

## **An Assessment Impact of Irrigation on Cropping Pattern in Solapur District with Special Reference of Case Study in Sample Selected Villages**

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### **Abstract:**

*The present research paper has been made an attempt in to analyses an assessment impact of irrigation on cropping pattern in Solapur district with special reference of case studies in sample villages. This study is based on primary data collected from questionnaire and personal interview methods. The Physical, climatologically, socio-economic, technological, organizational factors, and farmer's attitude, etc. determinants closely influenced on the cropping pattern in study region, but in the study area irrigation is an important determinant affected on the cropping pattern. The collected data regarding area under different crops has been computed with the help of Weaver's Minimum Positive Deviation Method of cropping pattern. It has observed that the more variations in the cropping pattern in village to village in study area. In the study area the village are found to two crop combination of Mundhewadi their identify and the number of crops in the basic combination as SW (Sugarcane-Wheat) and the Ten crop combination obtained in the village of Jainwadi their identify the number of ten crop combination as SMPWGnFVGBaJ (Sugarcane- Maize- Pomegranate- Wheat-*

*Groundnut- Fodder- Vegetables- Grape- Bajara- Jowar). Present study gives an idea of realisation of cropping pattern in village level and helps to minimize the village level inequalities and helpful for proper planning of the agricultural practices to the farmers. Also helps to planners, agricultural scientists and research scholars.*

**Key words:** Irrigation, Cropping Pattern, Crop Combination, Determinants.

### **Introduction:**

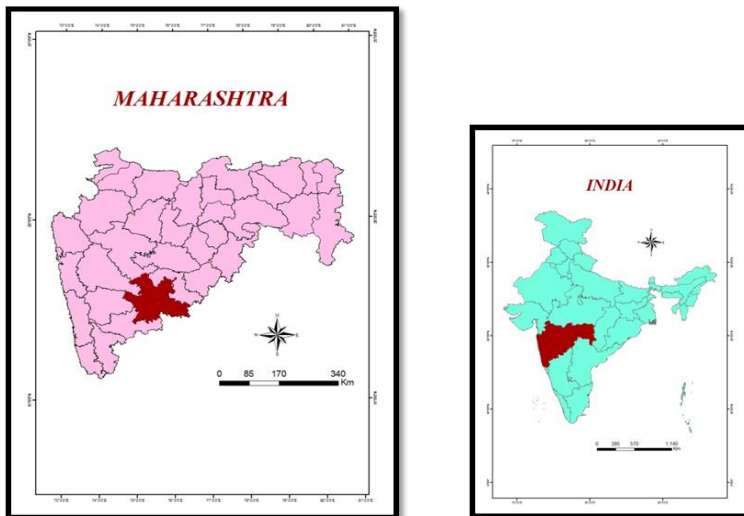
Only 11 per cent of the total land portion of the world is under cultivation, which is 1441 million hectare whereas in India cropland area is 141 million hectare, which is 46 per cent of the land area of the country (Kushwaha, 2008). Agricultural land use is depends on good suitable climatic condition (rainfall, temperature, moisture, etc.), water resources, physical situation (topographical i.e. soil, slope, terrain), technology (seeds, chemical and fertilizers), socio-economic and organizational factors. Agriculture is described as the backbone of Indian economy, mainly because of three reasons. First, agriculture constitutes largest share of country's national income though the share has declined from 55 per cent in early 1950s to about 25 per cent by the turn of 20<sup>th</sup> Century. Secondly, more than half of India's workforce is engaged in its agriculture sector. Third, growth of other sectors and overall economy depends on performance of agriculture to a considerable extent (Chand 2005). Agriculture is the prime and one most the important activity for the survival of the mankind and his animals.

In India about 70 per cent of the total population is directly or indirectly engaged in agriculture sector. As population is increasing the pressure of agriculture is also increasing eventually government is taking steps towards increasing the crop production. The attempts are made to increase the yield by improving the traditional methods and

using HYV seeds, chemical fertilizers, agricultural mechanization and advance methods of agricultural cultivation and also the land utilization is also changing from single crop to multi crops dependant on the development of irrigation facilities as a region or area. It means that the irrigation is an important determinant to the development of agriculture and the cropping pattern of an area.

