.

Even so, not all of his fellow villagers have taken up organic farming. “Since organic farming requires more attention, time and work, villagers find it difficult to keep up and opt for pesticides,” he explained. In 2012, the state government ran a local training program on zero

budget natural farming techniques. For the last seven years, Veerabharao has run a fully organic farm, growing sugarcane, turmeric and chili.

“Organic farming has a market. I get to decide the price of my products, unlike in chemical farming where the price is decided by the buyer,” Veerabharao explained.

It took three years for K. Narasimha Rao to start seeing comfortable profits from his organic farm, but now he is able to fix his price and sell directly to customers instead of relying on the markets. His belief in his organic mission kept him going through that initial difficult period. Narasimha's organic farm is now 90 acres. He grows gourds, coriander, beans, pulses, turmeric, eggplants, papayas, cucumbers, chili peppers and a variety of vegetables. He divides his land in half and grows marigold and castor as trap crops alongside his produce. In collaboration with the Food and Land Use Coalition (FOLU), CEEW (council for energy, environment and water), has given an overview of the current state of sustainable agriculture practices and systems (SAPSs) in India. India is aiming to scale-up SAPs, through policymakers, administrators, philanthropists, and other which represent a vital alternative to conventional, input-intensive agriculture. In idea these efforts identify 16 SAPSs – including agroforestry, crop rotation, rainwater harvesting, organic farming and natural farming – using agroecology as an investigative lens. In a conclusive understanding it is realised that sustainable agriculture is far from mainstream in India. Further proposals for several measures for promoting SAPSs, including restructured government support and rigorous evidence generation for benefits and implementation of sustainable farming are ongoing progress in Indian Agriculture. An example of initiatives in India towards exploring the world of sustainable farming has been set by the Sowgood Foundation. (WIKIPEDIA, 2022) It started by teaching primary school children about sustainable farming



**Agriculture Development towards Sustainability**

by helping them farm on small farm strips in suburban farmhouses and gardens. Today many government and private schools in Delhi, India have adopted the sowgood foundation curriculum for sustainable farming for their students. It is small hope to encourage sustainable farming, we have to go back our roots like zero waste, digging more ponds in villages, promotion of village industries will make possible sustainable growth of economy.

**Conclusion**

Sustainable agriculture must incorporate social, economic, and environmental sustainability, which is essential. With a growing population, depleting resources, and the growing threat of climate change, it will be impossible to meet future needs unless we transition to sustainable food and agricultural systems that ensure global food security, provide economic and social opportunities, and protect the ecosystem services on which our future depends.

**Bibliography**

1. <https://www.nationalgeographic.com/environment/article/partner-content-getting-back-to-nature>
2. <https://prepp.in/news/e-492-sustainable-agriculture-agriculture-notes>
3. <https://smallholdervoices.acetforafrica.org/case-study/making-agricultural-research-work-for-small-farmers-and-agroecological-approaches-in-west-africa/?gclid=CjwKCAiAs8acBhA1EiwAgRFdw1ZMNL3mEwfCthKqBgJyxPccX>
4. "What is sustainable agriculture | Agricultural Sustainability Institute". [asi.ucdavis.edu](http://asi.ucdavis.edu). 11 December 2018. Retrieved 2019-01-20.
5. "Introduction to Sustainable Agriculture". Ontario Ministry of Agriculture, Food and Rural Affairs. 2016. Retrieved 10 October 2019.
6. "FAO – News Article: Food systems account for more than one third of global greenhouse gas emissions". [www.fao.org](http://www.fao.org). Retrieved 22 April 2021.
7. Crippa, M.; Solazzo, E.; Guizzardi, D.; Monforti-Ferrario, F.; Tubiello, F. N.; Leip, A. (March 2021). "Food systems are responsible for a third of global anthropogenic GHG emissions". *Nature Food*. **2** (3): 198–209. doi:10.1038/s43016-021-00225-9. ISSN 2662-1355.
8. Brown, L. R. (2012). *World on the Edge*. Earth Policy Institute. Norton. ISBN 978-1-136-54075-2. [page needed]
9. Jump up to:<sup>a</sup> <sup>b</sup> Rockström, Johan; Williams, John; Daily, Gretchen; Noble, Andrew; Matthews, Nathaniel; Gordon, Line; Wetterstrand, Hanna; DeClerck, Fabrice; Shah, Mihir (2016-05-13). "Sustainable intensification of agriculture for human prosperity and global sustainability". *Ambio*. **46** (1): 4–17. doi:10.1007/s13280-016-0793-6. PMC 5226894. PMID 27405653.
10. Ben Falk, *The resilient farm and homestead: An innovative permaculture and whole systems design approach*. Chelsea Green, 2013. pp. 61–78.
11. "Sustainable Agriculture in India 2021". CEEW. 2021-04-16. Retrieved 2022-06-09.
12. "Delhi-based SowGood Foundation fosters a green thumb". *The New Indian Express*. Retrieved 2022-06-09.

