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ASSOCIATION OF GROWTH OF IRRIGATED AREA AND AREA UNDER SUGARCANE: A CASE STUDY OF COMMAND AREA OF DUDHGANGA PROJECT IN KOLHAPUR DISTRICT

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Abstract

Irrigation means the supply of water to the land by means of channels, streams, and sprinklers in order to permit the growth of crops. Agriculture land use is a function of number of factors including physical and non-physical factors. Rainfall is uncertain and unpredictable in India; therefore irrigation is identified as a decisive factor. Irrigation plays most important role in agricultural land use. With the growth of irrigated area under cash crops increases considerably. With the development of perennial irrigation facility area under sugarcane is increased in western Maharashtra because it requires less laours and less capital as compare to other cash crops. Therefore attempt is made here to examine the impact of growth of irrigation on growth of area under Sugarcane in command area of Dudhganga project. The paper is mainly based on primary data. To examine the impact of growth of irrigated area on growth of area under Sugarcane. The Pearson's Coefficient of Correlation, Coefficient of determination and regression technique has been utilized. The study reveals that there is high positive correlation between growth of irrigated area and growth of area under Sugarcane in command area of Dudhganga project. It is found that increase of one per cent of irrigated area causes for increase of area under Sugarcane by 0.735 pe rcent to total net sown area in study region.

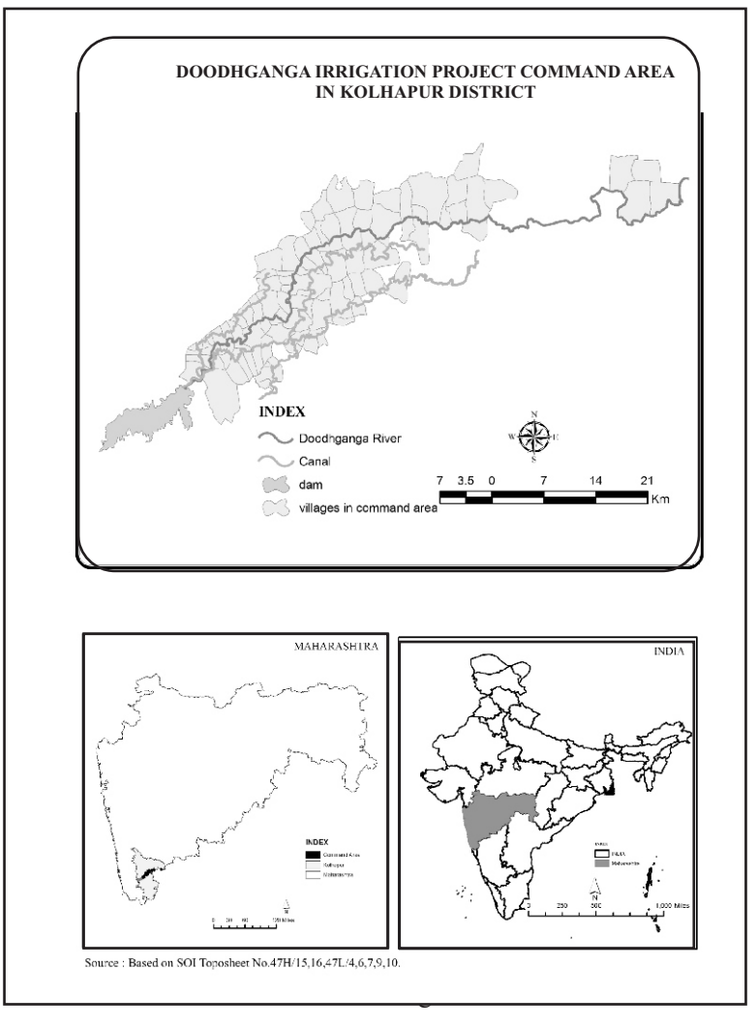
Keywords: Irrigated area, Area under Sugarcane, Correlation, Regression.

