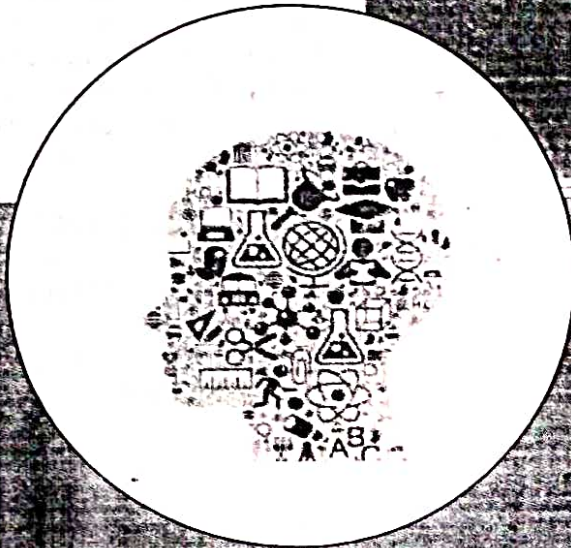


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Spatial and Temporal change in crop combination in Amravati district of Maharashtra

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Abstract

A study of crop combination constitutes an important aspect of agricultural geography and it also provides a good basis for agricultural regionalization. Crop combination is the analysis of the total percentage of area occupied by the different crops in a given region in that particular agricultural year. The crops are generally grown in combination and it is rarely seen that a particular crop occupies a position of total isolation; other crops in a given area unit at a given point of time. The distribution maps of individual crops are interesting and useful for planners, but it is even more important to view the integrated assemblage of the various crops grown in an area unit. For a comprehensive and clear understanding of the agricultural mosaic of an agro-climatic region and for the planning and development of its agriculture, a systematic study of crop combination is of great significance. In the present paper, author has made attempts to demarcate the crop combination region of the Amravati district of Maharashtra state for the year 2010-11 to 2021-22. Amravati district occupies the western part of the Vidharbha region of Maharashtra. Administratively the district is divided into fourteen tahsils. Agriculture is the main occupation of the district. Physiographical the region is divided into two regions Melghat hill region and the plain region. Fourteen crops have been considered for crop combinations of the region. Among these are Jawar Wheat, Rice, Bajra, Cotton, Gram, Maize, Soyabean, etc. are the main crops of the region. By computing the crop combination of the Amravati district it has been found that there are three to four crop combinations for the year 2010-11 and 2021-22. It has also been observed that the change in the cropping pattern of the region.

Keywords: crop combination, agriculture regionalization, total percent of area, area unit, agriculture mosaic.

Introduction

Crops are generally grown in combinations (Weaver, 1954). The study of crop combination of any region has gained importance in geographical study. It gives us the relative position of crops on the regional scale. The concept of crop combination is a scientific device to study the existing relationship of crops in association with each other and land utilization (Comred, 1979). Crops are commonly grown in combination and it is hardly that a specific crop occupies a position of total isolation from other crops in a given area. The pattern of crop combination gives spatial prevalence of certain crops or combination resulting in the emergence of crop regions (Todkari 2012). Crop combination study in geography is fruitful in

several ways; firstly, it provides an ample understanding of an individual crop. Secondly, the combination is in itself an integrative reality, and finally crop combination regions are essential for the construction of a more complex structure of vivid agricultural regions. The study of crop combination thus forms an integral part of agricultural geography and such study is significantly helpful for regional agricultural planning. For the point of view of the importance of crop combination other has find out crop combination of Amravati district.

2 Location of Study Area:-

Locational extends of the study area are between 21°30' to 21°50' north latitude and 76°35' to 78°27' east longitude. The total geographical area of the Amravati district is 12212 sq. km. 75% of the area of the district is covered by Deccan Trap while 25% area is covered by Purna alluvium. It is located in the Vidharbha region on the northeastern side of the State of Maharashtra. It is bounded by the Khandwa and Betul districts of Madhya Pradesh State on the north and by the Maharashtra districts of Nagpur on the northeast, Wardha on the east, Yavatmal on the south, Washim on the southwest, and Akola and Buldhana districts on the west. The district is divided into fourteen tehsils viz., Amravati, Morshi, Warud, Tiwsa, Chandur Railway, Nandgaon kh., Bhatkuli, Daryapur, Anjangaon surji, Dharni, Chikaldhara, Achalpur, and Chandur Bazar. Amravati district has a monsoon climate is characterized by a hot summer and general dryness throughout the year except during the southwest monsoon season. The average annual rainfall in this district ranges from 700 to 900 mm. It receives 85 to 95% of the year from June to September.

