



USE OF CROP COMBINATION TECHNIQUE FOR QUANTITATIVE EVALUATION OF LAND USE IN AHMEDNAGAR DISTRICT IN 1960-61 AND 2010-11

Dr. M. R. Erande

Asst. Professor,

Shri Mulikadevi Mahavidyalaya, Nighoj,
Tal.- Parner, Dist.- Ahmednagar(MS), India.

ABSTRACT

The net sown area, current fallows and land under tree crops and groves are included in agricultural land use. Use of land is an important factor for planning process because of the finite nature of land resource. Ahmednagar district in Maharashtra covered an area of about 17 lakh hectare comprising nearly 73.52 percent area under net sown area in 1971-1972. Area under forest decreased slightly, area not available for cultivation decreased by 0.52 percent, other uncultivated area increased by 0.38 percent, while fallow land decreased by 0.92 percent during that period. Among the tahsil, overall volume of change is greater in Nagar, Sangamner, Shrirampur and Newasa tahsils probably due to dynamic conditions existing there.

Key Words: *Crop Combination, Land Utilization, Net Sown Area.*

INTRODUCTION

Agriculture is very important occupation in most of the Indian states. Agricultural scientists, economists, geographers and many others are engaged in the study of agriculture. Utilization requires proper planning for being limited resource. For agriculture, land is a very important resource. For its large area size, and physical and socio-cultural diversities, Ahmednagar has different types of land uses. Agriculture is predominant economic activity in Ahmednagar, engaging nearly three-fifths of its working population. Though the share of agricultural sector in gross domestic product has considerably declined to about one-fourth yet the importance of agriculture as employment provider to workforce especially in the countryside is very high. Obviously, agriculture forms the hub of Indian economy as a large number of industries are also heavily dependent on agriculture for supply of raw materials. Agriculture involves not only crops rising but also animal ranching and fishing. Here an attempt has been made to study the land use pattern in Ahmednagar district from 1960-61 to 2010-11.

DATA SOURCE

Secondary data has been used from Socio-Economic Reviews and District Statistical Abstracts of Ahmednagar District from 1961 to 2011. The data have been collected for various crops for the year 1960-61 and 2010-11 in both kharif and rabbi crops from taluka headquarter office, Ahmednagar District Gazetteer, Socio-Economic Abstract of Ahmednagar District and Census Handbook of Ahmednagar District are sources of data for this study. It is supplemented by numerous spot-inquiries. The areas of crop have converted into percentage (to net sown area) which is later on, used for ranking of crops to identify the relative strength of individual crop.

OBJECTIVES

1. Know the availability of land in Ahmednagar and its different uses.
2. To present area wise efficiency of the crops grown in the taluka by ranking and analysis the factors responsible for this rank distribution.

STUDY AREA

Ahmednagar district in western Maharashtra region of Maharashtra state is an economically and agriculturally developed area. In 1961-62, there were thirteen tahsils in Ahmednagar district. The District 'Ahmednagar' is located middle part of the bank of Godavari and Mula river. This lays between 18°02'North 19°09'North to 73°09'East 75°05'East longitude with an area of 1701836 hectors of land and in Thirteen tahsils as per 1971-72 District gazetteer. It has an average elevation of 549 metres (1,801 ft) from mean sea level. Physiography, rainfall, soil, temperature, and drainage influences on agricultural land use pattern in this district. Rainfall varies between 508 to 635 mms annually. The underline basalt on disintegration and decomposition brought various agents had yielded three kinds of soils viz. Deep black, deep & shallow Alluvial soils in Pravara, Mula and Seena river basins. These rivers are main irrigation source of middle district areas. The rainfall is mainly due to rain shadow area in term of amount of rainfall average receives 571.5 mms in western and middle part of district but southern part of district six tahsil are totally drought prawn area. Therefore these areas are mostly hilly and unirrigated. The variation in amount of rainfall & type of soil exerts influence on the Land use pattern of the study region in 1960-61 to 2010-11.

CROP COMBINATION

Recently the crop combination analysis in geographical studies has gained momentum and its importance is increasing day by day. Any study of crops on regional scale must take into consideration the combinational analysis and the relative position of crops. Such analysis would ultimately minimize the change of oversimplified generalization (Ali, 1978). Combination studies are fruitful in many ways; firstly, they provide an adequate understanding of individual crop geography. Secondly, combination is in itself integrative realities that demand definition and distribution analysis, and lastly crop combination regions are essential for the construction of still more complex structure of vivid agricultural region (Weaver, 1954).