**“जागतिकीकरणाचा भारताच्या शाश्वत शेती विकासावर प्रतिकूल परिणाम - एक भौगोलिक अभ्यास”**

**प्रा. डॉ. गायकवाड सुभाष माणिकराव**

सहाय्यक प्राध्यापक, मा. ह. महाडीक कला व वाणिज्य

महाविद्यालय, मोडनिंब ता. माढा जि. सोलापूर

Corresponding Author- प्रा. डॉ. गायकवाड सुभाष माणिकराव

Email- subhash25gaikwad@gmail.com

DOI-10.5281/zenodo.7509462

**सारांश:-**

भारत हा कृषिप्रधान देश आहे. भारताला शेतीचे फार प्राचीन परंपरा आहे. भारताला स्वातंत्र्य मिळाल्यानंतर इस 1960 च्या दशकात शेती संशोधन विकास तंत्रज्ञानाच्या प्रगतीमुळे (हरितक्रांती मुळे) भारतात शेतीचे उत्पादन सुमारे 70 टक्के वाढले. पण 1980 च्या दशकात हरितक्रांतीमुळे वाढलेली शेतीची उत्पादकता व प्रगती कमी होऊ लागली त्यामुळे भारत दुसऱ्या हरितक्रांतीच्या मार्गावर होता. याच कालावधीत जगात जागतिकीकरणाचे वारे वाहू लागले होते. परिणामतः भारताने 1991 मध्ये गेट करारावर स्वाक्षरी करून जागतिकीकरणाचा स्वीकार केला 1 जानेवारी 2016 मध्ये युनो अर्थात युनायटेड नेशन ऑर्गनायझेशन ने शाश्वत विकासाचे ध्येय 2030 पर्यंत आत्मसात करण्याचा अजेंडा ठरविला होता. शाश्वत विकासाचे ध्येय स्वीकारताना शेतीचा विकास कसा साधता येईल आणि जागतिकीकरणाचा त्याच्यावर काय परिणाम होणार आहे याचा आढावा घेत असताना असे जाणवले की, जागतिकीकरणाचा शेतीच्या शाश्वत विकासावर प्रतिकूल आणि अनुकूल परिणाम होत आहे. विकसनशील देशाच्या दृष्टीने प्रतिकूल परिणाम होणे शाश्वत शेतीच्या विकासाला खीळ घालणारे आहे.

**प्रस्तावना:**

भारत हा कृषिप्रधान देश असल्याने राष्ट्राची अर्थव्यवस्था विविध सेवा व उद्योगधंदे, (कृषीवर आधारित) रोजगार, विदेशी व्यापार, भारतीयांच्या उत्पन्नाचे साधन शेतीचा आहे. त्यामुळे भारतीय अर्थव्यवस्थेला कृषीप्रधान अर्थव्यवस्था म्हणतात. शेतीचे महत्व विचारात घेता नियोजनकारांनी द्वितीय पंचवार्षिक योजनेनंतर शेतीच्या विकासासाठी 1960 ते 1965 या काळात जास्तीत जास्त प्रमाणात उत्पन्न देणा-या संकरित बी- बियाणांचा विकास, सिंचन पद्धतींचा विस्तार व्यवस्थापनाचे आधुनिकीकरण, रासायनिक खतांचे व कीटकनाशकांचे वितरण इत्यादीच्या सुधारणांमुळे म्हणजेच हरितक्रांतीमुळे भारतातील शेतीचा विकास दर चार ते आठ टक्क्यांनी वाढला शेतीची उत्पादकता 70 टक्क्यांनी वाढली शिवाय उत्पन्नातही मोठ्या प्रमाणात वाढ झाली. यालाच भारताची हरित क्रांती म्हणतात.. हरितक्रांतीमुळे भारत अन्नधान्याच्या बाबतीत स्वयंपूर्ण झाला परंतु हरितक्रांतीचा प्रभाव 1980 च्या दशकात कमी झाला. परिणामी शेतीचा विकासदर 1.5% ते 2.3% राहिला. त्यामुळे भारताला दुसऱ्या हरितक्रांतीची गरज भासू लागली. याच कालावधीत जागतिक पातळीवर कांही भूगोल शास्त्रज्ञांनी व अर्थशास्त्रज्ञांनी आर्थिक विकास हा शाश्वत स्वरूपाचा असावा अशी नवी संकल्पना मांडली.. या शाश्वत विकासाच्या संकल्पनेवरच “शेतीचा शाश्वत विकास” ही संकल्पना आधारित आहे. अर्थात शेतीचा शाश्वत विकास ही संकल्पना काय आहे? जागतिकीकरणाचा शाश्वत

शेतीच्या विकासावर कसा परिणाम झाला आहे? याचे विवेचन करण्यासाठी प्रस्तुत शोधनिबंधाचा विषय आहे, “जागतिकीकरणाचा भारताच्या शाश्वत शेती विकासावर प्रतिकूल परिणाम - एक भौगोलिक अभ्यास”

**बीज संज्ञा:**

युनो, आयएमएफ, डब्ल्यूटीओ, शाश्वत शेती विकास, हरितक्रांती (युनायटेड नेशन ऑफ ऑर्गनायझेशन, आंतरराष्ट्रीय नाणेनिधी, जागतिक व्यापार संघटना, विकास प्रक्रियेत कुठलाही खंड न पडता अखंडपणे पिढ्यान्पिढ्या चालणारी विकासाची प्रक्रिया, कृषी उत्पादकतेत व उत्पन्नात अचानक झालेली प्रचंड वाढ)

**संशोधनाची उद्दिष्टे (Objective) :-**

- 1) शाश्वत शेती विकासाची संकल्पना अभ्यासणे.
- 2) शाश्वत शेती विकासावर जागतिकीकरणाच्या परिणामाचे विश्लेषण करणे.
- 3) शाश्वत शेतीच्या विकासावर जागतिकीकरणाच्या प्रतिकूल परिणामाचा अभ्यास करणे.

**संशोधनाची गृहितके (Hypothesis) :-**

- 1) शाश्वत शेतीच्या विकासावर जागतिकीकरणाचा परिणाम झाला आहे.
- 2) जागतिकीकरणाचा शाश्वत शेतीच्या विकासावर प्रतिकूल परिणाम झाला आहे.

**अभ्यास क्षेत्राचे स्थान (Locational setting of the study Area) :-**

भारताचे स्थान उत्तर- पूर्व गोलार्धात असून दक्षिण आशियाच्या मध्यात आहे भौगोलिक दृष्ट्या विचार केल्यास भारत उत्तर गोलार्धातील महत्वाचा देश आहे. भारताच्या तिन्ही बाजू जलाशयांनी वेढलेल्या आहेत. आग्नेय आशियात प्रमुख द्वीपकल्पीय स्थान भारतास लाभले आहे.