The agricultural land under different crops in Solapur district is not only having close relation with physio-climatic conditions but also socio-economic and infrastructural facilities are also important for the agricultural practices. In Solapur district rainfall is very uneven, uncertain and inadequate and scanty because location of the district is drought prone area. Therefore, irrigation is a significant determinant influenced on the agricultural practices and changing pattern. So, in this study is an attempt to make to understand the variations of agricultural practices due the unequal availability of irrigation facilities in the study area with the references of case studies in the Pandharpur (irrigated) and Sangola (non-irrigated) tehsils.

### ***Study Area***



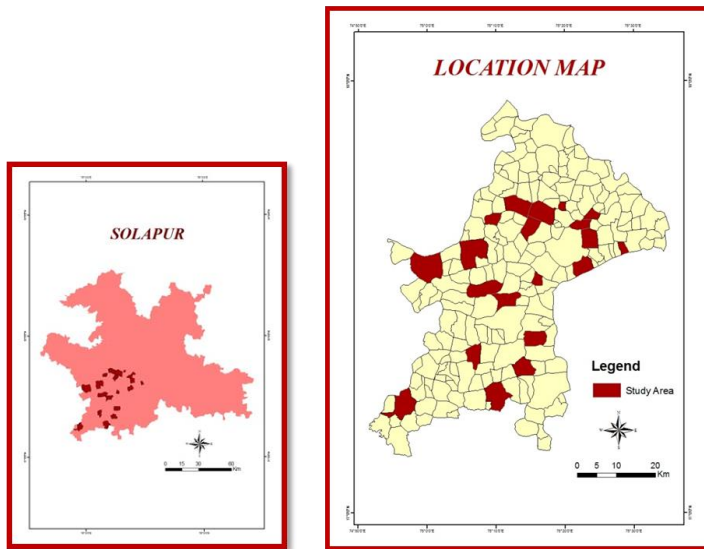


Figure 1: Location Map of Study Area

Solapur district is situated in the western part of Maharashtra state. The district lies between  $17^{\circ} 10'$  to  $18^{\circ} 32'$  North latitude and  $74^{\circ} 42'$  to  $76^{\circ} 15'$  East longitude. It is bounded by Pune and Satara district to the West, Osmanabad district to the east, Sangli district and Karnataka state to the South, Ahmdnagar district to the North. The total geographical area of the district is 14,895 sq. km with population of 43.16 lakh of which 22.34 lakh were males and 20.82 lakh females as per 2011 census. The maximum and minimum temperature throughout the year is  $40.1^{\circ} \text{C}$  and  $16.1^{\circ} \text{C}$  respectively with an average rainfall of 561.47 mm annually. In the year 2008-09, the total area under crop cultivation was 10,30,900 hectares of which 2,27,100 hectare was irrigated and 7,59,900 hectare was non-irrigated or rainfed area. Jawar, bajara, maize, millets, groundnut and soybean are the major crops grown in *kharif* season, whereas, wheat, potato, gram, tur are the important crops grown in *Rabi* season. Sugarcane is the important commercial crop raised in the district.

### **Aim and Objectives:**

The present study is undertaken with the specific objectives of the investigation as follows.

- To assess the impact of irrigation on the general cropping pattern and crop combination in the selected study area.

### **Database:**

Study of agricultural pattern in Solapur district with references of selected sample villages in the tahsils of Pandharpur and Sangola are conducted with the help of primary and secondary data.

The primary data is collected through field observation, field survey, questionnaire and personal interview method with the farmers and talathi of the village and the secondary data will be obtained from various sources i.e. Survey of India, Census of India, Statistical abstracts of Solapur district, Socio-economic reviews, National sample surveys, Irrigation Department, Agriculture Research Division, Grampanchayat and Talathi offices, etc.

### **Methodology:**

The detail study of agricultural pattern is conducted to understand the variations in the agricultural practices. In this concern cropping practices with the help of crop combination, crop diversification, crop concentration techniques are applied for the identification of variations in the agricultural practices in the villages to village. The collected area under different cropping data is tabulated, arranged in proper format and statistical methods are applied for the obtaining results. A comparative analysis is made among 20 villages with 20 farmers to each village to understand the cropping condition of

the year due the variations in the irrigation facilities. The identification of intensity of cropping in the villages of case studies on the basis of spatial distribution of irrigation facilities.

