

## CROP COMBINATION REGIONS IN SINA RIVER BASIN: MAHARASHTRA

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### ABSTRACT

*Agriculture is the major economic activity of peoples inhabited in Sina river basin. The concept of region is important in the study of agricultural geography. The significance of agricultural regionalization lies in the fact that it provides a sound and systematic, optimum and organized, and realistic and reliable footing and explanation of agricultural practices in an area. Crop combination is one of the methods of agricultural regionalization useful for analysis of agricultural practices and planning at micro level such as in Sina river basin. In the present research paper, an attempt has been made to delineate crop combination regions in Sina river basin of Maharashtra by applying Rafiullah's maximum positive deviation method. River Sina is a major left bank tributary of Bhima river of Krishna basin. Differential crop combination regions and changes in it are the results of difference in soil fertility, irrigation facilities made available and also of farmer's changing trend towards taking different crops in a season from the same piece of field.*

**KEYWORDS:** *Agricultural Regionalization, Cropping Pattern, Crop Combination, Crop Diversification, Monoculture*

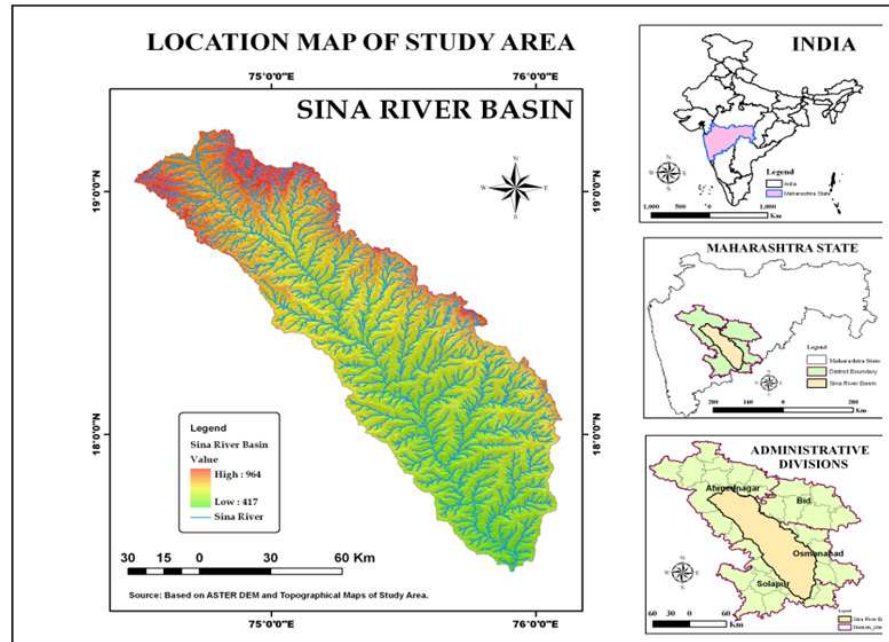
### INTRODUCTION

The Sina river basin is an agrarian area. The concept of crop combination includes growing different crops in a season from the same field. The pattern of crop combination advocates spatial predominance of certain crops or combination resulting in the emergence of crop regions, such analysis would ultimately minimize the chances of oversimplified generalization (Ali, Mohammad, 1978). Crop combination provides area significance and strength of individual crop. The method of crop combination suggests a suitable measure for planning and improvement in the underdeveloped regions and it is helpful to introduce innovations in agriculture. Variations in combinations recorded due to physical and human factors; especially amount of rainfall, soil fertility and irrigation facilities made available in some tracts and lack of it in other tracts also affected crop combinations in the study area.

### Study Area

Sina river basin lies in a drought-prone area of Maharashtra and is a sub-basin of Bhima river. The study region extended from 17° 22'43'' North Latitude to 19°09'09'' North Latitude and 74°43'11'' East Longitude to 75°53'48'' East Longitude. The total geographical area of the river basin is about 12051.446 sq. kms. It accounts for 4.73 per cent to the total of Krishna Basin (254743.31sq.k.ms). The study area is bounded by Rahuri tehsil of Ahmednagar district to the north, Beed and Osmanabad districts to the east, Karnataka state to the south and Malshiras and Pandharpur tehsils of Solapur district to the west. Study area comprises a) the parts of Ahmednagar, Pathardi, Parner, Shrigonda, Karjat and Jamkhed

tehsils of Ahmednagar district, b) whole Ashti tehsil of Beed district, c) whole Paranda tehsil and parts of Bhum, Osmanabad and Tuljapur tehsils of Osmanabad district and d) Whole Barshi and North Solapur tehsils and parts of Karmala, Madha, Mohol and South Solapur tehsils of Solapur district. (Figure. No. 1)



**Figure 1: Location Map of Sina River Basin**

## Objective

To delineate and analyze crop combination regions in Sina river basin.