भारताचा अक्षवृत्तीय विस्तार 8अंश 4 मिनिटे 28 सेकंद उत्तर अक्षवृत्त ते 37 अंश सहा मिनिटे 53 सेकंद उत्तर अक्षवृत्त आणि रेखावृत्ते विस्तार 68 अंश सात मिनिटे 33 सेकंद पूर्व रेखावृत्त ते 97 अंश 24 मिनिटे 47 सेकंद पूर्व रेखावृत्त असा आहे. क्षेत्रफळाच्या बाबतीत भारताचा जगात रशिया, कॅनडा, चीन, संयुक्त संस्थाने, ब्राझील आणि ऑस्ट्रेलिया नंतर सातवा क्रमांक आहे. भारताच्या वायव्येस पाकिस्तान व अफगाणिस्तान, उत्तरेस चीन नेपाळ भूतान, दक्षिणेस श्रीलंका, आग्नेयस इंडोनेशिया, नैऋत्येस मालदीव, पूर्वेस म्यानमार व बांगलादेश अशी सेजारील राष्ट्रीय आहेत. भारताच्या पूर्वेस बंगालचा उपसागर, पश्चिमेस अरबी समुद्र व दक्षिणेस हिंदी महासागर आहे. निकोबार बेटावरील इंदिरा पॉईंट ६ अंश 45 मिनिटे उत्तर अक्षांश हे भारताच्या सर्वात दक्षिणेकडील टोक आहे.

**संशोधन पद्धती**

प्रस्तुत संशोधन पेपरचे विश्लेषण करण्यासाठी दुय्यम स्रोतांचा वापर करण्यात आला आहे. यात प्रामुख्याने संशोधन विषयाच्या अनुषंगाने भारत सरकारचे कृषी मंत्रालय, वित्त मंत्रालय, नीती आयोग, रिझर्व बँक ऑफ इंडिया, नाबार्ड इत्यादी संस्थांचे प्रकाशित वार्षिक अहवाल विविध नियतकालिके आणि संकेतस्थळावरील उपलब्ध माहितीचा उपयोग करण्यात आला आहे. वरील उपलब्ध माहितीच्या आधारे सदरील संशोधन निबंधातील विषयांचे स्पष्टीकरण करण्यात आले आहे.

**विषय विवेचन (Result and Discussion):-**

प्रस्तुत शोधनिबंधाचे विवेचन (स्पष्टीकरण) करताना प्रथमतः शास्वत शेती विकासाच्या संकल्पनेचा अर्थ आणि त्यानंतर शास्वत शेती विकासावर जागतिकीकरणाच्या प्रतिकूल परिणामाचे स्पष्टीकरण करण्यात आले आहे.

**शास्वत शेती विकास संकल्पना:-**

शास्वत शेती म्हणजे जमीन, पिके, जंगल, पशुपालन, वन्यजीव, मासे, पर्यावरण इत्यादी पुनःर्जीत करण्याजोगे स्रोतांच्या प्रतवारीचा घसारा न होऊ देता संतुलित व्यवस्थापन करून वर्तमान व भावी पिढीसाठी

अन्न, वस्त्र व निवारा यांचा पुरवठा करणे होय. शास्वत शेतीला सेंद्रिय शेती नैसर्गिक शेती पर्यावरणीय शेती असेही म्हणतात. शास्वत शेतीत पर्यावरण संतुलनाला अधिक महत्त्व दिले जाते म्हणून तिला पर्यावरणीय शेती म्हणतात. शास्वत शेतीसाठी अन्नद्रव्ये व्यवस्थापनासाठी सेंद्रिय पदार्थ मुख्य स्रोत म्हणून वापरतात. शास्वत शेतीचा मूलमंत्र जलविख्यात कृषी तज्ञ व प्रगतशील शेतकरी महाराष्ट्राचे माजी मुख्यमंत्री वसंतराव नाईक यांनी शेती व शेतकरी हिताचा संदेश दिला. “भावी पिढीला आवश्यक असणाऱ्या मूलभूत स्रोतांना कोणत्याही प्रकारची हानी पोहोचू न देता वर्तमान पिढीच्या गरजा भागविण्यासाठी अवलंबण्यात आलेली शेतीची पद्धत म्हणजे शास्वत शेती होय.”

**शास्वत शेतीची व्याप्ती:-**

शास्वत शेती पद्धती अवलंबण्यासाठी पाणलोट क्षेत्र व्यवस्थापन, एकात्मिक अन्नद्रव्य व्यवस्थापन, कार्यक्षम पाणी व्यवस्थापन, एकात्मिक तन व्यवस्थापन, मूळ अनुवंशिक स्रोतांचे संवर्धन आणि एकात्मिक कीड व रोग व्यवस्थापन या व्यवस्थापन पद्धतीचा काटेकोरपणे वापर केला जातो. सदर व्यवस्थापन पद्धतीचा मूळ उद्देश म्हणजे मर्यादित रासायनिक निविष्टा जास्तीत जास्त शेती उत्पादित निविष्टांचा वापर करून विना प्रदूषण व नैसर्गिक साधनसंपत्तीला कोणतीही हानी न पोहोचता शास्वत उत्पादन घेणे हे होय.

**शास्वत शेतीचे फायदे :-**

- 1) पर्यावरणाचे संतुलन राखणे.
- 2) शास्वत शेतीत पीक उत्पादन खर्च कमी असतो.
- 3) शुद्ध पर्यावरण आणि कोणतीही हानिकारक अवशेष नसलेले अन्न उत्पादन शास्वत शेती द्वारे केले जाते.
- 4) शास्वत शेती पद्धतीत निव्वळ सामाजिक नफा वाढतो.
- 5) शास्वत शेती पद्धतीमुळे प्रतिकूल हवामान व बाजारभावामुळे होणारे नुकसान टाळता येते.