To study the agriculture land use and cropping pattern there are several statistical techniques or methods available which provides truthful results. The details in the cropping practices are studied in a scientific manner using crop combination, crop concentration and diversification methods.

### **Weaver's Minimum Positive Deviation Method:**

J.C. Weaver has applied least standard deviation technique for computing crop combination of a region in 1954. It is known as Maximum Positive Deviation Method or Weaver's Crop Combination Method. In his work Weaver calculated deviation of the real percentages of crops occupying over 1 per cent of the cropped area all the possible combinations in the component areal units against a theoretical standard. He had used the theoretical curve for the standard measurement was employed as follows.

- Monoculture = 100 per cent of total harvested crop land in one crop
- 2 - Crop Combination = 50 per cent in each of two crops
- 3 - Crop Combination = 33.33 per cent in each of three crops
- 4 - Crop Combination = 25 per cent in each of four crops
- 5 - Crop Combination = 20 per cent in each of five crops
- 10- Crop Combination = 10 per cent in each of ten crops

Following formula was used for the determination of minimum deviation the standard deviation.

$$SD(\bar{d}) = \sqrt{\frac{\Sigma d^2}{n}}$$

**Where,**

**d** is the difference between the actual crop percentage in a given areal unit and the appropriate percentage in the theoretical curve.

**n** is the number crops in a given combinations

As Weaver pointed out, the relative, not absolute value being significant, square routes were not extracted so, the actual formula used was as below

$$SD = \frac{\Sigma d^2}{n}$$

### **General Cropping Pattern in Selected Villages:**

The cumulative effect of farmer's decision regarding the choice of crops, the method of tillage and his appreciation of the land resources is reflected in the spatial variation in agriculture land-use due to the availability of irrigation in the area. Cropping pattern means the proportion of area under various crops at a point of time or yearly sequence and spatial arrangement of crops. Cropping pattern is a dynamic concept as it changes over space and time.

There are various crops being cultivated in the different village in the study area which can be grouped into food crops and non-food crops. The area under each crop varies from very few hectares to hundreds of hectares. Here only which crops available in the case studies are considered for the study. The cropping pattern of each crops occupied in the 20 villages are studied. The list of actual area under different crops grown in the different villages is quite long but for convenience of this study. Due to the variations in the availability of irrigation facilities and their impact on the proportion of land under each crop is changing and commercial approach of farmers is also created change in cropping pattern. For instance, the area under Sugarcane lies between 30 to 60% to total crops in the villages of Pandharpur tehsil means irrigated villages i.e. Gadegaon, Gopalpur, Tavashi, Mundhewadi, Bhandi Shegaon,

etc. which is elected for the study. While in the villages of Sangola tehsil means less irrigated areas, the area under millets i.e. Jowar, Wheat and Bajara is higher and sugarcane is not cultivated in that village due the lack of permanent irrigation facilities in these villages.

Another important variation is found that, the Kharip season is the major cropping season in the monsoon based villages in the study area, but in recently the low duration crops are cultivated in the selected villages in Rabi Season. The returning monsoon is more active due to which cropping in Rabi season is increased. Also developed irrigation facilities are supporting to take yearly crops. In other words, crops are grown in both the seasons of a year in inadequate irrigated areas but low duration crops i.e. Kharip, Rabi and in adequate irrigated areas also crops cultivated in the summer season.

### **Study of Cropping Practices:**

In recent years the concept of crop combination had engaged the attention of geographers and agricultural land use planner. The distribution maps of individual crops are interesting and useful for planners (Husain, 2004). In this section the study of cropping pattern is made with the help of statistical methods. To understand the cropping pattern in the collected data from the case studies in the selected villages with selected farmers in that villages. The cropping practices are checked by implementing crop combination crop concentration and crop diversification techniques.

With the help of gathering information to the irrigation facilities and cropping pattern in the selected sample villages, the condition of each village may differ from other rather it is different due to mainly the irrigation parameters. We are analysed the micro level analysis depicts the condition better way hence the village level condition of Pandharpur and Sangola tehsils are discussed in below section.



### **Crop Combination:**

This study represents real situation of cropping pattern in the study area and it helps to planners, farmers and research scholars. This study is also carried out by applying same two techniques of crop combinations.

