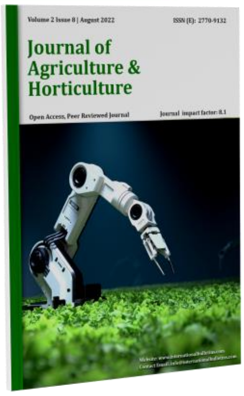

GROWING EFFICIENCY OF ORGANIC VEGETABLES IN SUBSTRATES BASED ON COTTON WASTE AND BIOHUMUS.

Yusupov I.I.
Andijan Machine-Building Institute, Faculty of Transport and Logistics, Department of Labor Protection. Republic of Uzbekistan, Andijan city Bobur avenue 56.
Mambetullayeva S.M.
Karakalpak Scientific Research Institute of Natural Sciences, Academy of Sciences of the Republic of Uzbekistan, Autonomous Republic of Karakalpakiya, Nukus city, Berdakh avenue 41.
Connection. Tel.+99893 -250-15-08 e-mail:ilhomjonyusupov588@gmail.com
https://doi.org/10.5281/zenodo.8137590

Abstract: The article analyzes worldwide research works in the field of growing plants in various substrates, such as mineral wool, cocovite, peat, zeolite, lignin, sand, gravel, vermiculite, perlite, expanded clay, birch bark and others. Analyzing the work done, a substrate is recommended for growing seedlings from the waste of the cotton cleaning industry, which consists of an organic substance - cellulose. For the effective disposal and use of waste in agriculture, a technology for recycling and their use has been created. On the basis of pressed glasses and with the use of vermicompost, different types of plants are grown. This article describes the work done related to the cultivation of sweet potatoes.

Keywords: mineral wool, cocovite, riding peat, zeolite, lignin, sand, gravel, vermiculite, perlite, expanded clay, birch bark, cotton waste, biostack, biohumus, substrate, cellulose, sweet potato,

1. Introduction.

The most intensive branch of agricultural production is the replacement of soil in the root environment with other substances when growing vegetables. In the nutrient medium used by plants in greenhouses, an underdeveloped root system should provide a strong trunk in the aboveground part of them, therefore, the requirements for soil and substrates used for protected ground conditions are high, and they should ensure the full realization of the plant's potential to obtain high yields. [1,2,8,15,20].

When cultivating plants in low-volume technologies, mineral wool, cocovite, peat, zeolite, lignin, sand, gravel, vermiculite, perlite, expanded clay, birch bark and others are used. [13,21,22,23,24,25,26,28].

The use of various substrates is determined by their availability in places of consumption. The most important economic factor is the cost of its transportation and preparation. With this in mind, the use of substrates and their available sources is used in this area. No matter how useful the above-mentioned substrates are, their import into Uzbekistan increases in price, and the end result increases the price of the product. Therefore, most low-volume technologies in Uzbekistan mainly use rice husks, cotton waste and vermicompost.

In the Netherlands, 58% of vegetable growers use mineral wool and only 2% peat [10]. 37% of substrates and soil additives used in the UK do not use peat.[16]. Most greenhouse complexes in Ukraine work with mineral wool. Despite the large reserves of peat in Belarus, mineral wool is used in most greenhouses [13].

Chemoponics is widely used in Russia using organic substrates (peat, buckwheat husk, tree bark, rice husk, coconut husk). In the northern and central part of Russia, peat is mainly used in many greenhouses. In the south of the country, the main attention is paid to such substrates as mineral wool, expanded clay, zeolite. When choosing a substrate, vegetable growers pay attention to its price, quality and other aspects [28,11,3].

Studies conducted in a number of countries show that prepared substrates made of mineral wool and expanded clay are 12-30 higher in yield for the main plants% in comparison with organic substrates, but growing vegetables in mineral wool-based substrates requires high technical equipment. This requires material costs on a large scale. [29,30,31].

