



IMPACT OF IRRIGATION ON FOOD GRAIN CROP PRODUCTIVITY IN WESTERN MAHARASHTRA: A GEOGRAPHICAL ANALYSIS.

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Abstract:

Irrigation is an age old practice. In a country like India where the rainfall is both inadequate and unpredictable; irrigation plays an important role in minimizing its adverse influence on agriculture. Agriculture stability and development depends on the availability of water for irrigation. Agriculture has always occupied an important place in Indian economy. Agricultural productivity is to know general areas where different crop dominate and their contribution in food grain crop productivity for the important crops Jawar, Bajara, Wheat, Gram and Rice have been considered. Agricultural productivity is a measure of overall performance of a region, which is quite useful in planning the developmental programmes in rural areas. Jawar is the most important cereal crop in the region, which occupies 74.75 per cent of total cereal cropped area. The Solapur, Sangli, Kolhapur, Satara and Pune districts are western part of Maharashtra. It covers an area of 57235 Sq .Km With comprise five district and 58 tehsils and population of about 23449049 as per 2011 census. All these data were collected from primary and secondary. The modified method of Jasbir Sing by considering sugarcane yield concentration and recovery indices ranking co-efficient have been applied. The Collected data indicated with the cartographic techniques. Jawar is the high productivity (below 8) of Jawar is observed in the tehsils Madha, Pandharpur, North Solapur, Wai, South Solapur, Atpadi , It shows positive effect of irrigation on productivity of Jawar.

Key Word: Food grain Productivity, High Yielding Variety,

2 Introductions

Irrigation is important aspect to the changes of the Agricultural landscape. The land is fixed in its area extent and the growing pressure of population on land resources is a major problem of the Third World Countries, where there is an acute problem of food scarcity. To feed these teeming millions, we have to increase farm production by a more intensive utilization of land and application of modern farm technology. The bulk of increased food production at least in the immediate future will come from further expansion of irrigated area and from the technology, already available in the areas with water availability (Swaminathan, 1977). During the successive plan periods, a special attention was given to the extension of irrigation in the dry areas of our country. Irrigation development and improved farm practices have tackled the basic problems of low productivity, inferior cropping pattern, subsistence agriculture and rural poverty in the rain fed areas (Singh, 1984). India has received worldwide acclaim for archiving more than fourfold increase in food grain production since independence (Pawar 2014). The level of agricultural productivity, a concept means the degree to Which the economic, cultural, technical and organizational variables (i.e. man-made frame) are able to exploit the biotic resources of the area for agricultural production (Singh 1984) Cannot be uniformly applied everywhere such studies provide a rational base for further orientation in agricultural planning. In view of the above, it is proposed to examine how irrigation affects the productivity of the crops in the study area for the important goal of irrigation is to raise per hectare yield in particular and overall productivity in general. The study of agricultural productivity has been attempted by many scholars by advising and improving different techniques (Stamp, 1953) Determining the agricultural productivity on global scale by selecting number of countries and some major crops the areal unit and ranking co-efficient was derived (Shafi 1960) applied his technique in determining the agricultural efficiency in Uttar Pradesh. Buck (1967) and many others measured the agricultural productivity in

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terms of grain equivalents per hand of population. Determining output in relation to input or output - input ratio and profitability of farming measured in terms of the return for the sum total or human efforts or paid-out-cost in relation to the output. Giving weightage to the ranking order of the output per unit area with the percentage share under each crop Sapre – Deshpande (1964) and Bhatia (1967) have calculated the productivity. Whereas Hussain (1976) measured it by money value of productivity per unit area which is applied by Shinde, Pawar and Jadhav (1978) for the Maharashtra Plateau. However, for the ensuring analysis, Jasbir Sings (1976) yield and concentration indices ranking co-efficient method is adopted, it gives due weightage to per hectare yield area occupied and ranking of various crops. A modified method of Jasbir Singh by considering sugarcane yield, concentration and recovery indices ranking co-efficient has been applied by Pujari (2004) calculating the sugarcane productivity in North Eastern part of Kolhapur district. The present study. The entire analysis is based on the empirical yield statistics collected for all the tehsils of the study region. The Solapur, Sangli, Kolhapur, Satara and Pune districts are western part of Maharashtra.

3 Objectives:

The present Research paper is examined in impact of irrigation on Food grain crop Productivity of western Maharashtra

4 Data Base & Methodology:

In the analysis primary and secondary data have been used. The primary data were collected through Schedules on field work. The secondary data were abstracted for the present analysis, from the published records of zilla Parishad of Solapur, Sangli, Kolhapur, Pune and Satara Districts. The tehsil wise data was collected and processed to calculate indices by employing statistical procedure in the present analysis for assessing a modified method of Jasbir Sing by considering sugarcane yield concentration and recovery indices ranking co-efficient has been applied. Levels of crop productivity are computed and delineated in the present study using Singh's formula as under

$$YI = \frac{Yae}{Yar} \times 100$$

Where, yI = Crop yield index

Yae = Average yield per hectare of crop 'a' in the component Enumeration unit

Yar = Average yield per hectare of crop 'a' in the region.

$$CI = \frac{Pae}{Pa} \times 100$$

Where, Ci = Crop concentration index

Pae = Percentage strength of crop 'a' in the gross area in the

Component

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Par = Percentage strength of crop 'a' in the entire region.

