

Correlation between Irrigation Intensity and Cropping Intensity in Kongu Uplands, Tamil Nadu

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ABSTRACT

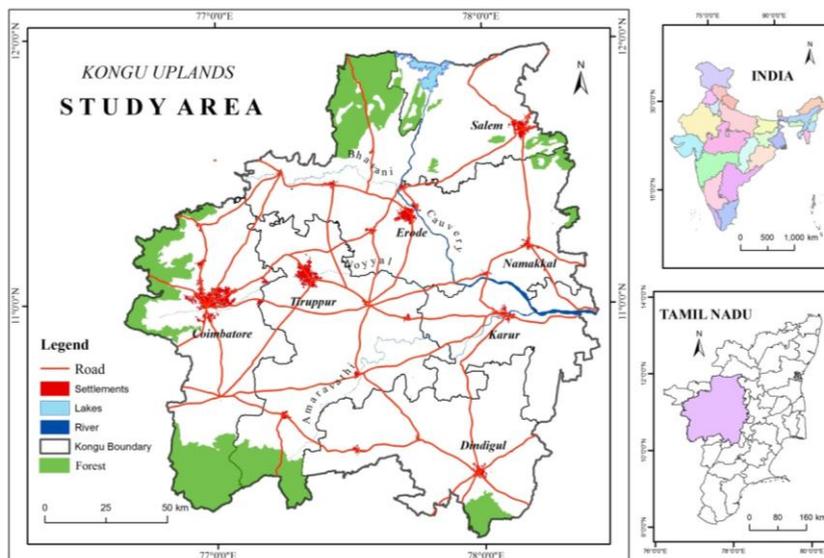
Irrigation simply refers to the artificial way of supplying water to plants. It is a very important physical input in modern agriculture as the crop production of an area largely depends on the existing irrigation facilities. Its urgency needs emphasis for having a stable and successful agriculture in an area like the Kongu Uplands, where rainfall is seasonally distributed and unreliable. The study area has secured a good position in agricultural production in Tamil Nadu during the past two years and its irrigation has also increased but unevenly at block level. This paper attempts to find out the spatial pattern of irrigation intensity and also the relationship between irrigation intensity and cropping intensity in Kongu Uplands in blocks level for the year of 2015 -16. Karl Pearson's Product moment of correlation coefficient method has been adopted to compute the relationship between irrigation intensity and cropping intensity. The block level G – return data has been collected from Economic and Statistical Departments of the respective districts for the year 2015 - 16. ArcGIS environment is employed for the preparing maps. Similar studies can be carried out in future with this same methodology as it facilitates the concerned authorities to make proper decisions.

1. Introduction

Irrigation may be defined as the artificial way of supplying water to plants. Irrigation is the backbone of Indian agriculture. It is one of the Physical inputs in modern agriculture. Seasonal and adequate water supply is necessary for better agricultural development. The monsoon climate of India is characterized by unreliable distribution of rainfall. However water is considered as a key input for crop farming. As India's economy strongly depends on its agriculture, it is important to guarantee a nonstop supply of water to the agricultural grounds. To overcome the problems of rainfall shortage and little quantity of water to crops, irrigation provisions in the method of canals, wells, tube wells and tanks have been made. Groundwater is

also considered as one of the important sources of irrigation. Since the incidence of Green Revolution in the mid-sixties, the situation of Indian agriculture experienced a radical change with the adoption of high yielding varieties of seeds and chemical fertilizer. The use of these inputs pre-required the development of assured irrigation. So the cropping pattern of a region is basically determined by its existing irrigation facilities (Sandipan Ganguly and Palash Patra, 2016). Increase in cropping intensity indicates increased agricultural development of region (Singh, 2015). For a suitable assessment of the potentiality of crop cultivation of a region, it is vital to have an analysis into the relationship between its irrigation and cropping intensity.