### **Weaver's Method of Crop Combination:**

The Weaver's method of crop combination is applied to conduct a micro level study (i.e. village level). The crop combination analysis is made for the 10 villages each in Pandharpur and Sangola tehsils. In this study the available crops are considered for the crop combination and also total 20 villages are considered for the study. Out of these five villages are found all crop combinations viz. Gadegaon, Tavashi and Jainwadi eight crop combinations, Ozewadi and Wakhari 7 crop combination and six villages are found 5 crop combination.

### **Two Crop Combinations:**

There are only on village is found out of 20 villages i.e. Mundhewadi. This is well irrigated, there are several crops are grown but sugarcane and wheat are important and based on the irrigation.

### **Three Crop Combinations:**

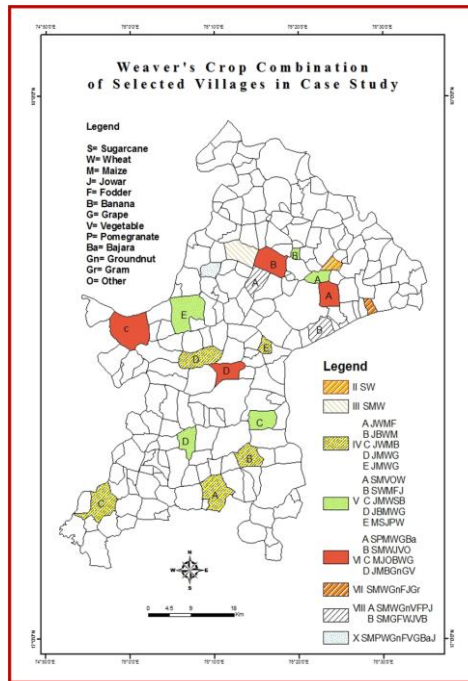
There are also only one village i.e. Bhandi Shegaon and the major crops are sugarcane, maize and wheat. These are also based on the availability of water for the irrigation and therefore grown in this village because of this village is well irrigated.

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**Table 1: Weaver’s Method: Village wise Variance Values**

Sr. No.	Name of Village	Monoculture	2 crop Combination	3 crop Combination	4 Crop Combination	5 Crop Combination	6 Crop Combination	7 Crop Combination	8 Crop Combination	9 Crop Combination	10 Crop Combination	Crop Combination Index
1	Gadegaon	1520.70	769.11	601.19	497.11	441.76	384.69	378.99	351.25	-	-	S+M+W+Gn+V+F+P+J
2	Tavashi	1997.44	716.68	493.00	395.96	336.14	308.63	292.28	277.27	-	-	S+M+G+F+W+J+V+B
3	Jainwadi	3856.39	501.20	251.50	186.86	154.06	134.43	127.23	121.73	116.58	113.35	S+M+P+W+Gn+F+V+G+Ba+J
4	Anawali	5004.19	716.53	180.84	63.18	37.51	54.21	-	-	-	-	S+P+M+W+G+Ba
5	Ozewadi	2420.71	590.95	393.99	315.55	272.99	248.63	236.16	-	-	-	S+M+W+Gn+F+J+Gr
6	Mundhewadi	1439.80	544.63	547.26	-	-	-	-	-	-	-	S+W
7	Gopalpur	4309.54	572.42	132.02	92.03	80.69	85.06	-	-	-	-	S+M+V+O+W
8	Wakhari	1418.45	860.60	644.81	539.57	458.87	431.58	392.53	-	-	-	S+M+W+J+V+O+Gn
9	Bhandi Shegaon	4302.69	297.00	28.16	107.53	-	-	-	-	-	-	S+M+W
10	ChincholiBhose	1382.04	736.26	554.88	489.57	477.66	-	-	-	-	-	S+W+M+F+J
11	Sonand	3096.72	452.17	236.48	178.05	193.50	-	-	-	-	-	J+W+M+F
12	Javala	3706.84	244.14	168.09	155.75	-	-	-	-	-	-	J+B+W+M
13	Kola	4102.70	260.26	144.10	125.83	148.62	-	-	-	-	-	M+J+B+W
14	Katfal	6245.14	853.46	167.18	70.04	38.66	28.25	37.15	-	-	-	M+J+O+B+W+G
15	Medashingi	4869.83	444.40	152.26	95.39	79.34	90.15	-	-	-	-	J+M+W+S+B
16	Watanbare	3496.84	548.53	226.47	143.03	115.24	143.41	-	-	-	-	J+B+M+W+G
17	Mahudk	4849.43	635.61	166.03	58.63	36.70	60.08	-	-	-	-	M+S+J+P+W
18	Shivane	4560.13	495.52	74.21	26.77	91.81	-	-	-	-	-	J+W+M+B
19	Chincholi	6250.10	863.57	185.54	69.82	32.45	20.92	24.71	-	-	-	J+M+B+Gn+G+V
20	Sangewadi	4372.42	447.60	84.59	64.33	97.91	-	-	-	-	-	J+M+W+G