A number of statistical techniques had been introduced by geographers, agriculturists, and economists to demarcate crop combination regions. The introduction of these crop combination methods by Weaver (1954), Thomas (1963), Coppack (1964), Johnson (1958), Rafiullah (1956), Bhatia (1960), Athawale (1966), Ayyar (1909) and Doi (1959). In the present study Weaver's technique (1954) used for finding crop combination.

METHODOLOGY

Weaver's Crop Combination Method

In the field of agricultural geography Weaver was the first Geographer who used (1954) statistical technique to show the crop combination of the Middle West (USA). In his attempt for the delineation of agricultural regions of the Middle West in the United States, Weaver based his analysis on acreage statistics. Weaver computed the percentage of total harvested cropland occupied by each crop that held as much as one percent of the total cultivated land in each of the counties covered his work. Excluding a few counties like Houston and Minnesota in which the

crop combination was easy to ascertain, other counties showed a complex and confused picture of the percentage, occupied by different crops. It was therefore necessary to devise “a rigorous approach that would provide objective constant and precisely repeatable procedure and would yield comparable results for different years and localities”. In his work Weaver calculated deviation of the real percentage of crops (occupying one percent of the cropped area) for all the possible combinations in the component areal units against a theoretical standard. The theoretical curve for the standard measurement was employed as follows;

Monoculture	= 100 % of the total harvested crop land in one crop.
Two crop combination	= 50 % in each of two crops.
Three crop combination	= 33.3 % in each of three crops
Four crop combination	= 25 % in each of four crops
Five crop combination	= 20 % in each of five crops
Ten crop combination	= 10 % in each of ten crops

For the determination of the minimum deviation the standard deviation method was used:

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

where d is the difference between the actual crop percentages in a given county (areal unit) and the appropriate percentage in the theoretical curve and

n is the number of crops in a given combination.

As Weaver pointed out, the relative, not absolute value being significant, square roots were not extracted so, the actual formula used as follows:

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

CROP COMBINATION: APPLICATION

To illustrate the Weaver's technique an example can be given from Akole taluka in which the percentage share of crops in the cropped area in a year (1960-61) was as follows : Fodder crops 30.18 percent, Bajara 29.79 percent, Pulses 9.73 percent, Rice 9.24 percent, oil-seeds 6.92percent, Wheat 2.29 percent and Jawar 1.39 percent.

1.Monoculture

$$= \frac{(100-30.18)^2}{1} = 4874.83$$

2. Two Crop Combination

$$= \frac{(50-30.18)^2 + (50-29.79)^2}{2} = 400.64$$

3.Three Crop Combination

$$= \frac{(33.33-30.18)^2 + (33.33-29.79)^2 + (33.33-9.73)^2}{3} = 193.14$$

4. Four Crop Combination

$$= \frac{(25-30.18)^2 + (25-29.79)^2 + (25-9.73)^2 + (25-9.24)^2}{4} = 132.83$$

5. Five Crop Combination

$$= \frac{(20-30.18)^2+(20-29.79)^2+(20-9.73)^2+(20-9.24)^2+(20-6.92)^2}{5} = 118.36$$

Table 1: Ahmednagar District: Crop Combination in 1960-61

Combination Type	Crops in Combination	No. Of Tahsil	Area in Hectares	% of Total Area
Monoculture	J	2	174566	15.11
Two crop	J/B	3	266930	23.10
Five Crop	Fo/B/P/R/Os	1	74784	06.47
Eleven Crop	J/B/W/Os/P/C/ R/V/Fo/S/Fr/M/Cs	7	639341	55.32
Total		13	1155621	100

Table 2: Ahmednagar District: Crop Combination in 2010-11

Combination Type	Crops in Combination	No. Of Tahsil	Area in Hectares	% of Total Area
Monoculture	J	1	43170	04.59
Two crop	J/B/S/C	5	413716	44.02
Six Crop	B/S/W/Fo/P/ V/Os/M/C	2	102130	10.87
Eight crop	C/B/J/V/W/P/Fo/Fr	1	33326	03.54
Eleven Crop	J/B/W/Os/P/C/ R/V/Fo/S/Fr/M/Cs	5	347528	36.98
Total		14	939870	100

(Source: By the Researcher)

