

# Crop Combination Analysis in Ahmednagar District, Maharashtra

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**Abstract:** Ahmednagar district is one of the drought-prone districts of Maharashtra, receiving below 560 mm average annual rainfall with high spatio-temporal variability. Agriculture is dominant economic activity in district, 70 percent of the population is directly and indirectly dependent on agriculture but almost 73 percent of agriculture is rainfed. In the present research, an attempt has been made to investigate the crop combination applying Weaver's method for 2011. The study reveals that Jamkhed tahsil has been recorded monoculture of Jowar. While six crop combinations were obtained at Akole, Sangamner, Rahata, Karjat and, Shrigonda, tahsils with crops Oilseeds, Bajara, Wheat, Maize, Vegetables, Cotton, Sugarcane, Fodder crops, and Pulses. The result reveals that rainfall distribution and better irrigation control the crop combination pattern in the Ahmednagar district. Crop combination techniques with integrations in GIS will support the researchers, regional planners in decision making, and agricultural regionalization-related planning processes.

**Keywords:** Crop combination, Rainfall, Drought, GIS

## 1. Introduction

The Indian economy hinging on agriculture because about 70 percent of the population are directly and indirectly dependent on agriculture. Agriculture and allied sectors contribute nearly 17.8 and 17.1 percent of the Gross Domestic Product (GDP) of India. It not only provides food to its teeming million but also provides the raw material for those agro-based industries. However, agricultural output depends on the monsoon; nearly 56 percent of the net sown areas (NSA) are dependent on rainfall which is highly erratic in India. The domestication of plants and animals is known as agriculture. The Latin term 'Agricultura' has its origin in the words 'Ager' mining the field and 'cultura' means to cultivate or culture. The crop combination constitutes an important aspect of agriculture; it provides a good basis for agricultural regionalization and helps in the formulation of strategy for agricultural development (Husain, 1996).

Crops are generally grown in combinations, it is rarely that total area occupied by a single crop. The number of crops associated with that agricultural land at the given time is known as 'crop combination' (Husain, 1979). Crop combination is a method of analysis for delimitating agricultural regions based on a multi-crop combination. Several quantitative and qualitative methods have been used for the demarcation of crop combination regions. In the field of agriculture geography, Weaver was the first who use statistical techniques to establish crop combinations for Middle West in the United States in 1954. In this attempt for the delimitation of agricultural regions of the Midwest in the USA. Weaver computed the percentage of total harvested cropland occupied by each crop that held as much as 1 percent of the total cultivated land in each of the 1081 countries covered in his work.

The attempt has been made to identify crop combinations in Ahmednagar district which is one of the drought-prone districts of Maharashtra. The average annual rainfall in the

district is below 560 mm with high variation in the spatial distribution. Almost 73 percent of agriculture is rainfed thus, the study of spatio-temporal changes in crop combinations and their integrations in GIS will support the earth scientists, researchers, regional planners in decision making, and agricultural regionalization-related planning processes.

## 2. Study Area

Ahmednagar district is the largest district of Maharashtra state with a geographical area of 17 418 sq. km. which is 5.66 percent of the total area of the State. It lies between 18° 2' N to 19° 9' N latitude and 73° 9' E to 75° 5' E longitude with covering 14 tahsils. The district is situated partly in the upper Godavari basin and partly in the Bhima basin occupying a somewhat central part in Maharashtra state. It is bounded by Igatpuri, Sinnar, and Yeola tahsils in the Nashik district in the north, Vijapur, Gangapur, and Paithan tahsils of Aurangabad district and Georgi, Beed, and Ashti tahsils of Beed district in east, Bhum and Paranda tahsils in Osmanabad district, and Karmala tahsils in Solapur district in the south, Junnar, Shirur, Daund and Indapur tahsils of Pune district and Murbad, Sahapur tahsils of Thane district in the west.

The climate of the region is characterized by hot summers and general dry throughout the year except during the southwest monsoon season. The mean maximum temperature is 39.1°C and the mean minimum temperature is 12.3°C. The average annual rainfall in the district is 568.7 mm. about 77 percent of the annual rainfall in the district is received during the SW monsoon season (June–September). The population of the district is 4543083 (Census, 2011) out of total workers 71.58 percent workers are engaged in agricultural activity. The major crops are Jowar, Bajra, Pulses, Wheat and Rice, Oilseeds, Grape, Onion, Sugarcane, and Cotton.

### 3.Database & Methodology

The entire work is mainly based on secondary data i.e., collected from the District Statistical Handbook of Ahmednagar, Agricultural Department of Ahmednagar District. For calculating crop combination, the crop combination method of Weaver has been applied.

$$d = \frac{\sum d^2}{n}$$

Where,

d = difference between the actual crop percentage in given areal unit

n = number of crops in a given combination

Maps prepared to indicate the crop combination in Ahmednagar district delimited into monoculture, two crop combination, three crop combination, etc. using Arc GIS 10.4 software.