Due to the high prices of imported substrates, growing plants without soil is considered somewhat difficult. An urgent task is the search for new components of substrates, the study of their properties, the creation of the most favorable conditions for plants in the root zone.

When preparing the soil for greenhouses, waste from the woodworking industry is used-sawdust, shavings, chips, bark and others. The use of wood waste in the composition of substrates reduces the cost of the soil, improves its water-climatic properties, increases crop yields, and also helps to prevent environmental pollution by waste from the woodworking industry. The use of woodworking waste in low-volume technologies in vegetable growing is advisable for regions where there are no natural organic substrates for growing vegetables in greenhouses.

When cultivating vegetables in the north-eastern zone of Russia, traditional soil technologies and more advanced technologies are used - cultivation of plants without soil (low-volume technologies). Due to the high prices of imported substrates, growing plants without soil is considered somewhat difficult. An urgent task is considered to be the search for new components of substrates, the study of their properties, the creation of the most favorable conditions for plants in the root zone [19].

Despite the fact that various soil materials are used to prepare substrates for the operation of greenhouses, peat is considered the most common among them. Peat is used for most greenhouses located in the northern and central parts of Russia, and mineral wool, expanded clay and zeolite are used for greenhouses in the southern regions. [14,7,5,9,4, 32, 12, 19].

2.Methods and materials. In the conditions of the Republic of Uzbekistan, the import of the above-mentioned substrates from abroad and the value of their prices affect the prices of agricultural products grown in the future, therefore they are used in small volumes.

The method of growing crops proposed by scientists of the Andijan Machine-Building Institute is protected by patent No. 006653 issued by the Agency for Intellectual Property of the Republic of Uzbekistan in December 2022. [17]

The product manufactured on the basis of this invention is briefly called a "biostack". The invention relates to agriculture and is mainly used for growing crops in low-volume technologies, while disposing of industrial waste from the cotton-cleaning industry in agriculture, an increase in soil fertility in the surrounding areas is achieved.

The biostack is made from waste from the cotton cleaning industry during the technological process of primary processing of raw cotton. The composition of the waste mainly includes organic substances of flower stalks, small leaf litter, immature buds, loose seeds, inorganic dust, cotton fluff, which are not used in the future and are subject to disposal.

The chemical composition of these components is more than 80% cellulose. Due to the lack of a recycling mechanism, cotton gins pay millions of soums for compensation payments due to the lack of a recycling mechanism. [33,34]

At the moment, this waste is used for feeding livestock and is used as a heat carrier in greenhouse farms of the population. For this purpose, they dig trenches, fill up the waste, tamp it down, water it abundantly, pour the earth on top and sow seeds. Due to the partial content of cotton fibers and moisture, rotting begins and as a result, heat is released, which warms the ground as a result of quickly germinating seeds.

Results. The biostack is produced by pressing cotton waste in special forms on press machines. Cotton waste of the pressed material for the bundle is mixed with soil heated to 80oC and water. The soil is heated in order to prevent various bacteria and infections. The resulting mass is put into a mold and pressed. For this purpose, a portable laboratory stand for the manufacture of biostacks was made. Figure 1 shows a general view of the stand for making a glass from waste.

pic1. General view of the stand for making cups from waste.

The stand consists of a housing, a mold, and a movable part. A screw jack is used as a movable element. The principle of operation of the stand consists of the following: the mold of the pressed material is filled, the lower stop is fixed from under the mold, then the material is pressed with a screw, after pressing the lower stop is removed, the screw is tightened again, and glasses are obtained from the bottom of the mold. After the glasses are made in a natural way. The glasses are filled with vermicompost. If necessary, nitrogen, phosphorus and potash fertilizers are added.After that, seeds of various plants are sown in biostacks - tomatoes, cucumbers, bell peppers, hot peppers, melons, watermelons and others, and when the seeds germinate, they can be transferred to the open ground, while early harvests are obtained.