B - Bajra

R - Rice

J - Jawar

V - Vegetable

C - Cotton

Fr- Fruits

P - Pulses

W - Wheat

M - Maize

Fo- Fodder Crops

Sc- Sugarcane

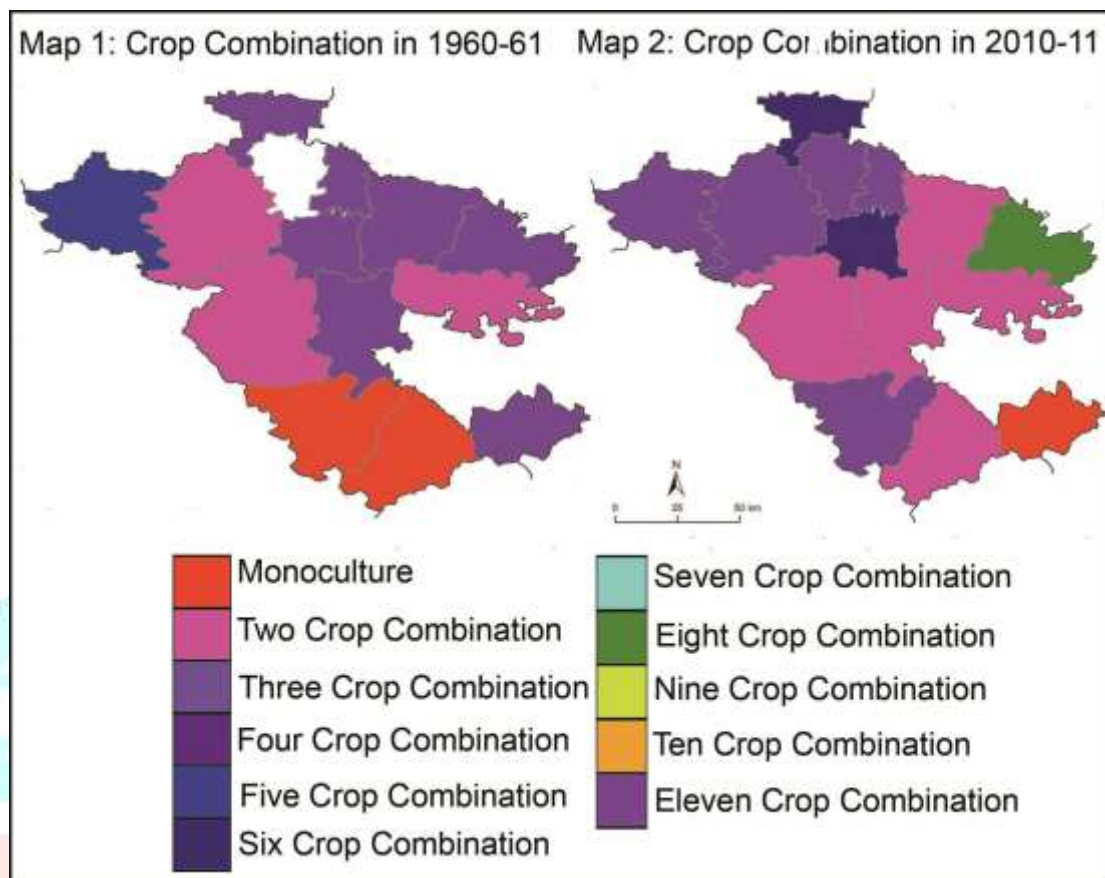
Os- Oil-seeds

Cs - Condiments and Spices

The deviation of the actual percentages from the theoretical curve is seen to be the lowest for a five crop combination. This result established the identity and the number of crops in the basic combination for the taluka as FoBPROs (Fodder crop+ Bajara + Pulses + Rice + Oilseeds).

CROP COMBINATION: OBSERVATION

Monoculture, two, five and eleven crops combinations had been identified in 1960-61 while monoculture, two, six, eight and eleven crops combinations had been observed in 2010-11 for the district. Table 6.10.A & B was shown the tahsil and area under each crop combination.

**1: Monoculture**

In 1960-61 monoculture combinations signify the increases in the number of crops with comparative diversification in crop combination. Only Jawar crop entered in monoculture combination. The region of monoculture was widely spread in Shrigonda and Karjat tahsil in the district (Map 1, Table 1).

Map 6.10.A shown the area of monoculture in the southern part of the district covered 174566 hectares (15.11 percent to total area). Furthermore it was observed that one taluka of one crop combinations appears in the district. Karjat and Shrigonda had combination of Jawar and it was covered respectively 91352 and 83214 hectares in the district.

In 2010-11 one crop combinations denote the decreases in the number of crops with comparative diversification in crop combination. One crop in this combination entered namely, Jawar. The region of one crop combination was located in the south eastern part of the district. It observed from Map 6.10.B that the area of one crop combination in the south western part covered 43170 hectares (4.59 percent to total area). Furthermore it was visible that Jamkhed taluka of one crop combination appears in the district. (Table 2 and Map 2). This combination was attributed to drought prone area of the district.