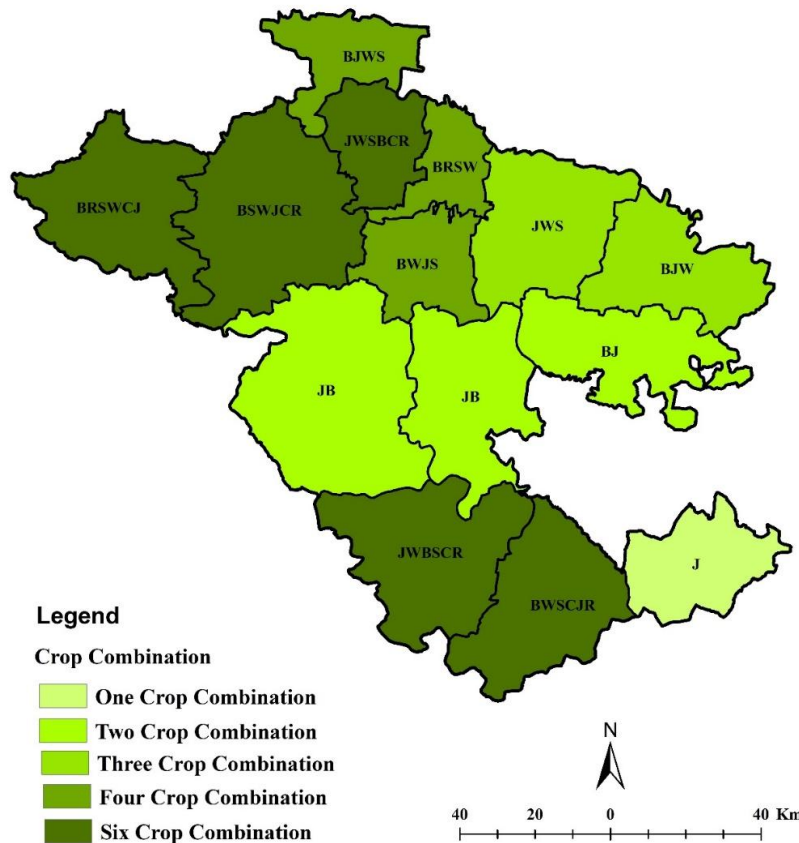
### 4.Results and Discussions

In the present research, an attempt has been made to investigate the crop combination applying Weaver's method. Crop in combination indicates during 2011 year in Ahmednagar district (Table 1).

**Table 1:** Ahmednagar District Crop Combination in 2011

Sr. No.	Crop Combination	Tahsils	Crops
1	One Crop Combination	Jamkhed	J
2	Two Crop Combination	Ahmednagar	JB
		Pathardi	BJ
3	Three Crop Combination	Parner	JB
		Newasa	JWS
4	Four Crop Combination	Shevgaon	BJW
		Rahuri	BWJS
		Shrirampur	BRSW
5	Six Crop Combination	Kopargaon	BJWS
		Karjat	BWSCJR
		Shrigonda	JWSBCR
		Akola	BRSWCJ
		Sangamner	BSWJCR
		Rahata	JWSBCR

(Source: Computed by Researcher)



**Figure:** Crop Combination in Ahmednagar district- 2011

### One Crop Combination

One crop combination (Monoculture) is found in Jamkhed tahsil. Jawar crops have appeared as monoculture in Jamkhed tahsil occupied 77.63% area. Because of low rainfall and lack of irrigation facilities only one crop combination is found in this tahsil.

### Two Crop Combination

Two crops, namely, Bajara and Jawar have entered this combination in Nagar (86.44%), Pathardi (86.67%), Parner (77.13%) tahsils. In these tahsils, fine alluvial soils, fate surface, warm climate, transportation facility, population density, and nearness of central market are suitable for cultivation of these two crops.

### Three Crop Combination

Jawar, wheat, Sugarcane and Bajara, Jawar, Wheat have registered as three crop combinations in Newasa and Shevgaon tahsils respectively. These crops occupied an area of 81.75% in Newasa tahsil and 80.85% in Shevgaon. Sugarcane occupies 25.24% area in Newasa while only 4.14% in Shevgaon tahsil because of good irrigation facilities in Newasa tahsil while poor irrigation facilities in Shevgaon tahsil.

### Four Crop Combination

Bajara, Wheat, Jawar & Sugarcane have appeared as four crop combinations in Rahuri tahsil (84.68%). Bajara, Rice, Sugarcane, and Wheat have registered as four crop combinations in Shrirampur tahsil (46.24%) and Bajara, Jawar, Wheat, and Sugarcane registered as four crop combinations in Kopergaon tahsil (75.51%).

### Six Crop Combination

Six crop combinations are found in Karjat (45.52%), Shrigonda (89.85%), Akole (40.74%), Sangamner (80.92%), and Rahata (80.95%) tahsils of Ahmednagar district.

## 5. Conclusion

In the present research, the crop combination method of Weaver was applied for the 2011 crop data of Ahmednagar district, which is one of the drought-prone districts of Maharashtra. Weaver's method of crop combination has been applied to identify the crop combination pattern. The study reveals that Jamkhed tahsil has been recorded monoculture of Jowar. Whereas Nagar, Pathardi, Parner tahsils obtained two crop combinations. While three crop combinations has been recorded in the tahsil Newasa and Shevgaon with Jawar, wheat, Sugarcane and Bajara, Jawar, Wheat. The Kopergaon, Shrirampur, and Rahuri have four crop combinations. Six crop combinations were obtained at Akole, Sangamner, Rahata, Karjat and, Shrigonda, tahsils with crops Oilseeds, Bajara, Wheat, Maize, Vegetables, Cotton, Sugarcane, Fodder crops, and Pulses.

The result reveals that rainfall distribution and better irrigation control the crop combination pattern in the Ahmednagar district.

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