Introduction:

Among the primary activity agriculture is most important as majority of population is depends on agriculture for their livelihood (Singh & Dhillon, 1984). In modern sense the agriculture consists of practice of cultivation of crops raising livestock, fish, pig farm, goat farm and poultry. Agricultural land use and productivity are important aspects of agricultural geography. Land use is a function of four variables – land, water, air and man. Each plays its own role in composing its life history. Land constitute its body, water runs through its veins life blood, air gives it Oxygen and man acts as dynamic actor to reflect its types, pattern and distribution (Singh R.P.,1992). The varying physical conditions are indeed responsible for variations in regional patterns of agricultural phenomena. However, different degrees of combinations in institutional, biotechnological, operational, demographic, cultural and infrastructural factors influencing agricultural patterns must be considered useful. This is because the combination of these circumstances furnish the basic material needed for explaining the modifications brought about in agricultural activities which otherwise are the primary creation of natural forces. Therefore, their discussion is unavoidable to comprehend the varying levels of agricultural development from place to place at a point of time (Singh and Dhillon, 1987).

Irrigation is essentially the artificial application of water to overcome deficiencies in rainfall for growing crops (Sivarama Krishnarao and M. I. Ali 1986).This could be done by artificial application of water to land for growing crops and is known by the term “irrigation”. Irrigation is identified as a decisive factor in Indian agricultural land use due to high variability and inadequacy of rainfall. Irrigation is the watering of land by artificial means to foster plant growth (Merrium Webster's Collegiate Dictionary, 2004). Irrigation means the supply of water to the land by means of channels, streams, and sprinklers in order to permit the growth of crops (Susan Mayhew, 2004). Irrigation is basic determinantsof agriculture because its inadequacies are the most powerful constraints to change agricultural land use. With the growth of irrigated area , the area under cash crops are increasing.

Sugarecane is most important cash crop in western Maharashtra. Sugarcane is tall tropical plant with thick stems from which sugar is made (Hey & Holloway, 2015). The Sugarcane plant is classified under the genus 'saccharm' the world being derived from Sankrit word 'Sharkara'. it is locally called 'Oos'. it is the main source of Sugar in India and premier cash crop (Todkar & Dande, 2013). Sugarcane is twelve months crop and it is planted in between July- August and January. It is waterloving tropical crop and therefore requires high temperature and maximum moisture. therefore it is cultivated in those area which have perennial irrigation facility. The area under Sugarcane cultivation has increased considerably in the western Maharashtra due to development of mediam and major irrigation projects and availability of Regur soils in river basin. further more it requires less labour force as compared to other cash crops and less diligence. Now a days due to non availability of agricultural labours majority farmer prefer sugarcane. therefore it is hypothesed that higher is the irrigated area more is the area under sugarcane. So attempt is made here to assess the impact of growth of irrigated area on growth of area under Sugarcane.



Source : Based on SOI Toposheet No.47H/15,16,47L/4,6,7,9,10.

Study Area:

Dudhganga Irrigation Project is located in Kolhapur District of south Maharashtra. Dudhganga Project is mainly irrigation project and its command area
lies between 16026'15" north to 160 43' 12" north latitude and 740 01' 54" east to 740 39' 22" east longitude (Fig. 1). It is a big irrigation project built on Dudhganga river having 27.43 TMC capacity. The gross command area of this multi-state project is 93,209 hectares of which 73,340 hectares lies in Maharashtra.

Dudhganga river which gets its origin in Western Ghats and flows eastwards and joins to Krishna river in the state of Karnataka. The command area covers the parts of six tahsils in Kolhapur district, namely, Radhanagari, Bhudargad, Kagal, Hatkanagle, Shirol and Karveer comprising 96 villages. It occupies an area of 63212 hectares with population of 267275 persons (2011). The region has varied topography with narrow basin in the west which gradually broadens in the east. The study region has monsoon climate . The average maximum temperature of the region is 30.0^{c} and minimum 14.0^{c}. The region has varied type of rainfall which ranges from 5000 mm to west and 600 mm to the east. The western part of the command area is occupied by an alluvial and laterite soils and eastern part is covered with alluvial and black soils. The area is thickly populated and agriculture is the main source of livelihood of the people.