**जागतिकीकरणाचा भारतातील शास्वत शेतीच्या विकासावर परिणाम**

भारतात दुसऱ्या हरित क्रांतीची मुहूर्तमेढ रोवली जात असताना दहाव्या पंचवार्षिक योजनेत (२००२ ते २००७) मध्यवर्ती शेतीचा आढावा घेण्यात आला. या आढाव्यात शास्वत शेतीच्या विकासाची संकल्पना स्वीकारण्याचे धोरण स्वीकारून शेतीचा विकासदर चार टक्के निर्धारित करण्यात आला. शास्वत शेतीचा विकासदर साध्य करण्यासाठी संभाव्य समस्या किंवा परिस्थितीला सामोरे जाण्याचा निर्धार करण्यात आला. पहिल्या हरितक्रांतीच्या वेळी भारतातील परिस्थिती वेगळी होती. त्यावेळी भारत एक बंदिस्त अर्थव्यवस्थेचा देश होता पण 1991 मध्ये

## Agriculture Development towards Sustainability

भारताने गॅट करारावर स्वाक्षरी करून जागतिकीकरणाचा स्वीकार केल्यामुळे भारताची अर्थव्यवस्था मुक्त झाली होती. जागतिकीकरणामुळे भारताने शेती, उद्योगधंदे, व्यापार, सेवा इत्यादी सर्व क्षेत्रांवरील आयात - निर्यात, गुंतवणूक, मालकी हक्क अशा अनेक घटकांवरील निर्बंध कमी केले. जागतिकीकरणाचा स्वीकार करून आज 31 वर्ष पूर्ण झाली. जागतिकीकरणाचा भारताच्या शाश्वत शेती विकासावर कसा प्रभाव पडला आहे हे अभ्यासणे गरजेचे आहे. जेव्हा आपण भारताच्या शाश्वत शेती विकासावर जागतिकीकरणाच्या झालेल्या परिणामाचा अभ्यास करतो तेव्हा असे स्पष्ट होते की, जागतिकीकरणाचा शाश्वत शेतीच्या विकासावर नकारात्मक प्रभाव देखील झालेला आहे तो पुढील प्रमाणे.

### भारतातील शाश्वत शेती विकासावर जागतिकीकरणाचा प्रतिकूल परिणाम:-

जागतिकीकरणाचा भारतातील शाश्वत शेती विकासावर प्रतिकूल परिणाम झाला आहे तो पुढील प्रमाणे.

#### १)जैविक साधनांच्या उपलब्धतेत अडचण :-

भारतात पहिली हरितक्रांती झाली त्यावेळी गव्हाच्या उत्पादनात वाढ करण्यासाठी मेक्सिको मधून आणलेल्या जनुकांचा वापर करण्यात आला होता. कोणत्याही उद्योगांचे उत्पादन व उत्पादकतेत वाढ करण्यासाठी, नवीन जातीचा विकास करण्यासाठी अशा जनुकीय साधनांची गरज असते पण जागतिक व्यापार संघटनेच्या बौद्धिक संपदा हक्कामुळे देशा देशातील जैविक साधनांच्या हस्तांतरावर मर्यादा आली आहे. त्यामुळे भारतातील शाश्वत शेती विकासावर त्याचा प्रतिकूल परिणाम झाला.

#### 2)नवीन तंत्रज्ञान स्वीकारण्यास असमर्थ:-

भारतीय शेतकरी अधिक तर निरक्षर आहे. तो अंधश्रद्धाळू आणि त्यांच्यावर रूढी व परंपरेचा पगडा आहे. विशेषतः तो अल्पभूधारक आहे. पर्यावरण संरक्षण व मानवी आरोग्याची सुरक्षा पण करणारे निकष अर्थात तंत्रज्ञान महागडे आहे. त्यामुळे नवीन तंत्रज्ञानाचा स्वीकार करण्यास भारतीय शेतकरी असमर्थ आहेत.

#### ३)शेतकरी भूमिहीन होण्याची शक्यता:-

जागतिकीकरणामुळे विदेशी प्रत्यक्ष व अप्रत्यक्ष गुंतवणुकीवरील निर्बंध काढून टाकल्याने खाजगी गुंतवणूक वाढलेली आहे. करारात्मक किंवा बहुराष्ट्रीय कंपन्या अडचणीत असलेल्या शेतकऱ्यांच्या जमिनी अधिग्रहण करतील त्यामुळे शेतकरी भूमिहीन होण्याची शक्यता जास्त आहे.

#### ४)नफेखोरीमुळे शाश्वत शेती विकासाचा खेळ:-

जागतिकीकरणामुळे बहुराष्ट्रीय कंपन्या शेती व शेतीशी संबंधित उद्योगांमध्ये भांडवली गुंतवणूक करत आहेत. त्यांचा मुख्य उद्देश जास्त नफा मिळविणे असा असतो. अशा कंपन्या शेतकऱ्यांच्या अज्ञानाचा व निरक्षरतेचा फायदा घेऊन जास्तीत जास्त नफा स्वदेशी घेऊन जातात. परिणामी भारतात पुर्नगुंतवणूक झाली नाही तर शाश्वत शेतीच्या विकासाचा खेळ बसेल.

#### ५)जागतिक व्यापार संघटनेच्या नियमांचा विपरीत परिणाम :-

जागतिकीकरणानंतर जगातील सर्वच देशांना जागतिक व्यापार संघटनेच्या सर्व अटी व शर्ती मान्य करावे लागतात. त्यात शेतीसंबंधी अनुदान, बाजारपेठे संबंधी करार, बौद्धिक संपदा हक्क, गुंतवणुकी संबंधीत वस्तू व सेवांच्या व्यापारासंबंधी करार इत्यादी करारांचा समावेश होतो. या सर्व करारांच्या अटी व शर्ती जाचक आहेत. भारतासारख्या देशावर वरील अटीची पूर्तता करणे शक्य नाही. पण विकसित देशांना या गोष्टी अवघड नाहीत. त्यामुळे सर्व फायदे विकसित देशांना मिळतात व त्याचा विपरीत परिणाम भारतातील विविध क्षेत्रातील प्रगतीवर होतो.

#### ६)आयात वाढणे शाश्वत शेती विकासात वाधा:-

जागतिकीकरणामुळे भारतासारख्या शेतीप्रधान देशात उत्पादन वाढण्याऐवजी काही कारणामुळे कमी झाले तर आयातीचे प्रमाण वाढेल विशेषतः भारताने गॅट करारावर सही केल्यानंतर भारताच्या कृषी मालाची निर्यात घटली आणि खाद्यतेल, डाळी, साखर, मसाले, कापूस इत्यादींच्या आयातीत 1991 पासून 95 टक्के वाढ झाली आहे. त्याचा विपरीत परिणाम भारताच्या शाश्वत शेती विकासावर झाला आहे. भारत सरकारने 20 डिसेंबर 2022 रोजी कापसावरील आयात दर कमी केल्याने भारतातील कापसाचे दर (९००००. वरून ७००००० झाला) कमी झाले आहेत.