## Data Base and Methodology

The present work is based on secondary data. The data related to cropping pattern is collected from District Socio-Economic Abstracts of Ahmednagar, Beed, Osmanabad, and Solapur district. ASTER data downloaded from the USGS website and the same used for extracting and Mapping the study area by applying ArcGIS ver.9.3.

Agricultural statistics used in the present study relate to the tehsil level and are decadal (i.e. 1990-91 and 2010-11). In order to delineate crop combination regions in study area, Rafiullah's maximum positive deviation method has been applied in which per cent area of twenty-eight crops for seventeen tehsils has been arranged in descending order. Crops having an area less than five percent were omitted for the calculation and for the rest of the major crops maximum positive deviation of variance calculated.

Rafiullah (1956) developed a new deviation method in his work *A New Approach to the Functional Classification of Towns*. The technique devised by Rafiullah may be expressed as follows:

$$d = \sum D^2 p - D^2 n \div N^2$$

Where,

d is the deviation,

Dp is a positive difference,

Dn is the negative difference from the median value of the theoretical value of the theoretical curve value of the combination, and

N is the number of functions (crops) in the combination.

Median values applied to delineate crop combination regions are as below:-

- Monoculture- 50 per cent
- Two crop combination- 25 per cent
- Three crop combination- 16.7 per cent
- Four crop combination- 12.5 per cent
- Five crop combination- 10 per cent

Finally, as per Rafiullah's maximum positive deviation method crop combination regions has been delineated and named as I) Monoculture, II) Two crop combination and III) Three crop combination. The obtained results have been shown in table No. 1, 2 and 1.3 and also in figure No 3.

### **Crop Combination Analysis**

The study of crop combination regions is a significant aspect in the agricultural sector. The delineation of the regions of agricultural homogeneity is always based upon the spatial distribution of crops. Crops are not grown in isolation but they generally have grown in combinations (Weaver J.C.). In the present paper an attempt has been made to analyze and delineate crop combination regions in Sina river basin as below:

#### **Monoculture**

Jowar is the principal food crop of peoples inhabited in the basin. During the period of the investigation it is found that nine tehsils (52.94 per cent tehsils) namely Ahmednagar, Pathardi, Parner, Shrigonda, Karjat, and Jamkhed of Ahmednagar district, Bhum and Tuljapur of Osmanabad district and North Solapur of Solapur district have Jowar crop as a monoculture in 1990-91. Jowar was the leading crop in Sina river basin grown on 593766 hectares (87.79 per cent). The tehsils experienced Jowar as a monoculture crop has medium to the deep black soil which retains moisture for the long period that is beneficial for jowar crop.

**Table 1: Crop Combination Regions in Sina River Basin (1990-91)**

Types of Crop Combination	Crops in Combination	Number of Tehsil	% to total Tehsil	Area in Ha	Area in per cent
Monoculture	Jowar	9	52.94	593766	87.79
Two Crop Combination	Safflower+Jowar	2	11.76	22883	3.38
	Tur +Jowar	2	11.76	30423	4.50
	Bajra+Jowar	1	5.88	11560	1.71
	Wheat+Jowar	1	5.88	4985	0.74
Three Crop Combination	Jowar+Gram+Wheat	1	5.88	5176	0.77
	Tur+Jowar+Gram	1	5.88	7540	1.11
<b>Total</b>		<b>17</b>	<b>99.98</b>	<b>676333</b>	<b>100</b>

Source: Based on District Socio-Economic Abstracts of Ahmednagar, Beed, Osmanabad, and Solapur

However, in 2010-11, Parner, Jamkhed, Bhum, and Tuljapur remained in this group and Osmanabad tehsil newly entered in this group. Total five tehsils (29.41 per cent tehsils) has Jowar as a monoculture crop with 184288 hectares area (58.57 per cent) in the Sina river basin. Table No.1.3 clearly shows that during the period of investigation the number of tehsils having monoculture has decreased by four and it indicates that the region has gone through crop diversification.