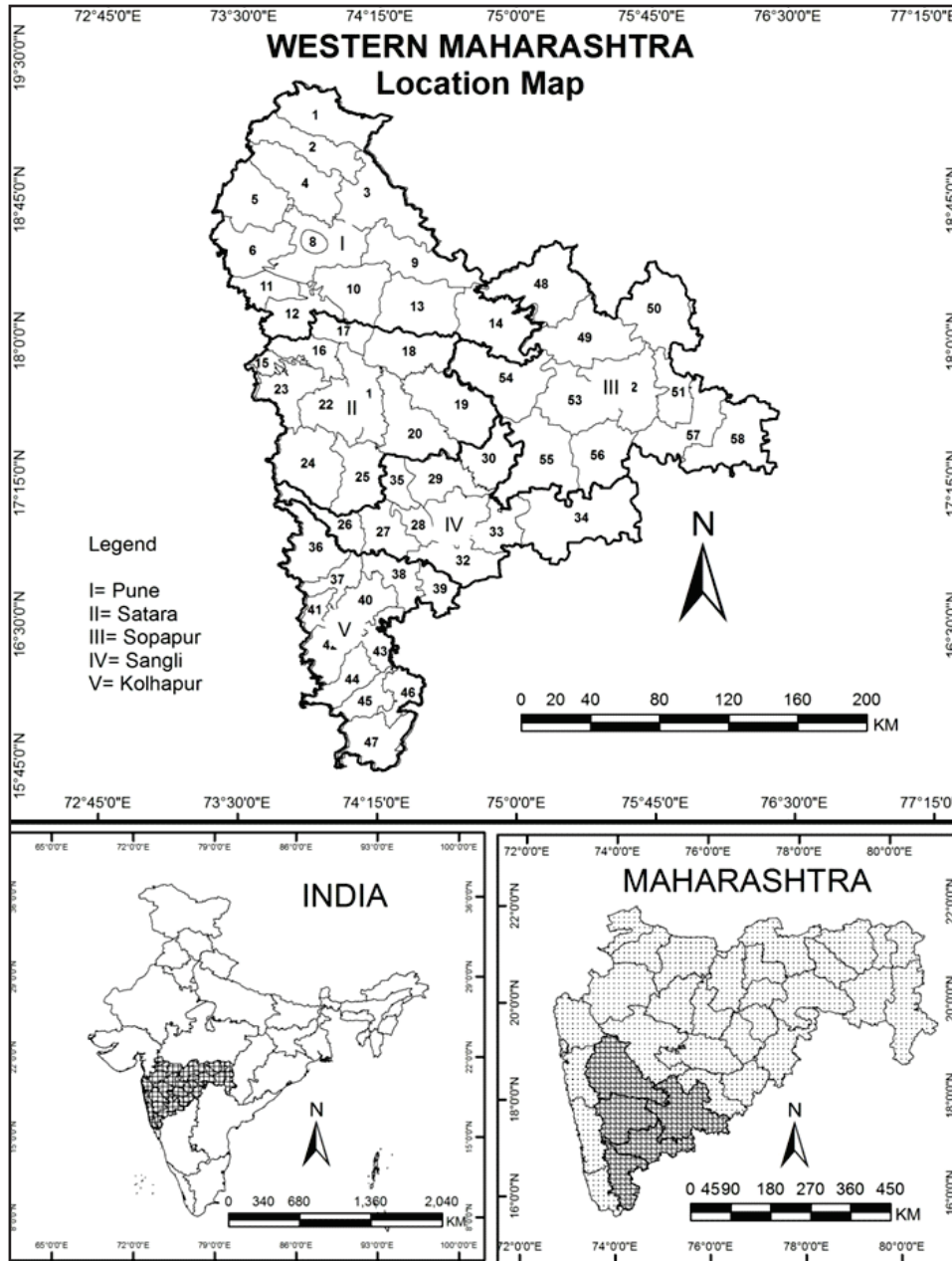
The crop yield and concentration indices thus derived for all the units and crops are ranked separately yield and concentration ranks for individual crops are added and thereafter divided by 2, thus giving the crop yield and Concentration indices ranking coefficient. The equation is as follows –
Crop yield & Crop yield index / Crop concentration / Concentration indices ranking of crop 'a' + index ranking of crop 'a' / Ranking coefficient for =

Crop 'a'

The ranking coefficients for individual crops thus derived are arranged in ascending order and the coefficient are derived into three categories i.e. high, moderate and low.

5 The Region:

The Western Maharashtra region is located in Maharashtra State. The Study region western Maharashtra extends between 15° 45' North to 19° 24' North latitudes and 73° 19' East to 76° 15' East longitudes. It covers an area of 57235 Sq. Km With comprise five district and 58 tehsils and population of about 23449049 as per 2011 census. The density of population is 347 persons. The region is surrounded by Karnataka state in the south, Konkan region in the west, Nasik in the north and the eastern boundary is surrounded by Aurangabad administrative region of Maharashtra. Fig No 1 broadly, The Physiographic of the region is uneven in nature. Higher elevation is Sahyadris. The average height of the range is 1300 meters. The highest peak of the region is Kalsubai 1646 Meters. Harishchandra-Balaghat and Shambhu-Mahadev these are the sub ranges of sahyadri, which extends in North-West and South -east direction in the study region. The major river system is Bhima and Krishna. These rivers with their tributaries flow in Southeast direction throughout the region. Sina, Nira, Ghod, Kukdi, Indrayani, Mula, Mutha, are the major tributaries of Bhima .Koyana, Yerla, Warana, Panchganga, are major tributaries of river Krishna. As mentioned earlier the study region comprises of five districts i.e. Pune, Satara, Sangli, Kolhapur and Solapur . There are total 58 tehsils in the Study region. The Solapur, Sangli, Kolhapur, Satara and Pune districts falls in Western part of the Maharashtra State. The region has Pangaon, Asthi, Ekruk, Tiangi, Maswad, Padwalkarwadi, Budhighal, Basapawdi, Siddhewadi, Doshinala, Andali, Pushpawati, Dahewale, Kasarsai, Kumbhi, Kasari, Patgaon where there are Medium irrigation projects. The Ujjani, Dudhganga, Tillari, Tulshi, Warna, Radhanagri, Koyana, Dhom, Kanher, Manikdoh, Wadaj, Dimbhe, Warasgaon, Panshet, Khadakwasala, Veer, Chasakman, Davdhar, Bhatghar, Kukadi and Balawadi, Irrigation project is the major irrigation projects in the Western Maharashtra. Takari, Tembhu, Mahishal, Kasari is the lift irrigation Projects in the Western Maharashtra, The Impact of those irrigation project on Agricultural development of western Maharashtra. The construction of the project was started in 1972. Before the severe drought, after completion of the project, the potential area under irrigation was 11, 50,581 hectare of the region. This region constructed Ujjani irrigation project envisages storage at with the canals of left and right side on the bank of Bhimariver. Takari, Tembhu and Mahishal lift irrigation schemes were established in the region. Dudhganga, Tillari, Tulshi, Warna, Radhanagri, Projects were envisages Panchganga river with the canals of Kolhapur district. Koyana, Dhom, Kanher, Khodshi projects constructed on Krishna, Koyana and Wang rivers on the Satara district. Manikdoh, Wadaj, Dimbhe, Warasgaon, Panshet, Khadakwasala, Veer, Chasakman, Devdhar, Bhatghar, Kukadi, Balawandi irrigation projects were developed in the Bhima and its tributaries in the Pune district.