#### ७)पर्यावरणाचा ऱ्हास :-

जागतिकीकरणामुळे उत्पादन वाढीसाठी सर्वच देशात मोठ्या प्रमाणात तीव्रस्पर्धा निर्माण झाली आहे. या स्पर्धेत स्वतःचे स्थान टिकविण्यासाठी रासायनिक खते, कीटकनाशके, प्रक्रिया उद्योग, ग्रीन हाऊस यांचा वापर जास्तीत जास्त प्रमाणात केला जातो. त्यामुळे पर्यावरणाचे संवर्धन करण्याऐवजी पर्यावरणाचा ऱ्हास होत चालला आहे.

#### पिकांच्या वैविधीकरणाचा अभाव :-

शाश्वत शेती विकासात पर्यावरणाचे समतोल राखण्यासाठी शेतीमधून घेतल्या जाणाऱ्या पिकांचे वैविधीकरण करावे लागते. परंतु जागतिकीकरणामुळे ज्या पिकांची निर्यात करता येते त्याच पिकांचे उत्पादन सर्वच शेतकरी अधिक

प्रमाणात घेतात. त्यामुळे शेतीत पिकांच्या वैविध्यीकरणाचा अभाव ही समस्या निर्माण झाली आहे.

**पिकांच्या पेटंट वर विकसित देशांचा वर चष्मा:-**

जागतिकीकरणामुळे नियंत्रण ठेवणाऱ्या आंतरराष्ट्रीय नाणेनिधी, जागतिक व्यापार संघटना, जागतिक बँक इत्यादी आंतरराष्ट्रीय संस्थांवर विकसित देशांचे वर्चस्व आहे. त्यामुळे प्रगत देश त्यांच्या देशातील शेतीला ब्लू बॉक्स, ग्रीन बॉक्स, सबसिडी अंतर्गत संरक्षण देतात शिवाय बौद्धिक संपदा हक्क संरक्षण कायदा अंतर्गत विविध पिकांच्या उत्पादन मालकी हक्कावर दावा करतात. उदाहरणार्थ भारतातील हळद, जांभूळ, कारले, बासमती तांदूळ इत्यादींचे पेटंट अमेरिकेने मिळविले होते. पण भारताने आंतरराष्ट्रीय न्यायालयात युक्तिवाद करून वरील पिकांचे पेटंट मिळवले. अशाप्रकारे विकसित देश विकसनशील देशांच्या पिकांवरील पेटंटवर मालकी हक्क दाखवितात.

**ग्राहक संरक्षणाची समस्या निर्माण होते:-**

जागतिकीकरणामुळे संकरित बी बियाणांचा व रासायनिक खतांचा वापर मोठ्या प्रमाणात करून उत्पादन व शेतीची उत्पादकता वाढविले जाते. त्यामुळे अशा शेती उत्पादनात ग्राहकांच्या हिताच्या दृष्टीने आवश्यक असणाऱ्या पोषक तत्वांचा त्या पिकात अभाव असतो. अर्थात जागतिकीकरणामुळे ग्राहक हितांचे संरक्षण धोक्यात येते.

**अन्नसुरक्षिततेची समस्या तयार होते :-**

शाश्वत शेती विकासांमुळे अन्न सुरक्षिततेची पूर्तता होते. पण जागतिकीकरणामुळे शेतीत संकरित बी बियाण्यांचा, रासायनिक खतांचा आणि कीटकनाशकांचा अधिक प्रमाणात वापर केल्याने शेतीचे उत्पादन वाढते. पण अन्नसुरक्षिततेच्या दृष्टीने आवश्यक पोषक तत्वे त्यात नसल्याने देशातील नागरिकांच्या आरोग्यावर विपरीत परिणाम होतो. याप्रकारे जागतिकीकरणामुळे अन्न सुरक्षिततेची समस्या निर्माण होते.

**निष्कर्ष:-**

- १) जागतिकीकरणाचा शेतीच्या शाश्वत विकासावर विपरीत परिणाम झाला आहे.
- २) जागतिकीकरणामुळे शाश्वत शेती विकासाच्या उत्पादन खर्चात वाढ झाली आहे. त्यामुळे देशातील सामान्य शेतकऱ्यांना शेतीत अधिक खर्च करणे कठीण झाले आहे.
- ३) अन्नसुरक्षितता आणि शेतीच्या उत्पादनात झाली झालेली वेगाने वाढ यात सातत्य राहणे ही एक गंभीर समस्या निर्माण झाले आहे.

- ४) जागतिकीकरणामुळे निर्माण झालेल्या समस्यावर परिणामकारक उपाययोजना केल्यास भारतात शाश्वत शेतीचा विकास होणार आहे.
- ५) शेतकऱ्यांची आर्थिक परिस्थिती मजबूत करून जागतिकीकरणामुळे निर्माण झालेल्या संधीचा फायदा प्रत्यक्ष शेतकऱ्यांना मिळवून दिला पाहिजे.
- ६) भारत हा कृषिप्रधान देश आहे म्हणून जागतिकीकरणामुळे भारतीय शेतीचा शाश्वत विकास करण्यासाठी शेती क्षेत्राला प्राधान्य दिले पाहिजे.

**संदर्भसूची :-**

- १) जोशी शरद शंकर, भारतीय अर्थव्यवस्थेची वाटचाल, डायमंड पब्लिकेशन, पुणे-30.
- २) डॉ. विठ्ठल धारपुरे, आर्थिक भूगोल, पिंपळापुरे अँड कंपनी पब्लिशर्स, नागपूर 2000
- ३) डॉ. प्रकाश सावंत, भारताचा भूगोल, फडके प्रकाशन कोल्हापूर.
- ४) मराठी विश्वकोश.
- ५) Devil, Calvin (2018-12-11) "what is sustainable agriculture" sustainable agriculture resource and education program (2020- 08-13) रोजी पाहिले.
- ६) Handbook statistics of Indian economy (2020-21) reserve Bank in India.
- ७) Lecture series in IMF; www.imf.orgmichaelmoore; Globalization and development its implications and institutions.
- ८) "sustainable agriculture," Wikipedia 01/12/2023 रोजी पाहिले.