Objectives:

The main objectives of this paper are as following

1) To examine the impact of growth of irrigated area on growth of area under Sugarcane

2) To estimate the rate of change in area under Sugarcane in relation to change in percentage of irrigated area.

Data collection and Methodology:

The present study is based on primary data source. In order to meet these objectives the relevant information and data regarding irrigated area, area under Sugarcane, are collected through extensive field survey with the help of schedule, questionnaire, interview and discussion. During field survey 96 villages are assessed for which The systematic sampling method is employed and every second farmer is considered for collection of data for the pre and post irrigation project period. Directors, Secretary and chairman of cooperative irrigation institutes are also interviewed.

Collected rough data are processed. To determine growth of irrigated are a and growth of area under Sugarcane the percentage to net sown are is computed.

To examine the impact of irrigated area on area under Sugarcane the Pearson's Coefficient of Correlation technique has been utilized. The degree of relationship by considering growth of irrigated area as an independent variable 'X' and growth of area under Sugarcane as dependent variable 'Y' is measured. The functional form of linear relationship has been measured by using regression equation Y on X i.e. $y = a + bx$. The rate of change in dependent variable has been estimated with the help of 'b' coefficient, which is the line of best fit. The 't' test is used with the view to understand the confidence level. Analysis of the study has been made with help of the statistical techniques and on the basis of this results and conclusion are drawn.

Discussion:

Growth of Irrigated Area and growth of area under Sugarcane:

The table-1 indicates that irrigated area has increased in 92 villages raging from 0.89 percent to 98.23 per cent to total net sown area in the post period of project. The high growth is found in 10 villages i. e. > 66 percent because these village are situated close to Doodhganga River. The moderate growth in irrigated area is recorded in 28 villages i.e. 33 - 66 per cent, while it is less than 33 per cent in 54 villages. The negative change in percentage of irrigated area is also found in 4 villages due to

increase in net sown area in post period of project.

Table 1:Growth of Irrigated area and growth area under Sugarcane in Command area of Dudhganga project