6 The Regional Pattern of Food grain Crop Productivity

In the study of agricultural productivity it is of interest to know the general areas where different crop dominate and their contribution in agricultural productivity for the purpose important crops (Jawar, Bajara, Rice, Wheat. and Gram,) have been considered.

6.1 Jawar Productivity:

Jawar is the most important cereal crop in the region, which occupies 74.75 per cent of total cereal cropped area. The area under high yielding varieties of Jawar seeds is 70.05 per cent. Here different types of high yielding varieties of Jawar seeds are used like Maldandi M-35 (51.78per cent), Mahabij (12.5per cent), and Mahiko (12.5per cent). CS HS (7.14per cent), Swati (5.35per cent), CSH-9 (5.35per cent) and Paras-67 (5.35per cent) etc Table No 1 in the study region per hectare yield of Jawar is 19.05 quintals which is higher than average of state yield (8.23 quintals).

The figure 2 exhibits the distributional pattern of productivity of Jawar. The high productivity (below 8) of Jawar is observed in the tehsils Madha, Pandharpur, North Solapur, Wai, South Solapur, Atpadi, These tehsils comprises about 84.48 percent of the total Jawar area. Here intensity of irrigation is high 89.65per cent. It shows positive effect of irrigation on productivity of Jawar. But the area under Jawar is replaced by Sugarcane crop. The per hectare water use for Jawar is 33 ha. Cm. And fertilizer consumption is 53.33 kg.ha. It is lower than standard requirement of both water and fertilizers. The total water use of Jawar is 123205.5ha.cm. And total fertilizer consumption is 199107 kg. Here area under high yielding varieties of Jawar seeds is 70.33per cent of total area under Jawar per hectare yield of Jawar is 23.16quintals and total yield of Jawar is 86481quintals in this area. It is higher than moderate and low category area.

Table 1
Per hectare yield of Jawar according to high yielding varieties in Western Maharashtra

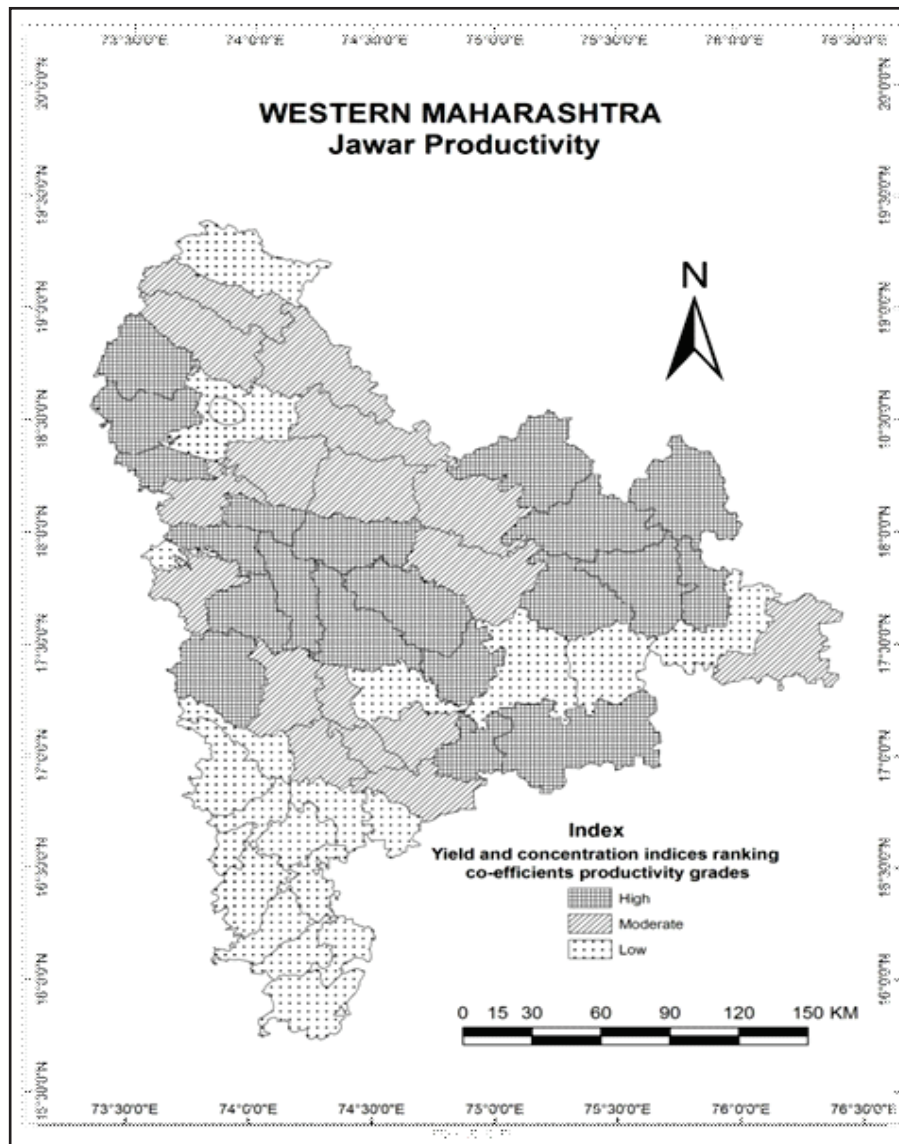
Sr. No.	Jawar H.Y.V.	Per hectare yield in quintal	Percentage of Jawar area
1	Maldandi M-3	23.95	51.78
2	Mahabij	22.85	12.5
3	Mahiko 51	36.77	12.5
4	Swati	27.5	5.35
5	- . .	19.5	7.14
6	CSH – 9	31.65	5.35
7	Paras – 67	42.5	5.35

Source – Compiled by the researcher based on the field work 2014.