Due to the provision of the glass with all the necessary nutrients for the growing season of the plant, they will be resistant to various diseases. At a later stage, when transplanting to the open ground, plants will not need additional agricultural practices, only the necessary watering will be enough.

Until the necessary heat is received for the plant to grow from the ground, there will be sufficient heat released in the process of biochemical reactions occurring in the biostack, the splitting of cotton-cellulose waste.

This technology was first used by our ancestors.They used paper cups for this purpose, and now plastic bags are used for this purpose. Currently, plastic films are being abandoned all over the world due to the harmful environmental consequences of food safety. Secondly, in the process of transplanting seedlings from a glass into the ground, the film is removed, while there is a possibility of damage to the roots, as well as clogging the environment with waste polyethylene- new films.

With the use of biostack from industrial waste of the cotton cleaning industry, issues in the following areas are being solved:

utilization of industrial waste from the cotton-cleaning industry, exclusion of the use of polyethylene bags in crop production, cultivation of early and environmentally friendly agricultural products, cultivation of additional agricultural products during repeated sowing after harvesting wheat crops, reduction of land compaction by reducing technological processes during repeated sowing and achieving economic efficiency, reducing environmental impact by saving energy resources; achieving economic efficiency by reducing mineral and organic fertilizers applied to the land; by introducing organic waste in the form of glasses with vermicompost, increasing soil fertility.

Laboratory and field experiments were conducted to confirm the above in practice. The basis of this resource-saving technology is bio glasses made by pressing industrial waste from the cotton cleaning industry on special presses with the addition of binding elements and water. Pic.2 shows ready-made pressed glasses for growing plants.

a) b)

Pic 2. a) ready-made biostacks, b) sweet potato seedlings in glasses.

The glasses are filled with vermicompost and planted with sweet potato seedlings. Vermicompost mainly serves as food for the planted plant at the beginning, and in the future the rotted waste of cotton mills will serve as a source of food.

Taking into account the above-mentioned features of this waste, experiments were conducted on growing cuttings of sweet potato seedlings in a substrate of pressed cotton waste with vermicompost. The main difference between sweet potatoes and growing ordinary potatoes is that after the sprouts sprouted from the potato tuber are cut and rooted in an aquatic environment, the seedlings are planted in the ground. These experiments were carried out in the scientific laboratory of the Andijan Engineering Institute. Localized varieties "Khazina" and "Khazina 1" were selected for the experiments. The experiments were carried out in special cups. Sweet potato tubers were planted in flower pots filled with the last waste of the cotton-cleaning industry, so called "Drill" and ordinary earth warmed up to 80 ° C and 2/3 of the sweet potato tubers were buried. Fig.3a shows the sweet potato tubers selected for planting on flower pots., Fig.3b shows the grown sweet potato seedlings for ripening.

a) b)

Pic. 3 a) sweet potato-sweet potato selected for planting. b) sweet potatoes sown on a substrate based on cotton waste and vermicompost.

The use of heated soil for the preparation of a substrate in the production of a biostack guarantees the absence of various diseases and bacteria in it.

However, since the temperature required for the development of the plant in the laboratory was insufficient, the processes of budding and rooting were somewhat delayed. That is, the tubers of sweet potatoes were planted on February 28, 2022, and began to sprout only in early April, the first rooting of cuttings were started on April 22, and on April 27, the 90-piece rooted seedlings of the varieties of sweet potatoes "Hazina" and "Hazina -1" were planted in the fields of the Andijan experimental station of the Research Institute of Vegetables, Potatoes and melons, located in the Andijan district of the Andijan region, and on May 17, 50 pieces of rooted sweet potato seedlings were planted in the fields of the Istiqlol livestock farm in the Khojaabad district of the Andijan region. Figure 4a shows grown sweet potato seedlings from tubers in the substrate, Figure 4b shows sweet potato sprouts rooting in a solution of 1% succinic acid.

a) b) **Pic**. 4. a) painted sweet potato seedlings, b) sprouts for rooting in 1% succinic acid solution.