Name of Village	Growth of Irrigated area in %	Growth of area under Sugarcane in %	Name of Village	Growth of Irrigated area in %	Growth of area under Sugarcane in %
Farale	-4.35	-1.91	Belawale Kh.	12.64	12.48
Panori	0.89	2.11	Kembali	38.46	33.19
Helewadi	-6.52	-3.62	Bachani	37.68	31.91
Bajawade	1.61	3.97	Vhanali	61.77	56.59
Mallewadi	19.66	15.03	Savarde Kh.	14.74	15.13
Mogharde	12.16	6.22	Kenavade	12.99	12.11
Solankur	8.12	10.09	Gorambe	18.45	17.42
Sulambi	41.07	40.54	Mhakave	28.71	25.43
Mangewadi	31.81	30.32	Shendur	13.73	12.74
Nartawade	16.98	15.28	Shankarwadi	78.78	61.92
Akanur	12.05	12.41	Bamani	86.02	73.17
Mangoli	56.12	52.05	Ekondi	74.23	64.26
Kapileshwar	17.21	17.38	Siddhanerli	47.36	45.33
Turambe	40.65	34.93	Vhannur	16.13	14.48
Kasarwada	9.75	9.08	Pimpalgaon Kh.	24.62	22.29
Titawe	12.54	14.08	Kagal (r)	37.50	25.21
Arjunwada	51.86	41.94	Vandoor	80.82	73.41
Talashi	19.55	17.36	Karnoor	20.66	19.32
Majagaon	32.90	24.22	Sangaon Kasaba	25.82	24.92
Thikpurli	21.18	15.4	Lingnur Dumala	32.02	27.96
Shelewadi	62.29	53.4	Sangaon Mouje	30.32	27.09
Chandre	21.38	19.01	Randivewadi	27.51	23.43
Kasabawalwe	25.39	23.03	Sulkud	49.18	46.65
Sarvade	24.78	22.11	Pimpalgaon Bk.	21.05	17.8
Kasarputale	87.46	73.32	Basarewadi	10.88	9.04
Majare Kasarwada	54.89	0.00	Pachavade	21.16	19.22
Savarde	3.25	0.94	Tikkewadi	11.01	10.14
Pandewadi	19.47	19.71	Nadhavade	39.11	35.33
Ategaon	19.27	15.49	Mudal	46.52	44.64
Dhamanwadi	98.23	67.56	Admapur	41.24	37.92
Aini	31.08	24.88	Khaparewadi	19.73	12.35
Palkarwadi	64.71	0.00	Nigave Khalsa	49.85	39.91
Dhngewadi (n.v.)	80.00	54.29	Kavane	48.35	42.39
Malve	-0.73	1.36	Chuye	22.24	14.19
Chandekarwadi	44.44	0.00	Yevati	-1.07	0.7
Undarwadi	30.37	26.77	Ispurli	59.46	51.59
Boravade	18.01	17.49	Wadakashivale	32.31	28.2
Pharakatewadi	69.16	57.37	Nagaon	28.53	22.51
Bidri	28.08	24.66	Khebavade	56.88	54.93
Valave Kh.	34.42	27.96	Nandgaon	37.85	35.46
Sonali	14.86	8.27	Dindnevli	23.69	21.5
Nindhori	36.12	30.96	Wadagaon	33.93	28.17
Kurni	23.64	21.74	Talandage	34.59	27.28
Chaundal	28.92	22.79	Yalgud	28.88	22.89
Savarde Bk.	15.43	14.47	Ghosarwad	22.87	23.13
Pirachiwadi	39.78	38.07	Takliwadi (n.v.)	38.71	40.14
Sake	16.71	16.24	Dattawad	13.70	14.38
Belawale Bk.	47.72	46.54	Danwad	70.83	52.2
				Coefficient of Correlation	+0.8821
				Coefficient of Determination	0.7781

Source: Compiled by author on the basis of field survey

The table-1 also indicates that area under Sugarcane has increased in 91 villages raging from 0.7 percent to 73.41 per cent to total net sown area in the post period of project. The high growth is found in 14 villages i. e. > 50 percent. The moderate growth in area under Sugarcane is recorded in 27 villages i.e. 25 to 50 per cent to total net sown area, while it is less than 25 per cent in 50 villages. The negative change in percentage of area under Sugarcane is also found in 2 villages due to increase in area under other cash crops. On an average area under Sugarcane is high in those villages which have high growth of irrigated area. But there are some exceptions that have high percentage of irrigated area but area under Sugarcane is low.

Impact of Growth of Irrigated area on Growth of Area Under Sugarcane:

The positive relationship between the growth of irrigated area (X) and growth of area under Sugarcane (Y) has been observed in the command area of Dudhganga irrigation project. The coefficient of correlation in this regard is at r = +0.8821. It indicates that there is a very good positive relation in between the variable 'X and 'Y'. The degree of linear association between these two variable obtained by using the coefficient of determination is found to be at 0.7781, which reveals that the independent variable (X) i.e. growth of irrigated area are explaining 77.81 per cent of the total variations in dependant variable (Y) i.e. growth of area under Sugarcane in the study area. It is a good explanation because 77.81 per cent of variation in 'Y' growth of Area under Sugarcane to be influenced by the variable 'X' i.e. growth of irrigated area and about 22.19 percent of variation is left to be influenced by other variables. The functional form of linear relationship of 'Y' on 'X' found to be at

y = 2.754+ 0.735x the line of best fists shown in figure -2.