Source: The result derived from calculation is presented in the table.



**Figure 2: Selected villages of Crop Combination prepared by Weaver’s Method.**

**Table 2: Weaver's Method- Crop Combination**

Sr. No.	No. of Crops	No. Villages	Name of Villages
1	Monoculture	-	-
2	2	1	Mundhewadi
3	3	1	Bhandi, Shegaon
4	4	5	Sonand, Javala, Kola, Shivane, Sangewadi
5	5	6	Anawali, Gopalpur, Chincholi, Bhose, Medshingi, MahudBk, Watambare
6	6	2	Katfal, Chincholi
7	7	2	Ozewadi, Wakhari
8	8	2	Gadegaon, Tavashi
9	10	1	Jainwadi

**Source:** The result derived from calculation is presented in the table.

#### **Four Crop Combinations:**

It has been observed that there are 5 villages are found viz. Sonand, Javala, Kola, Shivane and Sangewadi. All these are located in the Sangola tehsil, there is scanty water available for the irrigation and agriculture is totally depending on rainfall. Therefore, in these areas cultivated the crops of jowar, maize, bajara and wheat are the significant crops are grown in these areas.

#### **Five Crop Combinations:**

There are also 5 villages are founded viz. Anawali, Gopalpur, Medshingi, Watambare and Mahud Bk. It includes two villages in Pandharpur tehsil and three villages in the Sangola tehsil. There are several crops are grown but it's significant based on the availability of irrigation facilities. For instance in Anawali the five crop combination is sugarcane, pomegranate, maize,

grape and banana and Gopalpur village sugarcane, maize, vegetables, others and wheat all these crops are based on the irrigation, whereas, in the villages of Medshingi, Watambare and Mahud Bk. are the significant crop are jowar, maize, wheat, bajara etc. it is based on the seasonal irrigation or rainfall.

#### **Six Crop Combinations:**

It has been observed that the two villages are found in this group they are Katfal and Chincholi. Both are less irrigated and so six crop combinations are found and the crops are also near about same in both villages i.e. maize, jowar, others, bajara, wheat, and grape. In short, choice of crops is totally based on the available of water for irrigation.

#### **Seven Crop Combinations:**

It includes the villages of Ozewadi and Wakhari. It is well irrigated so several crops are grown but sugarcane is more dominant crop in these villages.

#### **Eight Crop Combinations:**

The eight i.e. all crop combination containing villages are located in the Pandharpur tehsil. In these villages having water available for the irrigation and also variety of crops are cultivated in these villages but sugarcane is more significant and others are less significant in these areas, therefore mix cropping pattern (up to eight crops) is observed in Gadegaon and Tavashi villages.

#### **Ten Crop Combinations:**

All ten crop combination is found in the villages of Jainwadi. There are more variations in the crop combination. Thus, there are sufficient amount of water available for the irrigation there farmers are growing multiple crops and water

consuming crops in the field rather than single crop and less water consuming crops are grown in the field.

### **Conclusion:**

Solapur district is one of the agro-based district of Maharashtra. The agricultural land use of Solapur district is of dynamic nature. Although Bhima, Nira, Sina and Man Rivers passing through Solapur district still a considerable amount of land is utilized for only single crop. The proportion of temporary fallow land is quite high that should be brought under agricultural use. Jowar is the main dominant crop in Solapur. There are more variations in farming practices in the Solapur district. Because the inadequate and uneven in the irrigation facilities of the district such as cultivation of sugarcane is cultivated in the irrigated areas and jowar, bajara, pulses are cultivated in the rainfed areas. The villages which are not having proper source of irrigation are producing at least one crop either form Kharip or Rabi Season.

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