2: Two Crop Combination

In 1960-61 two crop combinations denote the increases in the number of crops with comparative diversification in crop combination. Two crops in this combination entered respectively, Jawar and Bajara. The region of two crop combinations was widely spread in over the district (Map 1, Table 2).

It observed from Map 1 that the area of two crop combination was spread over the district covered 266930 hectares (23.10 percent to total area). Furthermore it was visible that three tahsil of two crop combinations appears in the district. Parner had combination of jawar and bajra covered 107098 hectares (9.27 percent to total area) Sangamner had combination of Bajra and Jawar covered 83926 hectares (7.26 percent to total area) and Pathardi had combination of Jawar and Bajra covered 75906 hectares (6.57 percent to total area) (Table 1 and Map 1). This combination was attributed to all over part of the district.

In 2010-11 two crop combinations denote the increases in the number of crops with comparative diversification in crop combination. Four crops in this combination entered are namely, Jawar, Bajara, Sugarcane and Cotton. The region of two crop combination was widely spread in the eastern part of the district (Map 2 and Table 2). It is observed from Map 2 that the area of two crop combination was in the eastern part covered 413716 hectares (44.02 percent to total area). Furthermore it was visible that five tahsil of two crop combinations appears in the district. Parner had combination of Jawar and Bajara covered 123300 hectares (13.12 percent to total area), Nagar had combination of Jawar and Bajara covered 106350 hectares (11.31 percent to total area) while Karjat had combination of Jawar and Bajara covered 58647 hectares (6.24 percent to total area), Newasa had combination of Sugarcane and Cotton covered 75146 hectares (5.35 percent to total area) and Pathardi had combination of Bajara and Jawar covered 50273 hectares (8.00 percent to total area) (Table 2 and Map 2). This combination was attributed to eastern and southern part of the district.

3: Five Crop Combinations

In 1960-61 five crop combinations denote the increases in the number of crops with comparative diversification in crop combination. Five crops in this combination entered are respectively, fodder crops, bajara, pulses, rice and oilseeds. The region of five crop combinations was western part of the district (Map 1, Table 1).

It was observed from Map 1 that the area of five crop combination was western part of the district covered 74784 hectares (6.47 percent to total area). Furthermore it was visible that only one taluka of five crop combinations appears in the district i.e. Akole taluka was had combination of in five crop combination. Five crops in this combination entered are namely, fodder crops, bajara, pulses, rice and oilseeds covered 74784 hectares (6.47 percent to total area) (Map 1, Table 1). There was no any taluka under five crop combinations in 2010-11 (Map 2).

4: Six Crop Combinations

There was none of taluka under six crop combinations in 1960-61. In 2010-11, six crop combinations denoted the increases in the number of crops with comparative diversification in crop combination. Six crops in this combination entered are respectively, bajara, sugarcane, wheat, fodder crops, pulses, vegetables, oilseeds, maize and cotton. The region of six crop combinations was in the middle part of the district (Map 2, Table 2).

It was observed from Map 2 that the area of six crop combination was in the middle part of the district covered 102130 hectares (10.87 percent to total area). Furthermore it was visible that two tahsil of six crop combinations appears in the district i.e. Rahuri taluka had combination of bajara, sugarcane, wheat, fodder crops, pulses and vegetables covered 51749 hectares (5.51 percent to total area) and Kopargaon taluka had combination of oilseeds, bajara, wheat, maize, vegetables and cotton covered 50381 hectares (5.36 percent to total area) (Map 2, Table 2).

5: Eight Crop Combinations

There was none of taluka under eight crop combinations in 1960-61. In 2010-11, eight crops namely, cotton, bajara, jawar, vegetables, wheat, pulses, fodder crop and fruits entered into eighth crop combination in one taluka. Map 2 reveals that eighth crop combination area was located in Shevgaon taluka in the district. Table 2 displays the eight crop combination of crops in orders, tahsil and area in the district. It is observed from Table 2, Map 2 that the area of eight crop combination in Shevgaon taluka covered 33326 hectares (3.54 percent to total area).

6: Eleven Crop Combinations

In 1960-61, thirteen crops namely jawar, bajara, wheat, oilseed, pulses, cotton, rice, vegetables, fodder crops, sugarcane, fruits, maize and condiments and spices enter into eleven crop combination in seven taluka. Map 1 show that eleven crop combinations was observed in Newasa, Nagar, Shevgaon, Kopargaon, Jamkhed, Rahuri and Shrirampur tahsil. Table 1 displays the eleven crop combination the district. It observed from table 1, Map 1 that the area of eleven crop combination was in seven taluka covered 55.32 percent to total area.