The Moderate productivity of Jawar noted in the tehsils of Malshiras, Indapur, Kadegaon, Karad, Baramati, Palus, Tasgaon, and Bhore These tehsils comprises 2.56per cent of the total Jawar area. Here intensity of irrigation 56.24per cent is high and proportion of deep black soils (58.55per cent) is high. Per hectare water use of Jawar is 49 ha.cm and fertilizer consumption is 65 kg. ha. It shows moderate use of water and fertilizer to Jawar crop in this area. Here area under high yielding varieties of Jawar seeds is 74.18 per cent of total area under Jawar per hectare yield of Jawar is 18.62 quintals The low productivity (above 16) of Jawar is found in the tehsils of Karveer, Junner, Hatkanagale, Chandgad and Kagal, these tehsils comprises 0.24 per cent of the total Jawar area. Here intensity of irrigation is high 77.71per cent. The area under low productivity is insignificant. Here per

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hectare water use of Jawar is 29 ha.cm. And fertilizer consumption is 98 kg.ha, which is also lower than the standard requirements. The area under high yielding varieties of Jawar seeds is 74.8 per cent in this area per hectare yield of Jawar is 11.4quintals.



6.2 Bajara Productivity

Bajara is Second important cereal crop in the region. Which occupies 12.88 per cent of total cereal cropped area. Most of the tehsils are included in high productivity region of Bajara. It covers an area of about 6.6 per cent of total Bajara cropped area. It is the state average yield of 7.65 quintals. In the study region area under improved variety of Bajara seeds is 50.08 per cent. The different types of H.Y.V. of Bajara used are like Mahabij (62 per cent), Mahiko (18 per cent) I.C.T. (8 per cent) P 8203

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(12per cent) W.C.C. 75 (8 per cent) etc. (Table – 2)

The analysis reveals that the high productivity (below 7) of Bajara is observed in the tehsils of Malshiras, North Solapur, South Solapur, Indapur, Koregaon, Pandharpur fig. 3 The area under high productivity contributes 60.15 per cent of the total Bajara productivity. Bajara is cultivated on the course shallow and well drained places of land therefore it is stable in irrigated area particularly in the region.

Here intensity of irrigation is 89.65 per cent and pro portion coarse shallow 52 per cent. The fertility of soil and availability of surface and ground water irrigation are most favorable for Bajara cultivation. Here per hectare water use of Bajara is 80.44 ha.cm. And fertilizer consumption is 80.10 kg.ha. The Per hectare yield of Bajara is 14.95quintal and total yield of Bajara is 8013.2quintals in this area.

The moderate productivity (7 to 14) of Bajara is noted in the tehsils of Tasgaon, Wai, Mangalwedha, Bhor, Atpadi, Barshi, Junner, Baramati and Madha intensity of irrigation is high 84.31per cent. The area under moderate productivity contributes to only 39.28 per cent of the total bajara area. Here per hectare water use of Bajara is 65 ha.cm. And fertilizer consumption is 73Kg ha. It is shows Moderate consumption of water and fertilizer. Per hectare yield of Bajara is 14.94 quintals.

The low productivity above 14 of which is observed in the tehsils of Karad, Palus, Kadegaon, Hatkanagale were intensity of irrigation is also low. The area under low productivity contributes an area about 0.56per cent of total Bajara area. It is observed in the tehsils were irrigated is developed and the area is replaced by irrigated crops viz. Sugarcane, Wheat etc Here per hectare water use of Bajara is 58.64 ha.cm. and fertilizer consumption is 67.85 kg. ha. Per hectare yield of Bajara is 12.5quintals. It is lower than high and moderate category regions of Bajara productivity Fig 3

Table 2

Per hectare yield of Bajara according to high yielding varieties in Western Maharashtra

Sr. No	Bajara H. Y. V.	Per hectare yield in quintals	Percentage of Bajara area
1	Mahiko	44.32	62
2	Mahabij	39.67	18
3	ICT	37.95	8
4	P .8203	33.99	12
5	W. C. C .75	28.45	8

Source – Compiled by researcher based on the field work 2014.