2. Study Area



Kongu Uplands is a semi-arid region situated in the western part of Tamil Nadu. The study area covers an area of about 26,000 km². This study area is approximately one fifth of the total geographical area of Tamil Nadu. It lies between 10°16'N to 12°27'N latitudes and 76°40'E to 79°45'E Longitudes. It falls in west to the Kolli hill, east to the Nilgiri hill, above the Kodaikanal hill and below the Stanley reservoir. The average elevation of Uplands is 450 metres in the west and 200 metres in the east. This region is unique in the ways of agriculture, industries and services. The region covers the districts of Coimbatore, Erode, Thiruppur and parts of Salem, Namakkal, Dindigul, Karur and Tiruchirappalli with eighty one blocks. It is one of the densely populated industrial regions in Tamil Nadu. The major rivers drained in this region are the tributaries of Cauvery viz; Bhavani, Noyyal and Amravati.

3. Objective

Cropping Intensity = (Gross cropped Area/Net Sown Area) x100
Irrigation Intensity = (Gross Irrigated Area/Gross Cropped Area) x100

5. Result and Discussion

a. Irrigation Intensity

The intensity of irrigation is the proportion of total gross cropped area to the net sown area. In principle the intensive cultivation is possible in two or more seasons for growing various crops or mono crop there is sufficient water is needed for crop cultivation. Since irrigation is the main source of supply of water for farming practices, the cultivable land is fully

The paper is intended to analyses the levels of irrigation intensity and cropping intensity of Kongu Uplands and to examine relationship between cropping intensity and irrigation intensity in study area.

4. Database and Methodology

The study is based on the secondary data that have been collected from Economic and Statistical Departments of respective districts. Here the block level has been taken as a unit for analysis. Karl Pearson's Product moment of correlation coefficient method has been applied for analyzing the relationship between cropping intensity and irrigation intensity. The resultant outcome is depicted through various thematic maps with the help of Arc Map 10.1 environment. The given equations are used for getting cropping intensity and irrigation intensity.

supplied by the water through irrigation and intensity index tends to be high that more than 100 value in a season. Since more than two third of the farming activities are based on underground water about 75 percent of the underground water is already utilized. Therefore higher intensity of irrigation reflects the high availability of irrigation to crop rising. The average irrigation intensity of the Uplands is 50.

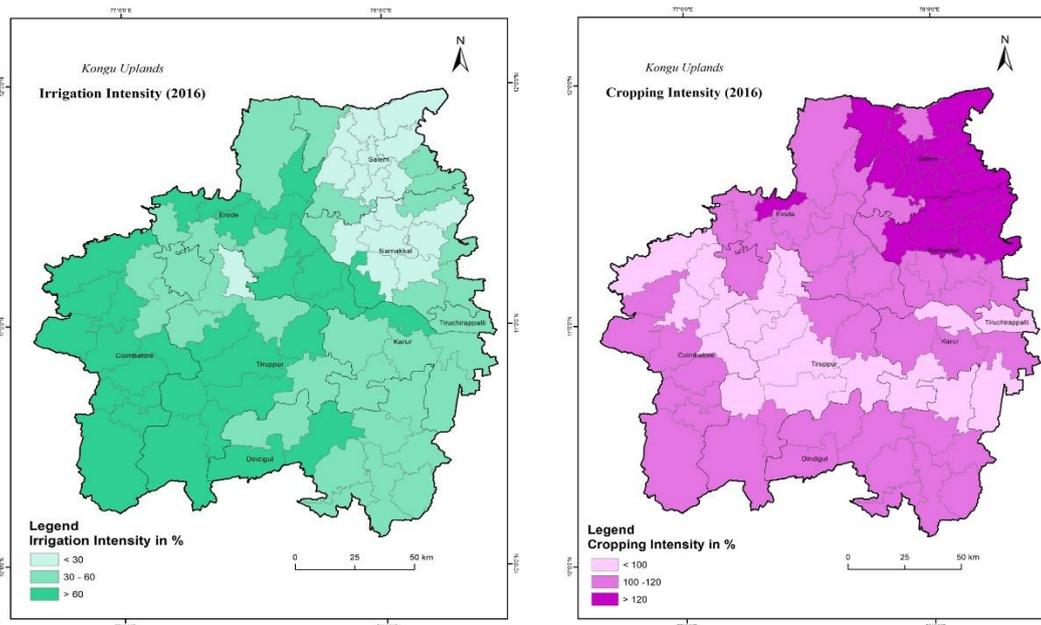
Table-1 Distribution of Irrigation Intensity