**Challenges of Agricultural Development in India**

**Dr. Nitinkumar M. Patil<sup>1</sup> · Dr. Babasaheb K. Wani<sup>2</sup>**

<sup>1</sup>Department of Commerce, The S.I.A. College of Higher Education, Dombivli (E), P-88, MIDC Residential Area, Dombivli Gymkhana Road, Near Balaji Mandir, Dombivli (East), Tal. Kalyan, Dist. Thane,

<sup>2</sup>Department of Geography, Padmashri Vikhe Patil College of Arts, Science and Commerce, Pravaranagar, A/P. Loni Kd., Tal. Rahata, Dist. Ahmednagar,

Corresponding Author- **Dr. Nitinkumar M. Patil**

**Email-** nitinkumar.patil1970@gmail.com

---

**Abstract**

Agriculture is the mainstay of India's national economy. The majority of population in this country is directly or indirectly dependent on agriculture. However, in spite of numerous efforts made by the government and NGOs, Indian Agriculture is facing many natural and human-induced challenges. Small and fragmented land holdings, sub-standard and high-priced seeds, high prices and inadequate supply of fertilizers, shortage of quality seeds, less area under irrigation, shortage of storage facilities, lack of transportation facilities etc. are some of the major challenges Indian agriculture faces today. The present paper attempts to understand these challenges. The paper is of a theoretical type and is based on secondary data. The study suggests that the government and NGOs can take initiatives to overcome these problems by framing and implementing suitable policies, providing financial assistance, enhancing infrastructure and by the declaration of minimum support prices for agricultural produce.

---

**Key Words:** Challenges, India, Agriculture, Development, Solutions.

**Introduction:**

The historical experience of almost all economies shows that the share of the agriculture sector in total employment and national income falls with the progress in economic development and growth over time. However, this decline does not diminish the need to address various challenges facing the agriculture sector from time to time because of several reasons. The foremost is the dependence of human life on food for survival. This dependence goes beyond survival to adequate nutrition for an active and healthy life. The other significant reasons for the continuing importance of agriculture are its role in supporting and improving rural livelihoods, maintaining agroecological balance, mitigating climate change and global warming and ensuring sustainable use of land, water and other natural resources (Chand R., 2022). Agriculture in India has been described as a gamble in the hands of erratic rainfall and in addition, numerous natural and economic factors add to the uncertainty. A crop failure means the loss of a season, family income, and capital invested in the crop. As most of the farmers are resource-poor and belong to a small and marginal category, their capacity to bear such loss is very limited, the resulting adversity of farmers leads to their failure to

pay rents and taxes, loss of purchasing power and mounting debts. This leads to reduced harvesting and curtailment of agricultural operations in the subsequent seasons and consequently increasing unemployment among agricultural laborers. Crop failures also affect the flow of raw materials to agro-industries. This way, the country's entire economy is affected by crop losses of which the farmers are direct and worst victims. In the interest of stabilizing the economy, it is, therefore, clear that adequate protection should be provided to the farmers to continue their agricultural operations unhampered and the economy undisturbed. (Yoga and Vetrive 2012). With this background, the present paper attempts to understand the challenges before development of Indian agriculture.

**Materials and Methods:**

The present study is based on secondary data sources such as government publications viz. Central Water Commission report 2015 and 2017, Agriculture and farmer welfare annual report 2021-22, Annual report of Indian Agricultural Statistics and Research Institute 2018-19, Agriculture Statistics at a Glance 2019, research and review papers, journals, articles and libraries. The results and findings are presented in descriptive form.

## ***Agriculture Development towards Sustainability***

### **Observations/Results:**

#### **Small and fragmented land holdings**

The issue of small and fragmented land holdings is more serious in densely populated states like West Bengal, Bihar and the western part of Uttar Pradesh where the average size of landholding is less than 1.0 hectare. Land fragmentation has decreased agricultural productivity. It has reduced the economic opportunities available. A small piece of land produces just about enough for the farmer's family. In addition, the variety of crop farmer can produce is severely limited due to the small size of the farmland. Effective agricultural practices like intercropping, mechanization of agriculture, livestock farming and commercial plantation are not possible due to small size of the land holding.

#### **Substandard and high-priced seeds**

The best quality seeds are a prerequisite for attaining good crop yield. However, most of the farmers in India do not have access to quality seeds which lowers crop production. Generally, the seeds in India are priced high. Small and marginal farmers do not afford such high rates of seeds, consequently, quality is compromised.

#### **High prices and inadequate supply of fertilizers**

Agriculture is the mainstay of Indian economy. People in this country have been using land for agriculture for thousands of years. However, enough care is not being taken to maintain the quality of soils in the agricultural sector. This has led to the depletion of soil quality and thereby low agricultural productivity. The application of manure and fertilizers have solved this problem to some extent. Soils if provided with a sufficient quantity of nutrients can produce well. As chemical fertilizers are costly, most small and marginal farmers cannot afford the same prices.

#### **Shortage of quality seeds**

Seed is the basic and most critical input of agriculture. It is one of the factors decisive for enhancing the production and productivity of the crops and critical input for long-term sustained growth of agriculture. Many attempts are being made by the government, seed companies, NGO's and individuals to produce quality seeds and supply them to farmers in need. However,

the shortage of suitable crop seeds is one of the limitations faced by farmers to implement contingency crop plans to tackle aberrant drought conditions. Shortage of quality seeds is a major challenge faced by farmers to implement contingency crop plans to tackle anomalous rainfall situations. In remote areas, farmers have a tendency to dispose-off the entire product as grain and thus depend on outside sources for seed supply in the upcoming season.