Pic.5. Special rack for rooting from sweet potato branches.

Pic.6. Harvesting from an experienced plot.

Pic.7. A painted sweet potato crop from an experienced plot.

Таб.1

№ p/p	Option	Yield, by repetitions centner/hectare					Average centner/hectare
		1	2	3	4	5	
1.	Sweet potato “Hazina” in a glass	580	675	665	650	680	650
2	Control (regular sowing of “Hazina")	550	580	600	620	580	586
3.	Sweet potato “Hazina1” in a glass	740	755	730	750	760	747
4.	Control (regular sowing of “Khazina 1")	680	690	700	710	700	696

The obtained results of field tests were processed by the mathematical static method [6].

Calculate the arithmetic mean and the sum of squares deviations

таб.2

X	Calculations by source dates X	Calculations based on transformed dates X_1	
	X^2	$X_1 = x - A$ (A=650)	X_1^2
580	336400	-70	4900
675	455625	25	625

665	442225	15	225
650	422500	0	0
680	462400	30	900
$\Sigma X=3250$ $\Sigma X^2=2119150$ $\Sigma X_1=0$ $\Sigma X^2{}_1=6650$			
Average: $x_{cp} = \Sigma X/n = 3250/5 = 650$: $A + \Sigma X/n = 650 + 0/6 = 650$			
Sum of squares: $\Sigma (X-x_{cp})^2$ $\Sigma X^2 - (\Sigma X)^2 / n = 2119150 - (3250)^2/5 = 6650$ $\Sigma X_1^2 - (\Sigma X_1)^2 / n = 6650 - 0^2/6 = 6650 - 0 = 6650$			
We read from the source data: $x_{cp} = \Sigma X/n = 3250/5 = 650$, $S^2 = \Sigma(X-x_{cp})^2/ n-1 = S^2 = 6650/4 = 1663$ $S = \sqrt{1663} = 40{,}7$ ц/га			
$V = S/x_{cp}100 = 40{,}7/650 \times 100 = 6{,}3\%$			
$S_{xcp} = \sqrt{1663/5} = 18{,}2$ ц/га			
$S_{xcp\%} = S_{xcp} / x_{cp}\ 100 = 18{,}2/650 \times 100 = 2{,}8\%$			
$x_{cp} \pm i_{0,5} S_{xcp} = 650 \pm 2{,}57 \times 18{,}2 = 650 \pm 46{,}8$ (603 - 697)			

During the experiments , the yields of sweet potatoes were obtained by repetition , respectively 578, 564, 539, 604, 551, 468c/ha. We calculate the arithmetic mean and the sum of the squared deviations.

1, Arithmetic mean: xsr = ΣX/n = 3250/5 = 650c/ha;
2. Variance: S2 = Σ(X-xsr)2/ n-1 = S2 = 6650/ 4 = 1663;
3.Standard deviation: S = = 40.7c/ha;
4. Coefficient of variation V=S/xcr100 = 40.7/650x100 = 6.3%
5. Average error: Sx% = Sx / xsr 100 =18.2 /650x100 = 2.8%
6. Confidence interval for the mean value: xsr ± i0.5 Xsr = 650 ± 2.57 x 18,2 = 650 ± 46,8 (603 - 697)

Discussions. The substrates used for low-volume technologies in foreign countries are not acceptable for greenhouses of the Republic of Uzbekistan due to the high prices of substrates, which in the end the painted products will be very expensive.

Therefore, a substrate based on waste from the cotton cleaning industry and vermicompost is proposed, which gives good results when growing various agricultural plants.

Large-scale production and use of glasses from waste from cotton gins in farms will allow growing early and environmentally friendly vegetable crops, eliminating the use of chemicals currently used in their cultivation. The greenhouses will refuse various substrates that are currently used imported from abroad.