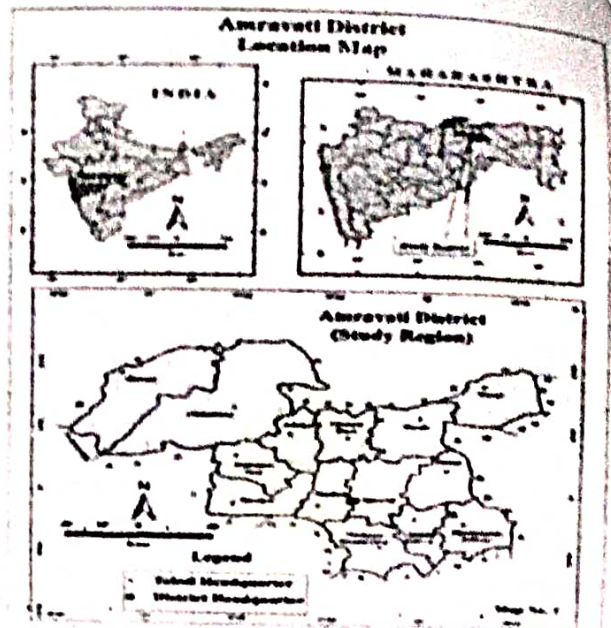
A major part of the district comes under Purna-Tapi and Wardha River basins. Agriculture is the main occupation of the population of the study region.

3 Methodology

This research paper is based on secondary data collected from the socio-economic abstract of the Amravati district of the year 2010-11 and 2021-22. All crops of the district are arranged and ranked in the hierarchy order and applied crop combination method of Weaver for finding the crop combination of the district. Maps are created with the help of ArcGIS 10.5 software.

Weaver's Crop Combination Method

Weaver was the first Geographer who used (1954) statistical technique to express the crop combination of the Middle West USA. In this process, Weaver attempted to delineate agricultural regions of the Middle West in the United States and computed the percentage of total harvested cropland occupied by each crop that held as much as one percent of the 184 total cultivated lands in each of the 1081 counties. In this work, Weaver calculated the 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 cropland in one crop.

Two crop combination = 50 % in each of the two crops.

Three crop combination = 33.3 % in each of the three crops.

Four crop combination = 25 % in each of the four crops.

For the determination of the minimum deviation the standard deviation method was used: Where d is the difference between the actual crop percentages in a given 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. $d = \sum d^2/n$

4 Result and Discussion

4.1 crop combination 2010-2011

In one agriculture year, singal crop is not cultivated, there is a combination of crops. The combination of the crops depends on the agroclimatic condition and socio-economic factors and need nutrient enhancement of soil. In the year 2010-11 except Dharni tehsil all other tehsils of the Amravati district have three and four crop combinations. Out of the fourteenth tehsils, ten tehsils had cotton as the first crop it means that cotton is a dominant crop of the district. There is no substitute cash crop available to cotton and as well as soil and agroclimatic condition are favorable to this

crop also. If we observe tehsil wise crop combination of year 2010-11 it shows that Daryapur is a monoculture crop combination and the crop of this tehsil is cotton. Two crop combination tehsils are Chikhaldra, Achalpur, Morshi, Nandgoan Kh., and Chikhaldara. Except Chikhaldara all other tehsils cotton is the dominant crop Tur and Munge and Jawer crops are shown in combination of cotton in this crop combination. Chikhaldara tehsil is a hilly area and land holding is very small as well as traditional farming is practiced so cotton is

not shown in this area. In three crop combination tehsils are Anjangoan Surgi, Warud, Tiwsa and Amravati and the combination of the crop in this tehsils are cotton, Jawar and Wheat, cotton jawar and Tur and cotton Jawar and Gram. Four crop combination tahsils are Chandur Bazar, Bhatkuli and Dhamangoan and crops are Cotton, Tur Wheat, and Gram. In Dharni tehsil seven crop combination is found and the reason is that it is forest and Tribble area so the crop combination is increased.

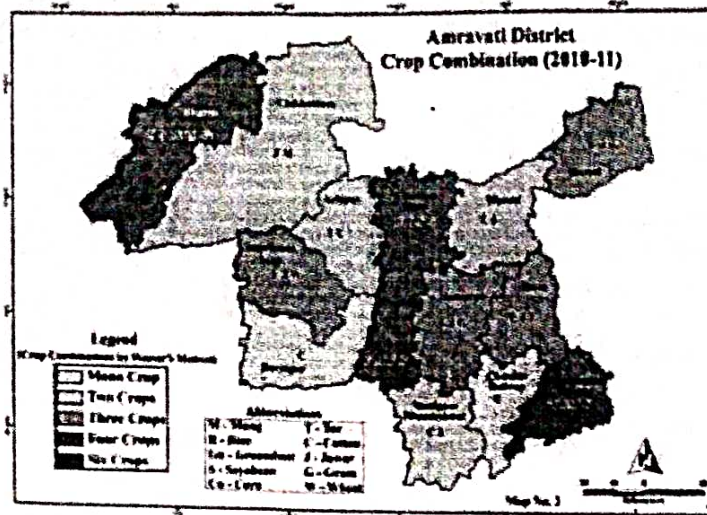
Amravati District crop combination 2010-11