6.3 Rice Productivity

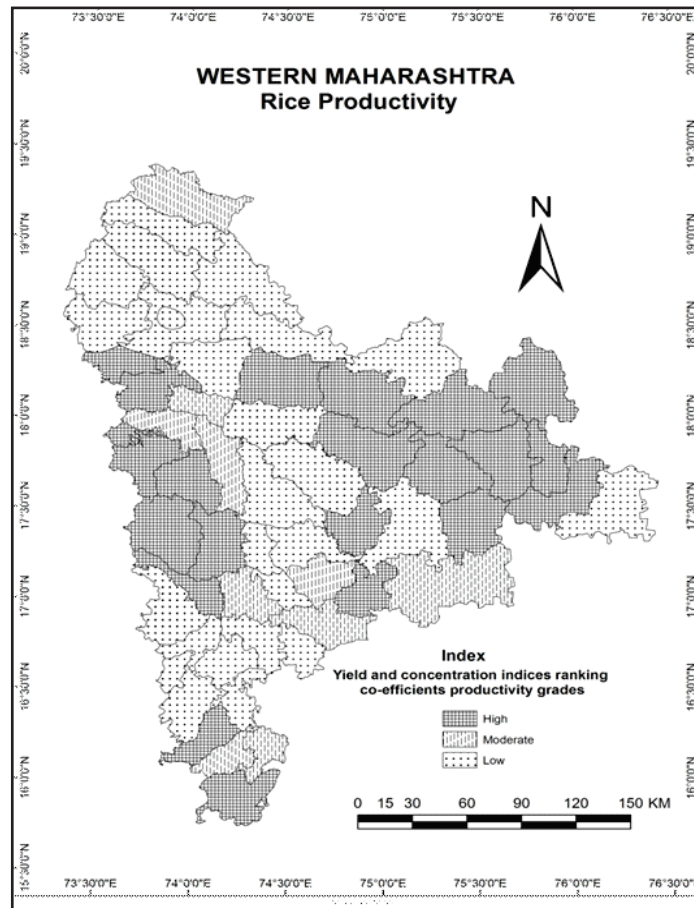
Rice is third important cereal crop in the region. Which occupies about 10.42 per cent of total cereals cropped area. Most of the tehsils are included in high productivity region of Rice. It covers an area of about 1.9 per cent of total rice irrigated cropped area the state average yield of 15.61 quintals. In the study region area under improved variety of rice seeds is 42.27 per cent. The different types of H. Y. V. of rice used are like Indriyani (44per cent), Ratre (local)(23.33per cent). Ratna (11.21per cent), Karjat (6.46 per cent) and Sahyadri-1(4.33per cent) etc

The analysis reveals that the high productivity (below 4) of Rice is observed in the tehsils of Bhor, Karad and Chandgad. Fig.4 The area under high productivity contributes 21.52per cent of the total Rice area, Rice is the tehsils situated in the south western part and south central part records high

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productivity. This can be well attributed to the favorable agro climatic condition prevailing in these parts along with assured rainfall and irrigation facilities. The per hectare yield of Rice is 53.16 quintal and total yield of Rice is 781.54 quintals in this area.

The moderate productivity (4 to 8) of Rice is noted in the tehsils of Kadegaon, Pusegaon, Tasgaon, Junner and Wai intensity of irrigation is moderate (62 per cent). The area under moderate productivity contributes to only 65.44 per cent of the total Rice area. Here per hectare water use of Rice and fertilizer consumption is well. The per hectare yield of Rice is 37.8 quintals and total yield of Rice is 1689.66 quintals in this area. The low productivity (below 8 per cent) of Rice is observed in tehsils of Karveer, Palus, Kagal and Hatkanagale where intensity of Irrigation is also low. The area under low productivity contributes an area about 13.03 per cent of total Rice area. Here per hectare water use of Rice and fertilizer consumption is low of standard requirement. The per hectare yield of Rice is 33.03 quintals. It is lower than high and moderate category regions of

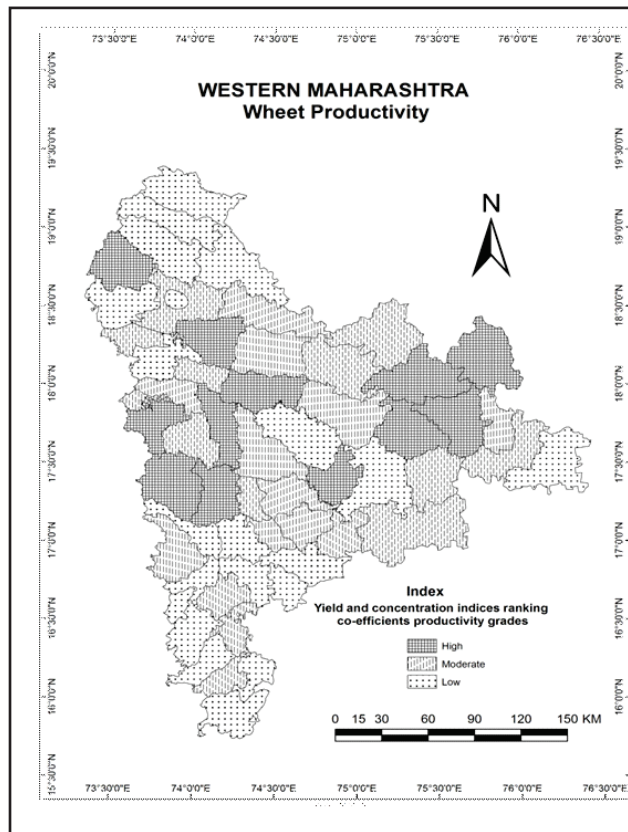


6.4 Wheat Productivity

Wheat is fourth important cereal crop in the region. Which occupies 4.33 per cent of total cereals cropped area. Most of the tehsils are included in high productivity region of wheat. It covers an

area of about 7.61 per cent of total wheat irrigated cropped area the state average yield of 14.86 quintals. In the study region area under improved variety of wheat seeds is 88 per cent. The different types of H. Y.V. of wheat used are like H.D. 2189 (60per cent), KalayanSona (13.33per cent). Western C-11 (13.33per cent), Kali Kusali (6.66 per cent) and H.D. 2184 (3.33per cent) etc. (Table No.3)

The analysis reveals that the high productivity (below 7) of wheat is observed in the tehsils of Madha, Koregaon, Karad, Atpadi and Pandharpur. Fig.5The area under high productivity contributes 34.03 per cent of the total wheat area, because at present the trend of farmers is to bring more area under sugarcane crop. Here intensity of irrigation is 58.89 per cent and proportion of black soil is 63.32 per cent. The fertility of soil and the availability of surface and ground water irrigation are most favorable for wheat cultivation. Here per hectare water use of wheat is 100.66 ha.cm and fertilizer consumption is 84.16 kg.ha. The per hectare yield of wheat is 41.2quintal and total yield of wheat is 40804 quintals in this area.