**Table 2: Crop Combination Regions in Sina River Basin (2010-11)**

Types of Crop Combination	Crops in Combination	No. of Tehsil	Per Cent to Total Tehsil	Area in Heaters	per cent of Area
Monoculture	<b>Jowar</b>	5	29.41	184288	58.57
Two Crop Combination	Sugarcane+Jowar	5	29.41	78450	24.93
	Wheat+Jowar	2	11.76	12517	3.98
	Gram+Jowar	1	5.88	9835	3.13
	Bajara+Jowar	1	5.88	6000	1.91
Three Crop Combination	Maize+Jowar+Sugarcane	1	5.88	8312	2.64
	Udid+Jowar+Tur	1	5.88	8090	2.57
	Gram+Jowar+Bajara	1	5.88	7169	2.28
<b>Total</b>		<b>17</b>	<b>100</b>	<b>314661</b>	<b>100</b>

Source: Based on District Socio-Economic Abstracts of Ahmednagar, Beed, Osmanabad, and Solapur

### Two Crop Combinations

As Sina river basin lies in a drought-prone area of Maharashtra, it is found that crops grown in this basin are generally drought resistant. A number of farmers practice their agriculture in such a way that if one crop suffered due to insufficient rainfall during its growing period; then another crop may be benefited from same farmland in the same season whatever may be the amount of rainfall in that particular crops growing period. So that the study region experienced two crop combinations. During 1990-91, total six tehsils (35.28 per cent) noticed two crop combinations with 69851 hectares (10.33 per cent) area in the study area. Ashti tehsil of Ahmednagar district has Jowar and Bajra crop combination, this is because of the majority portion of the tehsil has shallow coarse soil on hill top. However in Solapur district, Karmala and Madha tehsils has combination of Jowar and Safflower because jowar food crop supplemented with safflower as an edible oilseed crop and a large number of farmers uses safflower oil in their daily food; Mohol tehsil has Jowar and Wheat combination due to the irrigation facilities were made available through canal irrigation from Ujani reservoir and Barshi and South Solapur tehsils has Jowar and Tur crop combination due to the fact that the amount of assured rainfall in the early period of monsoon in these two tehsils is more than other tehsils in the study area which is essential for the growth of tur crop.

**Table 3: Crop Combination Regions in Sina River Basin (1990-91 and 2010-11)**

Types of Crop Combination	Number of Tehsil		Area in Hectares		Area in Per Cent	
	1990-91	2010-11	1990-91	2010-11	1990-91	2010-11
Monoculture	9	5	593766	184288	87.79	58.57
Two Crop Combination	6	9	69851	106802	10.33	33.94
Three Combination	2	3	30423	23571	1.88	7.49
Total	17	17	694040	314661	100	100

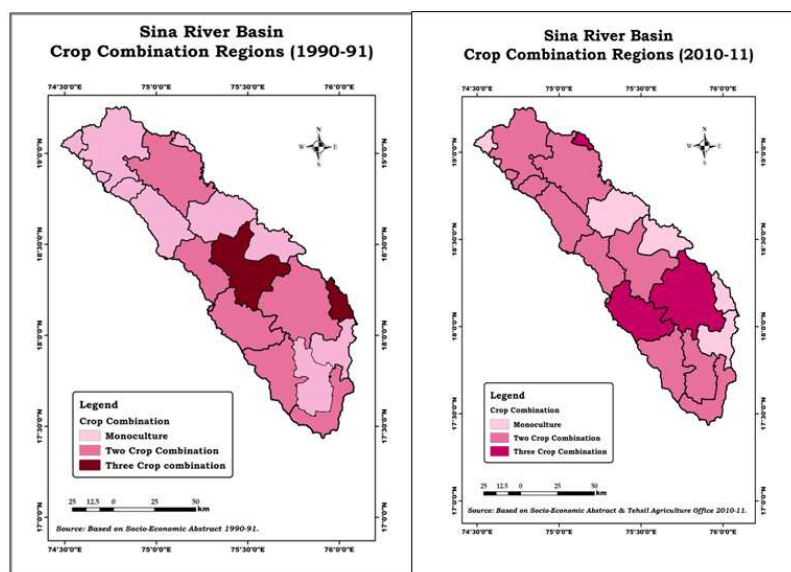
*Source: Based on District Socio-Economic Abstracts of Ahmednagar, Beed, Osmanabad, and Solapur*