Category	No. of Block	Name of Block
High Irrigation Intensity (> 60 %)	30	Karur, Kodumudi, Erode, Madathukulam, Bhavani, Gudimangalam, Dharapuram, Thoockanaickenpalayam, Udumalpet, Sulthanpet, Pollachi North, Pollachi South, Anaimalai, Sarkarsamakulam, Thondamuthur, Palani, Modakkurichi etc.
Moderate Irrigation Intensity (30 -60 %)	35	Aravakurichi, Pallipalayam, Anthiyur, Kangeyam, Bhavanisagar, Sulur, Thottiam, Perundurai, Erumaipatti, Mohanur, Thoppampatti, K.Paramathi, Thanthoni, Mulanur, Athoor, Palladam, Annur, Kadavur etc.
Low Irrigation Intensity (< 30 %)	16	Omalur, Kadayampatti, Namakkal, Tiruchengode, Nangavalli, Konganapuram, Mecheri, Rasipuram, Idappady, Mac. Donald Choultry etc.

The table 1 showsthere is a wide variation in the irrigation intensity. Its ranges from 99 to 10. The blocks of Karur, Kodumudi, Erode, Madathukulam, Bhavani, Gudimangalam, Dharapuram, Thoockanaickenpalayam, Udumalpet, Sulthanpet, Pollachi North, Pollachi South, Anaimalai, Sarkarsamakulam, Thondamuthur, Palani, Modakkurichi etc.belong to the high (> 60) category of irrigation intensity. Moderate level (30 - 60) of intensity prevails in Thirty five blocks Aravakurichi, Pallipalayam, Anthiyur, Kangeyam, Bhavanisagar, Sulur, Thottiam, Perundurai, Erumaipatti, Mohanur, Thoppampatti, K.Paramathi,

Thanthoni, Mulanur, Athoor, Palladam, Annur, Kadavur etc. The low intensity (< 30) is concentrated sixteen blocks. Some of Omalur, Kadayampatti, Namakkal, Tiruchengode, Nangavalli, Konganapuram, Mecheri, Rasipuram, Idappady, Mac. Donald Choultry etc. The high irrigation intensity is found in the western, north western, south western portions and some patches of central area of the Uplands. The major portions of the medium intensity of irrigation is prevails in the south and south eastern region. The lowest intensity is distributed in the extreme north east and a pocket area of central part.

Figure 2 and 3: Irrigation Intensity and Cropping Intensity



b. Cropping Intensity

Cropping intensity is the successive cropping in a particular land throughout the year. The intensity of cropping shows the magnitude to which the unit of area has been used intensively for several purposes of agriculture. The cropping intensity usually refers that the number of crops rising a region in a specific time. However, high intensity of cropping which reveals that the maximum and multiple usage of land and low intensity shows minimum and single usage of land. Following formula has been used for calculating the cropping intensity. The

average cropping intensity of the Uplands is 111. So there is variation in crop intensity over the blocks.

The cropping intensity of the study area intends to classify the area into three groups. These groups are high (above 120), moderate (100 – 120) and low (below 100). The crop intensity analysis shows that the Rasipuram, Vennanthur, Veerapandi, Konganapuram, Idappady,

Table-2 Distribution of Cropping Intensity

Category	No. of Block	Name of Block
High Cropping Intensity (>120 %)	21	Rasipuram, Vennanthur, Veerapandi, Konganapuram, Idappady, Tharamangalam, Senthamangalam, Puduchatram, Salem, Mallasamudram, Panamarathupatti, Kadayampatti, Mac. Donald Choultry, Omalur, Nangavalli etc.
Moderate Cropping Intensity (100– 120 %)	59	Erumaipatti, Gobichettipalayam, Mecheri, Pallipalayam, Kodumudi, Erode, Krishnarayapuram, Paramathi, Ammapet, Anthiyur, Mohanur, Bhavanisagar, Nambiyur, Palani, Madathukulam, Chennimalai, Udumalpet, Anaimalai, Thondamuthur, Shanarpatti, Bhavani, Namakkal, Perundururai, Pollachi South, Modakkurichi, Reddiarchattiram, Vadamadurai, Madukkarai, Sathyamangalam, Vellakoil, Kangeyam, Athoor, Pollachi North, Ottanchattiram, Kinathukadavu, Periyanaickenpalayam, Thoppampatti, K.Paramathi etc.
Low Irrigation Intensity (< 100 %)	1	Karamada