Furthermore it was shown that seven tahsil of eleven crop combinations appeared in the district. Newasa taluka covered 9.99 percent to total area of the district and have been combination of following crops. Those crops are jawar, bajara, oilseed, pulses, wheat, cotton, fodder crops, sugarcane, condiment and spices, vegetables and maize. Second Nagar had combination of Jawar, pulses, oilseed, bajara, wheat, fodder crops, cotton, vegetables, sugarcane, condiments and spices, rice covered 113320 hectares (9.81 percent to total area). Third Shevgaon had combination of jawar, bajara, cotton, pulses, oilseed, wheat, fodder crops, sugarcane, vegetables, condiments and spices and rice covered 99866 hectares (8.64 percent to total area). Fourth Kopargaon had combination of jawar, bajara, sugarcane, wheat, oilseed, pulses, fodder crops, cotton, vegetables, rice and condiments and spices covered 93206 hectares (8.06 percent to total area). Fifth Jamkhed had combination of jawar, oilseed, pulses, fodder crop, wheat, bajara, condiments and spices, cotton, rice, vegetables and sugarcane covered 77393 hectares (6.70 percent to total area). Sixth Rahuri had combination of jawar, bajara, oilseed, sugarcane, pulses, wheat, cotton, fodder crops,

vegetables, rice and condiments and spices covered 71280 hectares (6.17 percent to total area) and seventh Shrirampur has combination of jawar, sugarcane, bajara, oilseed, wheat, pulses, fodder crops, cotton, vegetables, rice and condiments and spices covered 68812 hectares (5.95 percent to total area).

In 2010-11 eleven crop combinations show the increases in the number of crops with comparative diversification in crop combination. There are thirteen crops participated in this combination respectively, Bajara, Jawar, Wheat, Oilseed, Pulses, Cotton, Rice, Vegetables, Fodder crops, Sugarcane, Fruits, Maize and Condiments and Spices. The region of eleven crop combination was all over district. It is observed from Map 2 that the area of eleven crop combination was covered 36.98 percent to total area. Furthermore it was observed five tahsil of eleven crop combinations appears in the district. Sangamner has combination of bajara, vegetables, sugarcane, oilseed, wheat, fodder crops, fruits, pulses, maize, jawar and cotton covered 98819 hectares (10.52 percent to total area), Shrigonda has combination of jawar, wheat, vegetables, sugarcane, bajara, pulses, fruits, maize, fodder crops, condiments and spices and oilseed covered 87127 hectares (9.27 percent to total area), Akole has combination of fodder crop, rice, condiments and spices, vegetable, wheat, pulses, oilseeds, sugarcane, fruits, maize and jawar covered 74083 hectares (7.88 percent to total area), Rahata has combination of oilseeds, bajara, wheat, sugarcane, pulses, jawar, fruits, fodder crops, vegetables, maize and cotton covered 48494 hectares (5.16 percent to total area) and Shrirampur had combination of bajara, oilseeds, wheat, fodder crops, pulses, cotton, sugarcane, jawar, vegetables, maize and fruits covered 39005 hectares (4.15 percent to total area) (Table 2 & Map 2).

CONCLUSION

- In Ahmednagar district on study periods eleven crop combinations have been identified in 1960-61 and 2010-11.
- In 1960-61, one crop combination obtained at Karjat and Jamkhed tahsil with jawar. Two crop combinations obtained at Parner, Sangamner and Pathardi tahsil with crops jawar and bajara. Five crop combinations obtained at Akole taluka with crops fodder crops, bajara, pulses, rice and oil seeds while eleven crop combinations obtained at Newasa, Nagar, Shevgaon, Kopargaon, Jamkhed, Rahuri and Shrirampur tahsil with Bajara, Jawar, Wheat, oilseed, pulses, cotton, rice, vegetables, fodder crops, sugarcane, fruits, maize and condiments and spices are common constituent crops.
- In 2010-11, one crop combination obtained at Jamkhed taluka with Jawar in this combination. Two crop combinations obtained at Parner, Nagar, Karjat, Newasa and Pathardi tahsil with crops Jawar, Bajara, Sugarcane and Cotton. Six crop combinations obtained at Rahuri and Kopargaon tahsil with crops oil seeds, bajara, wheat, maize, vegetables, cotton, sugarcane, fodder crops and pulses. Eight crop combinations observed at Shevgaon with cotton, bajara, jawar, vegetables, wheat, pulses, fodder crops and fruits while eleven crop combinations observed at Sangamner, Shrigonda, Akole, Rahata and Shrirampur tahsil with bajara, jawar, wheat, oilseed, pulses, cotton, rice, vegetables, fodder crops, sugarcane, fruits, maize and condiments and spices are common constituent crops.

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