The regression coefficient indicates that increase of one per cent irrigated area causes for increase of 0.735 percent area under Sugarcane to total net sown area in study area. By testing the significance of regression coefficient (a test of significance), the validity of this causal relationship has been confirmed.

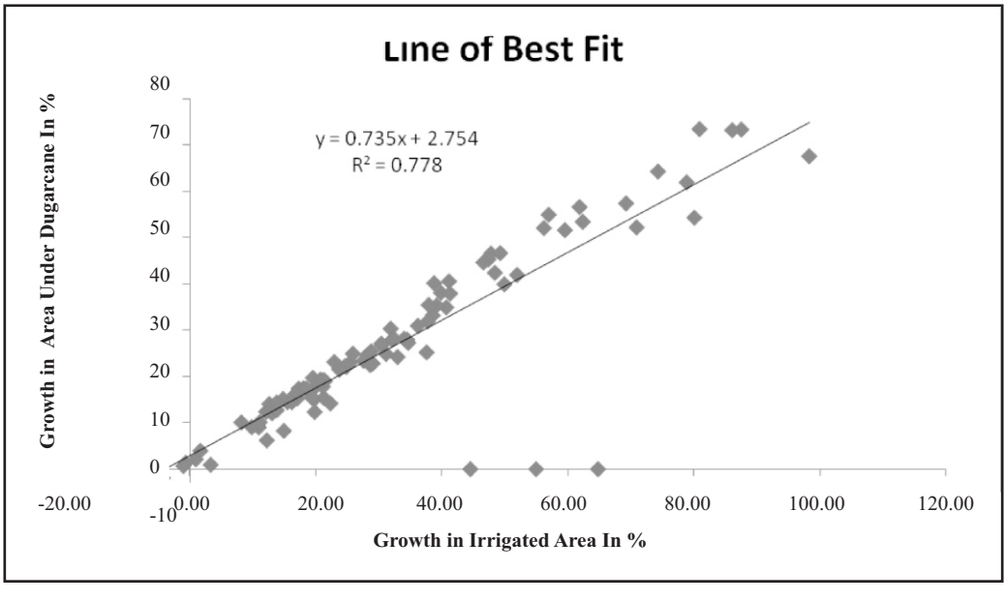


Table -2: Residuals from Regression of area under Sugarcane in Command area of Dudhganga project