Source: Computed by Authors

Tharamangalam, Senthamangalam, Puduchatram, Salem, Mallasamudram, Panamarathupatti, Kadayampatti, Mac. Donald Choultry, Omalur, Nangavalli etc. have the highest cropping intensity is found. It includes twenty one blocks. The moderate intensity is found Erumaipatti, Gobichettipalayam, Mecheri, Pallipalayam, Kodumudi, Erode, Krishnarayapuram, Paramathi, Ammapet, Anthiyur, Mohanur, Bhavanisagar, Nambiyur, Palani, Madathukulam, Chennimalai, Udumalpet, Anaimalai, Thondamuthur, Shanarpatti, Bhavani, Namakkal,

Perundururai, Pollachi South, Modakkurichi, Reddiarchattiram, Vadamadurai, Madukkarai, Sathyamangalam, Vellakoil, Kangeyam, Athoor, Pollachi North, Ottanchattiram, Kinathukadavu, Periyanaickenpalayam, Thoppampatti, K.Paramathi etc. The low cropping intensity is focused in the only one block. This block is Karamadai. The highest percentage of cropping intensity can be observed in the north eastern portions and a single area of north. The south and the south western parts exhibit the moderate developments of

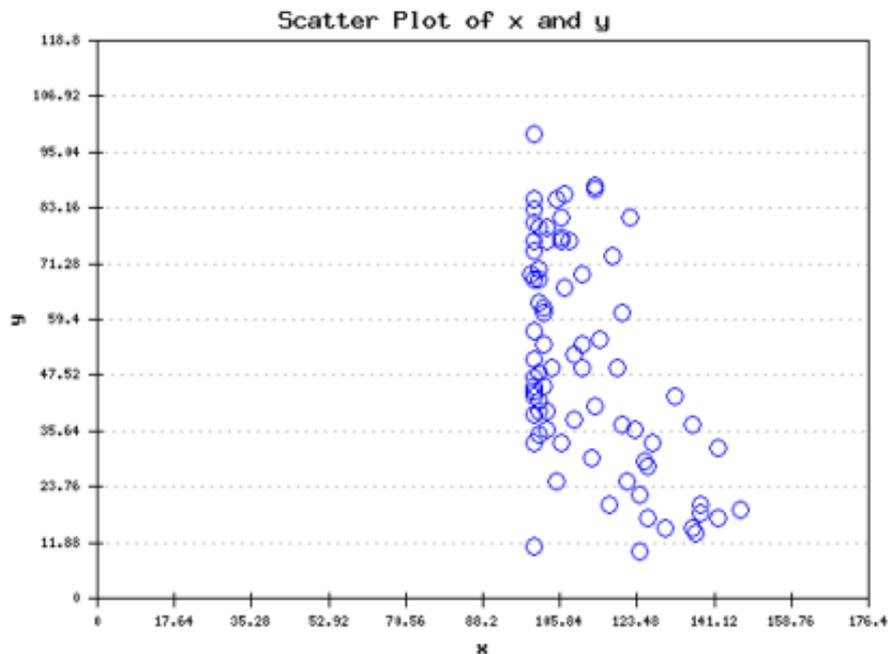
cropping intensity. The lowest cropping intensity stretches from North West to south east region.