Conclusions. Conducted experiments on growing plants on substrates based on waste from the cotton cleaning industry, at the same time makes it possible to recycle waste in order to increase soil fertility without the use of mineral fertilizers. To receive environmentally friendly products, to increase the export potential of vegetable and melon crops. The use of pressed waste in the form of glasses in low-volume technologies makes it possible to grow seedlings of various crops in greenhouses without the use of energy resources.

Experiments conducted with new varieties of sweet potato plants also gave positive results, the seedlings of the sweet potato plant grown in experimental glasses obtained by pressing in machines gave good results in yield, compared with conventional sowing.

The heat generated by chemical reactions occurring during the rotting of waste makes it possible to grow various plants without additional heating of greenhouses.

References:

1. Outko, A.A. , Dolbik N.N. , Kozlovskaya , I.P. Greenhouse vegetable growing . Minsk: UP " Technoprint ", 2003. 256 p

2.Borisov V.A., Litvinov S.S., Romanova A.V. Quality and keeping quality of vegetables. Moscow: VNIIPO, 2003. 670 p.

3. Belogubova, E.N. and others. Modern vegetable growing of closed and open ground: Study guide for agr. Educational institutions of 1-4 levels of accreditation in spec. 1310 "Agronomy" Kiev: JSC "Publishing House "Kiev, Pravda", 2006. - 528 p.

4. Brovko. G.A. Agrobiological substantiation of resource-saving technology of cucumber and tomato cultivation in winter greenhouses of the Far East: Abstract of the dissertation of the Doctor of Agricultural Sciences: 06.01.06 - M., 2006.-46s.

5. Bratukhin, M.N. Recommendations on the use of organic fertilizers in collective farms and state farms of the Kirov region - Kirov, 1979. - 51 p.

6. Armor..B.A. Methodology of field experience (with the basics of statistical processing of research results) 5th ed., supplement and revision -M.: Agropromizdat, 1985. - 351 p.

7. Ishkaev. T.H. and others. Recommendations for the effective use of greenhouse soils and fertilizers in the farms of the Tatar ASSR. Kazan: Kazan branch of TsINAO, 1979.-31 p.

8. Kovylin.V.M. Method of assessing the fertility of greenhouse soils. Effective methods of growing vegetable crops: Scientific.Proceedings of the VNIIO under the editorship of S. S. Litvinov. - M., 1998. - From 241 -244.

9. Krug. G. Vegetable growing / Per. wet. V.I. Leonov . - M.: Kolos , 2000. — 576 p.

10. Korol V.G. New in the vegetable growing of protected soil. Gavrish, 2005 No. 6. - pp.4-8.

11. Korchagina L.M. Study of physico-chemical properties and nutritional regime of peat-cyolite substrates when growing tomatoes in protected soil: Abstract. dis... cand. biol. nauk: 03.00.27 -M., 1999. - 20 p.

12. Koreshkova. V.N., et al. Cultivation of cucumber hybrid Fi Athlete in winter-spring turnover using low-volume technology "Gavrish" V.N. No. 4 2005. - pp.16-18.

13. PanasenkoA.S. Economic and ecological problems of choosing substrates for small-scale crops for greenhouses in the Republic of Belarus. Nature, people and ecology. Minsk: Gorky , 1999, - p. 79

14. Reshetnikova, G. F. Substrates, nutrient solutions and cucumber varieties with the hydroponic method of cultivation in spring greenhouses of the Middle Urals. Abstract of the dissertation of the Candidate of Agricultural Sciences: Moscow: Joint Scientific Council of the Research Institute of Vegetable Farming and the Research Institute of Potato Farming, 1968. -25 p.

15. Ronen Yal. Important aspects of nutrition control when cultivating plants without soil . Journal. Gavrish. - 2006. - No. 3. - pp. 14-17.