The moderate productivity (7 to 14) of wheat is noted in the tehsils of Malshiras, Mangalwedha, North Solapur, Kadegaon, Baramati, Karveer, Palus, Tasgaon, South solapur, Indapur, Wai and Kagal intensity of irrigation is high (93.97per cent). The area under moderate productivity contributes to only 65.70 per cent of the total wheat area. Here per hectare water use of wheat is 153.66 ha.cm and fertilizer consumption is 95.50 kg hectare. The per hectare yield of wheat is 35.38 quintals.

The low productivity (above 14) of wheat is observed in tehsils of Hatkanagale, Bhor, Barshi, Junner and Chandgad were intensity of Irrigation is also low. The area under low productivity

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contributes an area about 0.15 per cent of total wheat area. Here per hectare water use of wheat is 95 ha.cm and fertilizer consumption is 109 kg.ha. The per hectare yield of wheat is 24.65 quintals. It is lower than high and moderate category regions of wheat productivity

Table 3
Per hectare Yield of Wheat according to high yielding varieties in Western Maharashtra

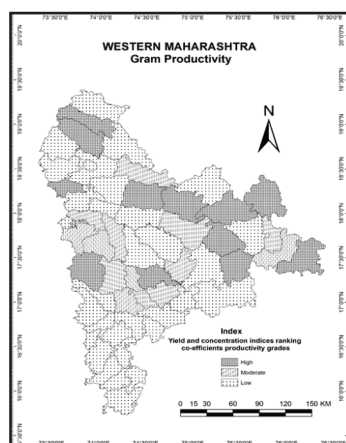
St. No.	Wheat H.Y.V.	Per hectare yield in quintal	Percentage of Wheat area
1	H.D. 2189	31.25	60
2	KalyanSona	30	13.33
3	Western G – 11	37.5	13.33
4	Kali Kusali	28.32	6.66
5	Gujarat	27.5	3.33
6	H.D. 2164	30	3.33

Source – Compiled by researcher based on the field work 2014.

6.5 Gram Productivity

Gram is most important pulses crop in the region. Which occupies 43.07 per cent of total pulses cropped area. It covers an area of about 3.59 per cent of total Gram cropped area. The Region per hectare yield is 7.07 it is higher than the state average yield of 7 quintals. In the study region area under improved variety of Gram seeds is 83.38 per cent. The difference types of H. Y. V. of Gram used are like Vikas, Phule, G- 12, Vishwas, Vijay, vishal, ICV -10 etc.

The analysis reveals that the high productivity (below 8) of Gram is observed in the tehsils of Pandharpur, Mangalwedha, Barshi, Indapur, Baramati and Madha. Fig. the area under high productivity contributes 56.58 per cent of the total Gram productivity. Here the intensity of irrigation is 94.33 per cent. The fertile soil and availability of surface and ground water irrigation are most favorable for Gram cultivation. Here per hectare water use of Gram is



97.32 ha.cm. And fertilizer consumption is 65 kg.ha. The per hectare yield Gram is 33.5 quintals and total yield of Gram is 23182 quintals in this area.

The moderate productivity (8 to 16) of Gram is noted in the tehsils of Tasgaon, Wai, Palus, Atpadi, Pusegaon, Karad, Malshiras, Kadegaon, North Solapur, and south Solapur. Intensity of irrigation is 60 per cent. The area under Moderate productivity contributes to 43.11 per cent of the total Gram area. Here per hectare water use of Gram is 77.20 ha.cm. and fertilizer consumption is 57 kg ha. Per hectare yield of Gram is 31.5 quintals. Fig 6

The low productivity (above 16) is observed in the tehsils of Karveer, Kagal, Hatkanagale, Junner, Bhor and Chandgad. Here intensity of irrigation is 73.69 per cent. And low productivity contributes an area about 0.36 per cent of Gram. Here per hectare water use of Gram is 68.65 ha.cm. and fertilizer consumption is 54.44 kg.ha. Per hectare yield of Gram is 16.16 quintal.

6.6 Overall Agricultural Productivity

A study of the spatial variation in agricultural productivity is useful for differentiating area of poor performance from the other more productive one. In developing countries land is limited to permit any expansion of cultivated area and the increasing pressure of population on land compels the Geographers and agricultural scientists to think for the improvement of agricultural efficiency (Singh 1976). Thus to solve the food problem a suitable strategy seems to increase production per unit area and per unit of time.

The measurement of overall agricultural productivity is useful to know the weaker areas of the region from the point of view of agricultural production further it becomes useful to the planner to give more attention to improve the productivity of weaker areas by adopting the new techniques advised by scientist. Moreover, in any scheme of removing regional imbalance in agriculture, it is of importance to know the area which are under developed and need more attention to be paid for advancement of agriculture (Hussain, 1979) Jyotiram More (2014). The overall pattern of crop productivity is determined according to the method developed by Jasbir Sing (1976)

Areas of High Productivity Figure 7 exhibits the pattern of overall levels of productivity for selected crops the high productivity (below 10) is observed in the tehsils of Mangalwedha, Madha, North Solapur, Malshiras, South Solapur, Koregaon and Atpadi. These tehsils comprises about 53.41 per cent of total cropped area. The high level of productivity could be attributed to high intensity of irrigation presence of fertile clay loam soils, Availability of modern inputs innovative techniques and fertilizers application. Here intensity of irrigation is high (74.27 per cent) the proportion of black soils (75.84 per cent) and plain area is high (79 per cent).

Here irrigation facilities are good. It is evident that these tehsils are in changing forward in agricultural productivity, which increases in irrigated area in association with introduction of improved seeds fertilizer and technology. As rightly pointed out by (Murthy 1976) "Irrigation, the basic input in most part of the cultivated land in our country has played a vital role in stepping up food production, as other inputs like fertilizers improved seeds etc. contribute their due share only when assured water supply is available." Here per hectare water use is 147 ha. Cm and fertilizers consumption is 204 kg.ha. Here per hectare yield is 1330 quintals, which is higher than per hectare yield of state average (790 quintals.) (Table-4)

The state level study regarding agricultural productivity carried out by Shinde et.al. (1978) also reveals that Solapure District (in which Karmala, tehsil rank top) stands supreme for it is endowed with favorable physico-socio-economic factors to a developed agricultural economy.