Table-3 Statistical Relationship of Irrigation Intensity and Cropping Intensity

Names of the block	Irrigation Intensity (x)	Cropping Intensity(y)	X - M _x	Y - M _y	(X - M _x) ²	(Y - M _y) ²	(X - M _x)(Y - M _y)
Karamadai	69	99	18.654	-12.14	347.98	147.28	-226.4
Madukkarai	62	102	11.654	-9.136	135.82	83.463	-106.5
Periyanaickenpalayam	63	101	12.654	-10.14	160.13	102.73	-128.3
Sarkarsamakulam	76	100	25.654	-11.14	658.14	124.01	-285.7
Thondamuthur	76	106	25.654	-5.136	658.14	26.376	-131.8
Anaimalai	77	106	26.654	-5.136	710.45	26.376	-136.9
Kinathukadavu	68	101	17.654	-10.14	311.68	102.73	-178.9
Pollachi North	79	101	28.654	-10.14	821.07	102.73	-290.4
Pollachi South	79	103	28.654	-8.136	821.07	66.191	-233.1
Annur	44	100	-6.346	-11.14	40.268	124.01	70.664
Sulur	51	100	0.654	-11.14	0.428	124.01	-7.286
Sulthanpet	80	100	29.654	-11.14	879.38	124.01	-330.2
Dindigul	42	101	-8.346	-10.14	69.65	102.73	84.59
Palani	76	108	25.654	-3.136	658.14	9.833	-80.45
Ottanchattiram	70	101	19.654	-10.14	386.29	102.73	-199.2
Vedasandur	40	101	-10.35	-10.14	107.03	102.73	104.86
Thoppampatti	48	101	-2.346	-10.14	5.502	102.73	23.775
Guziliamparai	39	100	-11.35	-11.14	128.72	124.01	126.34
Vadamadurai	36	103	-14.35	-8.136	205.8	66.191	116.71
Reddiarchattiram	40	103	-10.35	-8.136	107.03	66.191	84.17
Shanarpatti	33	106	-17.35	-5.136	300.87	26.376	89.084
Athoor	45	102	-5.346	-9.136	28.576	83.463	48.837
Perundurai	49	104	-1.346	-7.136	1.811	50.92	9.602
Modakkurichi	76	103	25.654	-8.136	658.14	66.191	-208.7
Anthiyur	54	111	3.654	-0.136	13.354	0.018	-0.496
Chennimalai	66	107	15.654	-4.136	245.06	17.105	-64.74
Gobichettipalayam	73	118	22.654	6.864	513.22	47.117	155.5
Bhavani	85	105	34.654	-6.136	1200.9	37.648	-212.6
Ammapet	69	111	18.654	-0.136	347.98	0.018	-2.533
Bhavanisagar	52	109	1.654	-2.136	2.737	4.562	-3.533
Erode	87	114	36.654	2.864	1343.5	8.204	104.99
Kodumudi	88	114	37.654	2.864	1417.8	8.204	107.85
Nambiyur	38	109	-12.35	-2.136	152.42	4.562	26.368
Thoockanaickenpalayam	81	122	30.654	10.864	939.69	118.03	333.04
Sathyamangalam	61	102	10.654	-9.136	113.52	83.463	-97.34
K.Paramathi	48	101	-2.346	-10.14	5.502	102.73	23.775
Thanthoni	48	101	-2.346	-10.14	5.502	102.73	23.775
Aravakurichi	57	100	6.654	-11.14	44.28	124.01	-74.1
Karur	99	100	48.654	-11.14	2367.2	124.01	-541.8
Kadavur	43	100	-7.346	-11.14	53.959	124.01	81.8
Krishnarayapuram	41	114	-9.346	2.864	87.342	8.204	-26.77
Elaichipalayam	10	124	-40.35	12.864	1627.8	165.49	-519
Erumaipatti	49	119	-1.346	7.864	1.811	61.846	-10.58
Kabilarimalai	61	120	10.654	8.864	113.52	78.574	94.442
Mallasamudram	15	130	-35.35	18.864	1249.3	355.86	-666.8
Mohanur	49	111	-1.346	-0.136	1.811	0.018	0.183
Namakkal	25	105	-25.35	-6.136	642.4	37.648	155.52
Puduchatram	15	136	-35.35	24.864	1249.3	618.23	-878.8
Paramathi	30	113	-20.35	1.864	413.95	3.475	-37.93