16.
Tsydendambaev A.D. Organic substrate. Scientific and production . Journal. For specialists, the "World of Greenhouses" soil is protected.-2004. No. 1.pp.39-41.
17. Shunichev S.S., Dr. Technology of industrial production of vegetables in winter greenhouses (recommendations). M. _ IN " Agropromizdat ", 1987. — 109 p.
18. Yusupov I.I., Kabulova N.Zh, Khodzhiev A. Patent IAR No. 06653. Method of growing seedlings of agricultural crops. Official Bulletin of the Agency for Intellectual Property under the Ministry of Justice of the Republic of Uzbekistan Tashkent 2022 year 1(249).
19. Yagovkin V.V. Organic _ substrate for low-volume Cultivation if the tomato hurts the north-eastern region of the P axis. All-Russian Scientific Research Institute of Vegetable Growing (VNIIO) . Diss.kan.of biological sciences. M-2007 189.
20. Yanishevskaya, O.L. Assessment of the suitability of an artificial substrate for growing various vegetable crops in protected ground conditions. Journal. Gavrish. - 2004. - No. 2. - pp. 19-21.
21.Trauer R. Torfsackkultur, eine vielsprechende Produktionsalternative Gartenbauwirtschaft. - 1989, T. 44, № 15. - S. 8-10.
22.Gruda N, Michalsky F., Schnitzler W.H. Substrateigenschaften im Vergleich. Gemuse. - 1997, Jg. 33, № 12 (Beil)- S. 2-5.
23. Kanazirska V., Simidchiev H., Panayotov Z. Container sustem for tomato production based onagroperlite is Pochvoznan. Agrochem. Ekol. - 1998, g. 33, No. 1. - P. - 23-31.
24.Goodwin P., Cowell C. Influence of IBA concentration, botrom heat, and medium on propaqationof of camellis. Intern. Plant Propaqators Soc. - 2000. - S.l, Vol. 49. - P. 149-153.
25. Kreij With de, Leeuwen Q.J.L. van. Growth of pot plants in treated coir dust as compared to peat. Communic. in Soil Sc. Plant Analysis. - 2001/ - Vol. 32, № 13/14. - P. 2255-2256.
26.Piroq J. Usefulness of expanded clay as a substrate for greenhouse cucumber cultivation. Veqetable crops research bull. - Skierniewice. -2001.-Vol. 54,№ 1.-P. 111-115.
27. Hao H., Papadopoulos A.P. Growh, photosynthesis and productivity of greenhouse tomato cultivated in open or closed rockwool systems. Canad. I. Plant Sc- 2002. - Vol 82, № 4. - P. 771-780.
28.Gunther.J.Produkthaftunq bei kultursubstraten TASPO Gartenbau mag. - 1994, № 3. - S. 20-23.
29. Groos V.U. Wahst Deutschlands Gemuse bold auf NFT. Gemuse. - 1989, Jg. 25, № 6. - S. - 94-297.
30.Smith G.D., Lennartsson M., Baume W.F., 2001. Laboratory methods of estimating potentially mineralizable nitrogen in organic potting mixes. Communic. in Soil Sc. Plant Analysis. -2001. - Vol. 32, № 17/18. -P. -2755-2768.
31.Kowalska J. Effect of fertilization by various substraites on yielding and gyality of greenhouse tomato. Vegetable crops research bull/ - Skierniewice. -2001, Vol. 55. -P. 19-22.
32. Vladeva D, Rostov O. Transformation of nitrogen in sawdust and its uptake by tomato plants using 15 N technigue I Soil. Agrochem. Ecol. -1996.-G. 31, No. 4.-pp. 27-31.
33. Yusupov I.I. et al. TO REDUCE CLIMATE ISLAND FOCUSTD LOCAL COOPERATION. “Clarivate Analytics” International Impact Factor scientific and practical journal. Philadelphia, USA 11/930 November 2020 Doi:https//dx.doi. org/10.15863/TAS.
2020. 11.91.78 501-507str.

34. Yusupov I.I. “Ways to reduce the processes of global warming by biological resources” International scientific and Practical journal Russia “Economics and Society" No. 12(79) 2020.