Name of Village	yi	Yi-yi	Name of Village	yi	Yi-yi
Farale	-0.45	-1.46	Belawale Kh.	12.05	0.43
Panori	3.41	-1.30	Kembali	31.02	2.17
Helewadi	-2.04	-1.58	Bachani	30.45	1.46
Bajawade	3.94	0.03	Vhanali	48.16	8.43
Mallewadi	17.21	-2.18	Savarde Kh.	13.59	1.54
Mogharde	11.69	-5.47	Kenavade	12.30	-0.19
Solankur	8.72	1.37	Gorambe	16.32	1.10
Sulambi	32.94	7.60	Mhakave	23.86	1.57
Mangewadi	26.13	4.19	Shendur	12.85	-0.11
Nartawade	15.24	0.04	Shankarwadi	60.65	1.27
Akanur	11.61	0.80	Bamani	65.98	7.19
Mangoli	44.00	8.05	Ekondi	57.31	6.95
Kapileshwar	15.40	1.98	Siddhanerli	37.56	7.77
Turambe	32.63	2.30	Vhannur	14.61	-0.13
Kasarwada	9.92	-0.84	Pimpalgaon Kh.	20.85	1.44
Titawe	11.97	2.11	Kagal (r)	30.32	-5.11
Arjunwada	40.87	1.07	Vandoor	62.15	11.26
Talashi	17.12	0.24	Karnoor	17.94	1.38
Majagaon	26.94	-2.72	Sangaon Kasaba	21.73	3.19
Thikpurli	18.32	-2.92	Lingnur Dumala	26.29	1.67
Shelewadi	48.54	4.86	Sangaon Mouje	25.04	2.05
Chandre	18.47	0.54	Randivewadi	22.97	0.46
Kasabawalwe	21.42	1.61	Sulkud	38.90	7.75
Sarvade	20.96	1.15	Pimpalgaon Bk.	18.23	-0.43
Kasarputale	67.03	6.29	Basarewadi	10.75	-1.71
Majare Kasarwada	43.10	-43.10	Pachavade	18.31	0.91
Savarde	5.14	-4.20	Tikkewadi	10.85	-0.71
Pandewadi	17.06	2.65	Nadhavade	31.50	3.83
Ategaon	16.91	-1.42	Mudal	36.95	7.69
Dhamanwadi	74.95	-7.39	Admapur	33.06	4.86
Aini	25.60	-0.72	Khaparewadi	17.25	-4.90
Palkarwadi	50.31	-50.31	Nigave Khalsa	39.39	0.52
Dhngewadi (n.v.)	61.55	-7.26	Kavane	38.29	4.10
Malve	2.22	-0.86	Chuye	19.10	-4.91
Chandekarwadi	35.42	-35.42	Yevati	1.97	-1.27
Undarwadi	25.08	1.69	Ispurli	46.45	5.14
Boravade	15.99	1.50	Wadakashivale	26.50	1.70
Pharakatewadi	53.59	3.78	Nagaon	23.72	-1.21
Bidri	23.39	1.27	Khebavade	44.56	10.37
Valave Kh.	28.05	-0.09	Nandgaon	30.57	4.89
Sonali	13.68	-5.41	Dindnevli	20.17	1.33
Nindhori	29.30	1.66	Wadagaon	27.70	0.47
Kurni	20.13	1.61	Talandage	28.18	-0.90
Chaundal	24.01	-1.22	Yalgud	23.98	-1.09
Savarde Bk.	14.10	0.37	Ghosarwad	19.56	3.57
Pirachiwadi	31.99	6.08	Takliwadi (n.v.)	31.20	8.94
Sake	15.04	1.20	Dattawad	12.82	1.56
Belawale Bk.	37.83	8.71	Danwad	54.82	-2.62

Source: Compiled by author on the basis of field survey

In the case of other villages with residuals between > ± SE to >± 2 SE the situation is different because here the regression is a poor indicator. It clearly indicates that these are the villages whom the influence of variables other than the independent one. The variations in increase of area under Sugarcane of villages in the latter case may be due to the variation in rainfall and soil, variation in farmers choice, labour force and variation in capital of farmers

Conclusions:

This study reveals that there is high positive correlation between growth of irrigated area and growth of area under Sugarcane in villages of command area of Dudhganga project in Kolhapur district. The coefficient of correlation in this regard is +0.8821. The degree of linear association between these two variable obtained by using the coefficient of determination (r2) is found to be at 0.77.81, which reveals that the independent variable (X) i.e. growth of irrigated area are explaining 77.81 per cent of the total variations in dependant variable (Y) i.e. area under Sugarcane in villages of command area of Dudhganga project. The percentage of irrigated area is found to be more effective than the other variables considering increase of area under Sugarcane. The functional form of linear relationship of 'Y' on 'X' found to be at y = 2.754+ 0.735x . The regression coefficient indicates that increase of one percent irrigated area causes for increase of area under Sugarcane by 0.735 percent in study region. The confidence intervals of the predicted values states that variations in increase of area under Sugarcane of villages in command area of Dudhganga project is the function of the variations in irrigated area. Therefore it is to be stated that the increase in percentage of irrigated area is helpful to increase area under sugarcane but it is water consuming crop, which restrict extension of irrigated area. Public awareness should made regarding to cultivate other cash crops than Sugarcane to save water and to increase irrigated area in turn to increase agricultural productivity.

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