Pallipalayam	55	115	4.654	3.864	21.663	14.932	17.985
Rasipuram	19	147	-31.35	35.864	982.55	1286.2	-1124
Senthamangalam	37	136	-13.35	24.864	178.11	618.23	-331.8
Tiruchengode	25	121	-25.35	9.864	642.4	97.302	-250
Vennanthur	32	142	-18.35	30.864	336.56	952.6	-566.2
Idappady	18	138	-32.35	26.864	1046.2	721.69	-868.9
Sankari	37	120	-13.35	8.864	178.11	78.574	-118.3
Konganapuram	20	138	-30.35	26.864	920.86	721.69	-815.2
Mac. Donald Choultry	17	126	-33.35	14.864	1111.9	220.94	-495.7
Kolathur	36	123	-14.35	11.864	205.8	140.76	-170.2
Kadayampatti	28	126	-22.35	14.864	499.33	220.94	-332.2
Tharamangalam	14	137	-36.35	25.864	1321	668.96	-940.1
Salem	43	132	-7.346	20.864	53.959	435.32	-153.3
Veerapandi	17	142	-33.35	30.864	1111.9	952.6	-1029
Panamarathupatti	33	127	-17.35	15.864	300.87	251.67	-275.2
Nangavalli	22	124	-28.35	12.864	803.48	165.49	-364.6
Mecheri	20	117	-30.35	5.864	920.86	34.389	-178
Omalur	29	125	-21.35	13.864	455.64	192.22	-295.9
Thottiam	51	100	0.654	-11.14	0.428	124.01	-7.286
Vellakoil	61	102	10.654	-9.136	113.52	83.463	-97.34
Udumalpet	81	106	30.654	-5.136	939.69	26.376	-157.4
Avinashi	35	101	-15.35	-10.14	235.49	102.73	155.54
Gudimangalam	85	100	34.654	-11.14	1200.9	124.01	-385.9
Mulanur	47	100	-3.346	-11.14	11.194	124.01	37.257
Thiruppur	33	100	-17.35	-11.14	300.87	124.01	193.16
Pongalur	74	100	23.654	-11.14	559.53	124.01	-263.4
Madathukulam	86	107	35.654	-4.136	1271.2	17.105	-147.5
Dharapuram	83	100	32.654	-11.14	1066.3	124.01	-363.6
Kundadam	68	100	17.654	-11.14	311.68	124.01	-196.6
Kangeyam	54	102	3.654	-9.136	13.354	83.463	-33.39
Palladam	45	100	-5.346	-11.14	28.576	124.01	59.528
Uthukuli	11	100	-39.35	-11.14	1548.1	124.01	438.15

Source: Computed by author



The study also reveals fact that there is a moderate negative correlation between irrigation intensity and cropping intensity in the blocks Uplands. The value of R is - 0.547. This is a moderate negative correlation, which means there is a trend for high X variable (Cropping Intensity) scores to go with low Y variable (Irrigation Intensity) scores (and vice versa). Its further indicates that the cropping intensity in study area is not purely dependent on the irrigation but on the other natural, socio-cultural, economic, political, technological and infrastructural factors. The analysis of degree of correspondence among different sources of irrigation and cropping intensity in the blocks evidently point that both the surface and ground water irrigation have almost same impact on the cropping intensity of the Uplands. But the ground water resource of most blocks of the area has been over exploited and groundwater level is declining day by day.

6. Conclusion

From the above analysis, it can be said that the high proportion irrigation intensity is found in the western, north western, south western portions and some patches of central area of the Uplands. And also the highest percentage of cropping intensity can be observed in the north eastern portions and a single area of north. It indicates there is no correlation between irrigation intensity and cropping intensity in the

Uplands region. Based on the study the irrigation intensity and cropping intensity are arranged into mainly three categories based on values. These are high, moderate and medium. The high, moderate and low irrigation intensity found in thirty, thirty five and sixteen blocks. But cropping intensity is concentrated in the twenty one, fifty nine and one blocks respectively. The study also conveys the idea that there is a moderate negative correlation correspondence between irrigation intensity and cropping intensity in the blocks Uplands which further indicates that the cropping intensity in study area is not only dependent on the irrigation but on the other natural, socio-cultural, economic, political, technological and infrastructural factors.

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