Sr. No	District	Monoculture	2-crop combination	3-crop combination	4-crop combination	5-crop combination	6-crop combination	Crop combination
1	Dharni	6435.41	1174.72	944.14	612.20	465.04	470.88	6
2	Chikhaldara	8342.49	2096.07	2492.30				2
3	Anjangoan Surgi	3299.01	437.95	434.71	854.17			3
4	Achalpur	3291.32	85.82	93.33				2
5	Chandur Bazar	5636.22	1980.06	953.57	504.51	521.32		4
6	Morshi	1961.16	769.35	1172.05				2
7	Warud	3458.35	901.90	864.72	973.46			3
8	Tiwsa	4320.69	1484.89	774.43	807.83			3
9	Amravati	4486.23	1438.21	794.46	904.33			3
10	Bhatkuli	6778.62	2178.38	1160.28	846.66	1627.52		4
11	Daryapur	2860.06	593.72	582.68	580.84	562.69		5
12	Nandgoan khand.	1895.60	805.92	1650.41				2
13	Chandur Riy	289.37	4688.34					1
14	Dhamangoan	7051.59	2579.34	1535.75	1027.09	1462.10		4
	Total	3829.20	1183.61	760.65	254.50	740.92		4

4.2 crop combination 2021-2022

In the year 2021-22 out of fourteen tehsils. eight tehsils are two crop combinations. In this crop combination Bhatkuli, Nandgoan khandeswar, Chandur Railway and Dhamangon first crop is Soyabeen and the second crop is Gram and in Morshi Warud and Daryapur cotton first crop and Gram is the second crop. In Dharni two crop combination are Gram and Corn. In three crop combination tehsils are Anjangoan surgu and Chandur Bazar and crops

combination is Cotton, Soyabeen and Gram. In four crop combination is found in Achalpur tehsil and crops combination is Cotton, Soyabeen, Gram and Tur. Chikhaldra is hilly area and land holding is small and subsistence farming is practice n this area so that in this tehsil nine crop combination is found. All for whole district three crop combination and crops are Cotton Soyabeen and Gram.



4.2 crop combination 2021-2022

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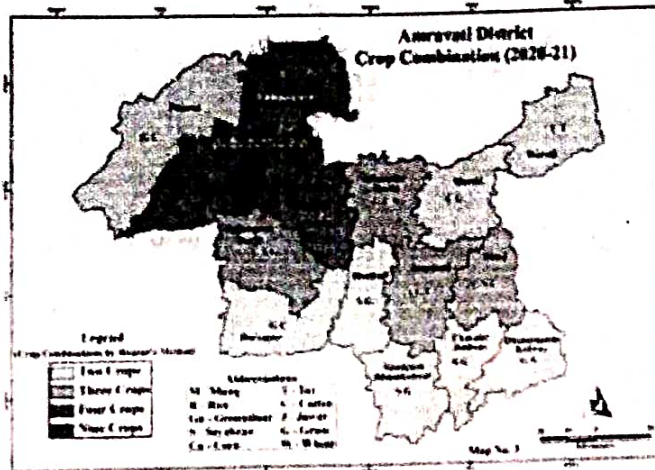
Amravati District crop 2021-22

Sr. No	District	1-crop Com bination	2-crop comb ination	3 crop combi nation	4 crop combi nation	5 crop combi nation	6 crop combi nation	7 crop combi nation	8 Crop comben ation	9 Crop comben ation	Crop comben ation
1	Dharni	2219.40	292.07	358.72							2
2	Chikhaldara	4624.10	1287.01	495.55	480.51	413.99	337.57	305.63	299.93	299.06	9
3	Anjangoan Surgi	4018.47	418.79	28.11	381.58						3
4	Achalpur	4865.98	1324.04	405.76	267.37	282.28					4
5	Chandur Bazar	3781.45	605.01	162.95	208.57						3
6	Morshi	1306.29	373.41	405.25							2
7	Warud	2228.29	368.96	696.33							2
8	Tiwsa	3659.68	306.92	31.56	652.04						3
9	Amravati	2468.92	387.80	528.66	652.04						3
10	Bhatkuli	602.72	664.72	1183.40							2
11	Daryapur	1229.61	176.77	1098.56							2
12	Nandgoan	1225.20	741.25	1186.26							2

	khand.									
13	Chandur Riy	2223.75	193.02	401.51						2
14	Dhamanngoan	1791.45	150.62	345.49						2
	Total	4196.68	437.22	34.20	387.44					3

As compared the crop combination of year 2010-11 with the year 2021-22. In year 2021-22 Soyabeen get a dominant place in all crop combination as per the year 2010-

11. Due to labour problem farmers choose the combination of Soyabeen and Gram in place of cotton.



Conclusion

After the analysis of crop combination of year 2010-11 and 2021-22 following conclusion are formulated:

- 1) Dharni and Chikhaldara is hilly and forest area of the region so agriculture in this area is subsistence type of farming so the crop combination in these thasils are increased.
- 2) In the year 2010-11 Cotton is main cash crop of the region but in year 2021-22 Soyabeen emerged as a substitute crop for Cotton.
- 3) Chandur Bazar, Amravati, Bhtkuli, Daryapur thasils come under the Purna river basin, and Warud, Morshi, and Tiwsa thasils under Wardha river basin and soil of this two basin is suitable for Soyabeen and Gram and Cotton crops. But the farmers select two or three crops combination as per their Land holding, nurtures requirement of the soil, highest returns in farming.

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