The moderate productivity (10 to 15) is noted in the tehsils of Indapur, Karad, Baramati, Barshi, Wai, Tasgaon, Kadegaon, Karveer and Kagal. It occupies area of about 1.42 per cent of total cropped area. Here intensity of irrigation is moderate 63.14 and intensity of black soil is high (78.66 per cent). Here per hectare water use (142 ha.cm.) and fertilizer consumption 216 kg.ha. Are high, per

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hectare yield is 1490kg.

The low productivity (above 15) is confined to the tehsils of Junner, Chandgad, Bhor, Palus and Hatkanagale infertile resulting into low level of productivity. It occupies area of about 0.38 per cent of total cropped area

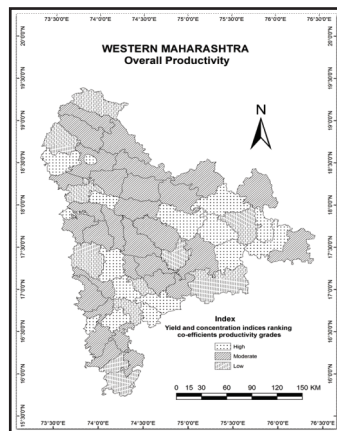
Therefore these are the weaker areas of the region where efforts have to be made to enhance the productivity. In fact these are the priority areas which need special attention of the agricultural scientist planners as well as central and state government agencies to executive future development schemes of agriculture. The region is Undulating topography.

Table 4
Food grain crop per hectare yield in Western Maharashtra (Yield in Quintal)

Sr.No.	Crop	1982-83	2013-2014
1	Bajara	5	15.17
2	Rice	14	40.05
3	Jawar	20	19.05
4	Wheat	13	34.18
5	Gram	5.31	26.59

Source - complied by researcher based on the field work 2014

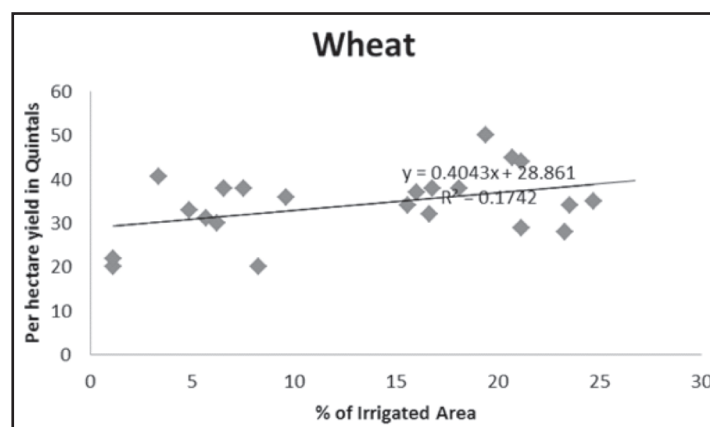
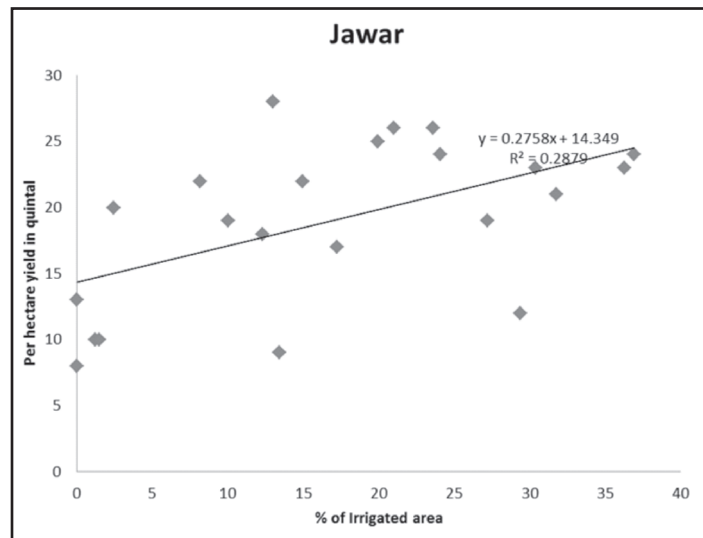
It contributes an area of about 0.38 per cent of cropped area. Here topography is undulating; the soils are very shallow and lie over rocky substrata. Thus in this category hilly area is 56.16 per cent, foot hill area is 33.8 per cent and coarse shallow soil is 20.8 per cent. It is higher than moderate and low category region. Here intensity of irrigation is comparatively low (48.20 per cent). Therefore per hectare water use is low (103 ha.cm.) and fertilizer consumption is also low (211 kg/ha) per hectare yield of this category is 1417 quintal high level of productivity could be attributed to adverse physical condition this tract In the study area Per hectare yield is high during period due to the Ujjani irrigation project, irrigation facilities were developed in the Solapur district and another Tambhu, Takari and Mahisal, Kumbhi, Kasari lift irrigation were fully capacity developed to the irrigation on agriculture in the tehsils of Sangli, Satara, Kolhapur districts of western Maharashtra. Table No 4, Fig No 7