Bajra and jowar remained in this group again but sugarcane, wheat and gram newly entered into two crop combinations in 2010-11. The number of tehsils in two crop combinations increased by three and it became nine (52.94 per cent tehsils) covering 106802 hectares area (33.95 per cent). Shrigonda, Karjat, Karmala, Mohol, and South Solapur tehsils have jowar and sugarcane crops combination. In Paranda and Bhum tehsil jowar and wheat combination is found. Parner and North Solapur tehsils have jowar and wheat crops combination. Ahmednagar tehsil has Jowar and gram crops combination whereas Ashti tehsils have jowar and bajra crops combination.

### Three Crop Combinations

As the study region experiences fluctuations in rainfall, farmers' plants more than two crops from the same piece of land in a crop season due to which either one or two crops got benefitted. Three crop combinations are found in isolated tehsils in 1990-91 i.e. two tehsils (11.76 per cent tehsils) has three crops combinations with 12716 hectares (1.88 per cent) area. Major crops cultivated are jowar, gram, wheat, and tur. Paranda tehsil has jowar, gram and wheat crops combination whereas Osmanabad tehsil has jowar, gram and tur crops combination. Both tehsils have a remarkable proportion of shallow coarse soil and the amount of rainfall in the early monsoon period is also ideal for multiple cropping.

Three tehsils (17.64 per cent tehsils) has three crops combinations having 23571 hectares area (7.49 per cent) in 2010-11. Madha tehsil of Solapur district has jowar, maize, and sugarcane crops combination; this is because of irrigation facilities are made available in some pockets. Barshi tehsil of Solapur district has jowar, udid, and tur crops combination and Pathardi tehsil has jowar, gram and bajra crops combination.

**Figure 2: Crop Combination in Sina River Basin**

## CONCLUSIONS

The study of crop combination in any area has much more importance in agricultural geography. Crop combination analysis gives us the relative position of crops on the regional level. The Sina river basin is a part of the drought-prone region of Maharashtra. Sina is a non-perennial river. By applying Rafiullah's maximum positive deviation method crop combination regions up to three crops in Sina river basin for seventeen tehsils delineated for the years 1990-91 and 2010-11. The study reveals that jowar is the principal crop grown throughout the basin. It is also found that the total number of tehsils in monoculture i.e. Jowar crop, decreased by 4 during the period of study in which Jamkhed, Bhum and Tuljapur tehsils remained in monoculture region. The analyzed trend suggests that the study area is going through crop diversification and the importance of jowar crop also decreased to some extent. As far as two crop combination regions are concerned, Safflower, tur, wheat and bajra crops were grown in association with Jowar in 1990-91; whereas Bajra, Gram, Wheat, and Sugarcane crops were grown in association with Jowar in 2010-11. The number of tehsils in two crop combination increased by 3 under the period of investigation and it denotes that crops are not grown in isolation but in association with other crops. It is found that the importance of safflower crop has been decreased and sugarcane as a cash crop has newly emerged in this group of crop combination and it is the result of Bhima-Sina link canal due to which irrigation facilities are made available in southern part of the study area and the establishment and development of sugar factories in the basin.

Three crop combinations are carried out in mid-eastern part of the study area; especially in Paranda and Osmanabad tehsils in which Jowar and gram are the same crops but wheat and tur crops preferred as the third crop in these tehsils respectively in 1990-91. It is interesting to note here that in 2010-11, three tehsils carried out three crop combinations in a central part of the study area comprising Madha and Barshi tehsils of Solapur district which are adjacent to each other and Pathardi is the third one in Ahmednagar district which is located at the north-western side in the study area. The crops grown in association with jowar are sugarcane and maize in Madha tehsil, Udid, and tur in Barshi tehsil and gram and bajra in Pathardi tehsil. While studying three crop combination regions it is found that maize and udid crops got importance in cropping pattern in the study area. Crop combination analysis suggests that the study area went through crop diversification in which the area under safflower and sunflower shows decline whereas the area under sugarcane, maize, and udid shows increase in it.

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