In the case of crops with a low seed multiplication ratio, seed rates and seed costs are high. Such a requirement includes a large investment toward the purchase of seeds at the beginning of the season. Water shortage in dry spells particularly during the early season and the need for re-sowing aggravates the adversity faced by farmers. Seeds of some minor millets are sometimes left out of the usual supply chain of seeds. In drought-prone and flood-prone areas, suitable seeds can be produced well in advance and can be kept in the seed bank for their use in contingency situations at the local level.

#### **Less area under irrigation**

In India, there is a substantial variation in the Spatio-temporal distribution of rainfall. Most of the rainfall occurs with the onset of southwest monsoon during the period from June to October. It varies from less than 100 mm in western parts of Rajasthan to more than 2500 mm in northeast region of the country (CWC, 2017). Efficient utilization of available water resources is crucial for a country like India, which shares 17% of the global population with only 2.4% of land and 4% of the water resources. Further, per capita availability in terms of average utilizable water resources, which was 5247 m<sup>3</sup> in 1951 (presently 1453 m<sup>3</sup>) is expected to dwindle down to 1170 m<sup>3</sup> by 2050 (CWC, 2015). Irrigation plays an important role in the agricultural development of any country. It is one of the crucial factors, particularly in a tropical country like India where farmers cannot depend much on uncertain rains. After China, though, India holds the second position as an irrigated country in the world, the ultimate irrigation potential of India is not fully utilised yet. This is due to the delays in the completion of irrigation projects, regional disparities in irrigation

## ***Agriculture Development towards Sustainability***

development, water-logging, increasing cost of irrigation, losses in operating irrigation projects, inter-state water disputes, salinization of soils, high evaporative losses due to a tropical location of the country, decline in the groundwater table and high construction cost of irrigation projects.

### **Shortage of storage facilities**

Agriculture being a seasonal activity makes it difficult to grow crops in all seasons. Thus, the crops are grown in a particular season and stored in warehouses for later use. However, there is always a shortage of storage facilities, particularly in rural parts of the country. Farmers sell their produce soon after the harvest for the prevailing prices. Agricultural produce, particularly perishable materials like fruits and vegetables, dairy products, fish catch, and meat get wasted in large quantities. Due to this insufficient storage facility, about 16% of agricultural produce gets wasted. Insufficient storage makes it hard to meet the demand of people during the off-season. As a result of this, the prices of several agricultural products have increased and sometimes citizens find it expensive to have a simple meal.

### **Lack of transportation facilities**

The key constraints in the transport of agricultural produce in India are shortage of logistics connectivity, support and facilities to ensure the farmers' timely delivery of their harvest into the markets, lack of services including mobile cold storage for fresh and perishable produce which can't be stored at the place of its production. A handful of transportation options cover a longer distance within a short period of time. There are several villages in the country that are not yet connected properly with highways or motorable roads. Thus, farmers cannot reach the markets to fetch fair prices for their products.

### **Inadequacy of capital**

Financial investment is the crucial factor that drives the growth of agriculture. Thus, the success of agriculture depends on financial support, with the enhancements in farm technology. Today, the role of capital in agricultural sustenance is becoming more important. However, a large share of the capital is locked up in land and stocks which makes people borrow from others. Farmers

approach money lenders and commission agents who provide a loan with high-interest rates.

### **Dependence on labor**

Mechanization of agriculture is not prevalent in India. Farmers use manual labor for different agricultural activities viz. Plowing, irrigating crops, applying fertilizers and pesticides, weeding, harvesting etc. However, dependence on human labor for agricultural activities has become a barrier to achieving good yields. It results in the wastage of human labor as these works can be done with the help of machines in an improved way. Mechanization of agriculture in India is essential to save the labor force so that, farming can be made convenient and efficient. Though mechanization of agriculture improved in the country after independence, it needs financial support, skilled manpower, adequate production of machines and supply of uninterrupted power to achieve the objectives. The mechanization of agriculture is limited to the use of electric pumps, tractors, power tillers, harvesters, and some power-operated machines. Thus, Indian agriculture is still largely dependent on the manual labor force.

### **Marketing**

Agricultural marketing is a large issue in India. The lack of well-established marketing facilities in the country has resulted in dependence on local traders and agents for the supply of agricultural produce to get into suitable markets and they charge huge prices. This causes fewer sales of produce. In view of meeting their needs of obligations, poor farmers have to sell their produce at a meagre price, which causes their exploitation. Too many intermediaries, faulty weighing machines and scales, illiteracy, dearth of financial resources, lack of organised marketing and unity among farmers, substandard and inefficient transport facilities, unsatisfactory storehouses, lack of standardization and awareness of the market, corrupt politicians of the mandis and lack of political will are some of the market-related problems the farmers of India facing today. The marketing of agricultural produce is witnessing key changes due to liberalization and globalization. Thus, agriculture has to be market-driven, cost-effective, advanced and

## ***Agriculture Development towards Sustainability***

approachable to high-level technology and should use Information Technology (IT) effectively. In addition, agriculture should be competitive. Agriculture in India is lacking on most of these fronts. In India, knowledge is not being properly conveyed to the thrust areas like market-driven production programs, post-harvest management of agricultural crops, Enhancing market systems by providing sufficient funds, generating information on facilities provided for quality assurance, standardization of agriculture produce, grading, packaging, storage, transportation, contract farming, direct marketing, alternative markets including future markets, commodity exchanges, online market information system etc. Training and education modules have not yet been properly developed in local languages and launched for reaching region-specific farmers. The objective of imparting training to marketing officials and stakeholders is not been created an ambiance of expected marketing practices in the country to protect the interests of farmers and consumers.