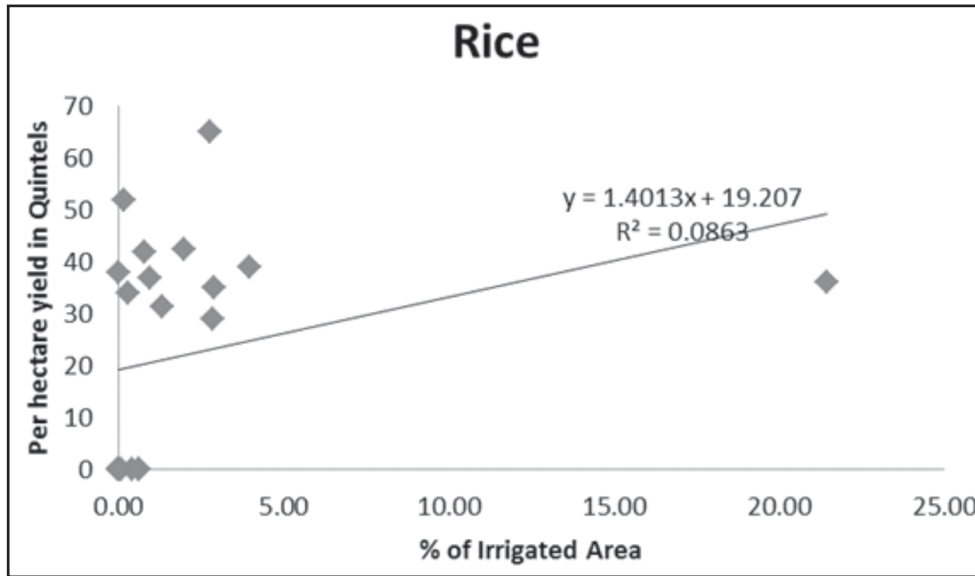


7 Correlation Analyses

Irrigation is one of the most significant inputs for the proper growth of plants. It is observed during the study period that the assured irrigation facilities have been considerably developed in the study region and due to the ample availability of irrigation facilities, the modern inputs have been widely adopted by the farmers of study area which has resulted in increasing per hectare yield of crops. Thus the irrigation played vital role in accelerating per hectare yield and total production in the study region.

The co-relation between irrigated area and yield of individual crops viz. Bajara, Jawar, Rice, Wheat and Gram is examined by regression technique and the results derived are shown in Figure. 8 The positive correlation between irrigated area and per hectare yield is observed in case of Jawar ($r = 0.53$), Wheat ($r = 0.41$), Bajara($r=0.40$) Gram ($r=0.36$), Rice($R=0.29$) these correlation ships are positive and significant co relationship has been observed between intensity of irrigation and per hectare yield of these crops.





8 Conclusions:

Jawar is the most important cereal crop in the region. The high productivity (below 8) of Jawar is observed in the tehsils Madha, Pandharpur, North Solapur, Wai, South Solapur, Atpadi, These tehsils comprises about 84.48 per cent of the total Jawar area. Here intensity of irrigation is high 89.65 per cent. It shows positive effect of irrigation on productivity of Jawar. But the area under Jawar is replaced by Sugarcane crop. The per hectare water use for Jawar is 33 ha. Cm. And fertilizer consumption is 53.33 kg. ha The low productivity (above 16) of Jawar is found in the tehsils of Karveer, Junner, Hatkanagale, Chandgad and Kagal, these tehsils comprises 0.24 per cent of the total Jawar area.

Bajara is Second important cereal crop in the region. The analysis reveals that the high productivity (below 7) of Bajara is observed in the tehsils of Malshiras, North Solapur, South Solapur, Indapur, Pusegaon, Pandharpur. The area under high productivity contributes 60.15 per cent of the total Bajara productivity. The low productivity above 14 of which is observed in the tehsils of Karad, Palus, Kadegaon, Hatkanagale were intensity of irrigation is also low. The area under low productivity contributes an area about 0.56 per cent of total Bajara area. It is observed in the tehsils were irrigated is developed and the area is replaced by irrigated crops viz. Sugarcane, Wheat etc

Rice is third important cereal crop in the region. The analysis reveals that the high productivity below 4 of Rice is observed in the tehsils of Bhor Karad and Chandgad. The area under high productivity contributes 21.52 per cent of the total Rice area, Rice the tehsils situated in the south western part and south central part records high productivity. The low productivity (above 8) of Rice is observed in tehsils of Karveer, Palus, Kagal and Hatkanagale were intensity of Irrigation is also low. The area under low productivity contributes an area about 13.03 per cent of total Rice area. Wheat is fourth important cereal crop in the region. The analysis reveals that the high productivity (below 7) of wheat is observed in the tehsils of Madha, Koregaon, Karad, Atpadi and Pandharpur. The area under high productivity contributes 34.03 per cent of the total wheat area, because at present the trend of farmers is to bring more area under sugarcane crop. The low productivity (above 14) of wheat is

observed in tehsils of Hatkanagale, Bhor, Barshi, Junner and Chandgad were intensity of Irrigation is also low. The area under low productivity contributes an area about 0.15 per cent of total wheat area. Gram is most important pulses crop in the region. The analysis reveals that the high productivity (below 8) of Gram is observed in the tehsils of Pandharpur, Mangalwedha, Barshi, Indapur, Baramati and Madha. The low productivity (above 16) is observed in the tehsils of Karveer, Kagal, Hatkanagale, Junner, Bhor and Chandgad Here intensity of irrigation is 73.69 per cent. The high productivity (below 10) is observed in the tehsils of Mangalwedha, Madha, North Solapur, Malshiras, South Solapur, Koregaon and Atpadi. These tehsils comprise about 53.41 per cent of total cropped area. The high level of productivity could be attributed to high intensity of irrigation presence of fertile clay loam soils, Availability of modern inputs innovative techniques and fertilizers application. The low productivity (above 15) is confined to the tehsils of Junner, Chandgad, Bhor, Palus and Hatkanagale infertile resulting into low level of productivity. It occupies area of about 0.38 per cent of total cropped area. In fact these are the priority areas which need special attention of the agricultural scientist planners as well as central and state government agencies to executive future development schemes of agriculture. The positive correlation between irrigated area and per hectare yield is observed in case of Jawar ($r = 0.53$), Wheat ($r = 0.41$), Bajra ($r = 0.40$) Gram ($r = 0.36$), Rice ($r = 0.29$) these correlations are positive and significant co relationship has been observed between intensity of irrigation and per hectare yield of these crops

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