### **Suggestions:**

- 1) The issue of small and fragmented land holdings can be tackled stepwise by the government. Consolidation of land records must be done urgently through digitization. The small farmers can be combined and leased out to producers. NGOs must take initiative to educate and train farmers to find out a way out from unproductive land holdings. Cooperative farming and pooling in multiple lands together must be encouraged.
- 2) . The solution to substandard and high-priced seeds might be integrating farmers expressively into markets and supply chains. Research for the development of improved, short-duration, disease resistant and drought-tolerant crop varieties should be strengthened. Farmers should be provided with easy access to the low-priced and High Yield Variety (HYV) seeds of the crops.
- 3) . Adequate supply of low-priced fertilizers is a must in a country like India where the national economy is primarily based on agriculture. Government should raise subsidies to bring down fertilizer prices for farmers. Government should assure that, there should no fertilizer shortage in any of the crop seasons and parts of the country.
- 4) Seed banks should be established and maintained in rural parts of the country to ensure an adequate supply of cheap and quality seeds to the farmers when required. National Seeds Corporation of India (NSC) and State Farms Corporation of India (SFCEI) should take initiatives to meet the seed requirements during the period of natural calamities like drought, flood, cold waves, hail storms and other unforeseen conditions.
- 5) Harnessing micro-irrigation, reduction of water-intensive crops, increasing water harvesting, watershed development, adoption of improved water conservation policy in the agricultural sector, promoting water user associations, in-time completion of irrigation projects, construction of farm and percolation tanks, use of pipes for water transportation to avoid evaporative losses are some of the actions should be taken to increase the area under irrigation.
- 6) Storage capacity of India should be increased to match the total food grain production of the country. Gap between the production of agricultural commodities and storage capacity should be bridged. As small and marginal farmers are not able to create storage facilities due to their meager income, the government should provide these facilities to them with subsidized rates. The capacity of public sector warehouses should be increased.
- 7) The transport system of a country plays an important role in its overall development for a variety of reasons. Construction of all-weather roads in rural parts of the country, provision of trains for transportation of agricultural produce and construction of farm roads using local materials and their maintenance can be done by using suitable technology. It is essential to manage the logistics properly.
- 8) Capital formation through investing in the agricultural sector helps to improve the stock of equipment, tools and productivity of natural resources, which, in turn, enables the farmers to use their resources efficiently, particularly land

## ***Agriculture Development towards Sustainability***

and labor and achieve more productively. Government funds and subsidies, funds from private investors and companies and generation of funds through cooperatives are the different sources of capital generation in the agricultural sector. The supply of loans at low-interest rates may help to improve the situation.

- 9) Mechanization of agriculture is the process of using machinery to do agricultural work which increases farm productivity. Powered machinery can replace many farm jobs carried out by manual labor or by working animals like oxen, horses and mules. Mechanization of agriculture can be of great help in saving manual labor.
- 10) Agricultural marketing covers the services involved in moving an agricultural product from the farm to the consumer. These services comprise planning, organizing, directing and handling agricultural produce in such a way that it should satisfy farmers, intermediaries and also the consumers. A minimum support price policy should be implemented extensively. Elimination of mediators from agricultural marketing is necessary because unless the farmer is allowed the facility of direct cells to the customer, he cannot get a fair price for his produce. For improving agricultural marketing standards weights should be used. These should be manufactured and organized by the government. The agricultural supply chain is one of the most important aspects of agriculture. But it is full of loopholes which makes it inefficient. Sometimes involvement of so many people in a supply chain makes it inefficient (Jibran A., and Mufti A. 2019). In villages, loans for the farmers are arranged by people with sound economic positions and money lenders, who also make deals with their products and exploit them on its basis. As transportation is the backbone of marketing, all-weather roads should be constructed in the rural parts of the country. Publicity of market policy can be done to cut market prices of the crops and training on the functioning of the marketing system should be provided to the farmers. Agriculture Produce Market

Committee (APMC) run markets should be regularized, the market survey should be conducted and grading and standardization of products should be done.

### **Conclusion:**

The present study confirms that agriculture in India is facing several challenges today. Lack of quality seeds, fragmentation of land, less area under irrigation, shortage of storage facilities, substandard and inadequate transport facilities, low capital investment and inadequate Minimum Support Prices (MSP) are the major limitations faced by agriculture in India. In view of coping with the challenges faced by agriculture in India, initiatives like the implementation of suitable policies, provision for financial assistance, enhancement of infrastructure and announcement of minimum support prices for agricultural products can be taken by the government and NGOs.

### **References:**

1. Central Water Commission, CWC (2015). Water and related statistics. Directorate of Information System Organisation, water planning and projects wing Report, New Delhi.
2. Central Water Commission, CWC (2017). Reassessment of Water Availability in India Using Space Inputs. Basin Planning & Management Organisation, New Delhi.
3. Chand, R. (2022). Agricultural Challenges and Policies for 21<sup>st</sup> Centuries, NABARD Research and Policy Series No.6/2022, Pp. 1.
4. Jibran, A., and Mufti A. (2019). Issues and Challenges in Indian Agriculture, International Journal of Commerce and Business Management, 12 (2), Pp.85-88
5. Yoga, S and Vetrive K. (2012). Problems and Prospects of Indian Agricultural Insurance-An Overview, Indian Streams Research Journal, Vol.2, Issue. II/March; 12 pp.1-4.



## Editors

### Editor

**RISWAN M**

Senior Lecturer,  
Department of Sociology,  
South Eastern University of Sri Lanka, Sri Lanka

**Dr. PRASANNA SRINIVAS.R**

Assistant Professor,  
Department of Microbiology  
M.S.Ramaiah College of Arts, Science and Commerce,  
M S R Nagar, Bengaluru, Karnataka, India

**RAJESH KR. ABHAY**

Assistant Professor  
Department of Geography,  
Dyal Singh College,  
University of Delhi, New Delhi 110 003 (India) Alternate

**SANTOSH P. MANE**

Assistant Professor,  
IQAC Coordinator & Head Department of Geography,  
Sameer Gandhi Kala Mahavidyalaya (Commerce & Science College) Malshiras, Solapur, Maharashtra-713107, India



Jyotikiran Publication, Pune

Sr. No. 204, Sahajeevan Society,

Bhekrinagar, Hadapsar, Pune-8

Mob- 8888454089

Email-

[jyotikiranpublicationpune@gmail.com](mailto:jyotikiranpublicationpune@gmail.com)

Web Site-

<http://jkpublications.com>

Rs-1000/-

ISBN 978-93-94819-16-0

