A STUDY OF CROP COMBINATION REGIONS IN THE DISTRICT OF JASHPUR, CHHATTISGARH STATE

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Abstract

The study of crop combinations is a very significance aspect of agricultural geography. Crop combination defined that the total or aggregate of different crops cultivated/grown in a region at a given point of time. The crop combination technique represents the areas sharing significant proportion of crops at higher rank and it is a very necessary measurement to analyze of the cropping intensity. This research paper is focused on a study of crop combination regions in Jashpur district of Chhattisgarh state. The study area Jashpur district is situated in north-eastern corner of Chhattisgarh state in India and it is located between $22^017'$ north to $23^015'$ north latitudes and $83^030'$ east to $84^024'$ east longitudes. The main objectives of the present study are to finding out the crop combination regions and understanding the cropping pattern of eight tahsils in Jashpur district for the reference year 2019-20. This research paper has been based on both the primary data and secondary data and J. C. Weaver's (1954) method has been used for the delineation of crop combination regions in Jashpur district. The collected data has been processed and presented with the help of quantitative and cartographic techniques respectively. As a reaching conclusion paddy (72.28 %) is the first dominated crop in Jashpur district, the second dominated crop is oilseeds (10.64 %) and the study area falls under the five crop combination regions based on weaver's method. Under the study area five crops combination regions is found in four tahsils which are namely Bagicha, Kansabel, Manora and Duldula. Monoculture (Single crop / one crop) is found in four tahsils which are namely Jashpur, Kunkuri, Farsabahar and Pathalgaon. Crop combination provides a good fundamental basis for agricultural regionalization and also helps to the formulation of strategy for the agricultural development in the study area.

Key words: Crop combination regions, J. C. Weaver's method, Percentages of crop area, Agricultural regionalization and Jashpur district.

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INTRODUCTION:

The study of crop combination is an important aspect in agricultural Geography. Agricultural activity not only involves cultivation of crops but also domestication of animals, forestry, irrigation and many other diversified activities (Andrabi, 2019). In the study area 91.08 % population are lived in rural area and they are economically depends on agricultural activities. Crop combination refers to the aggregate of different agricultural crops grown / cultivated in an area at a given point of time. The crops are generally grown in combinations and it is rarely that a particular crop occupies a position of total isolation other crops in a given area unit at a given point of time (Husain, 1996). It helps in understanding the cropping pattern and crop concentration in particular area (Pal, 2017). Present day crop combination a great influence of agricultural production (Jana, 2017). Recently the crop combination analysis in geographical studies has gained momentum and its importance is increasing day by day (Erande, 2020). Regional and temporal model of crop combinations gives learn how for the contemporary and the changing type of inter crop fight (Miah et al., 2021). The study of crop combinations thus forms an integral part of agricultural geography and such study is significantly helpful for regional agricultural planning (Singh and Gupta, 2020). The study of crop combination enables to evaluate the suitability and consistency of cropping patterns in the context of the role of the local environment (Gautam, 2016).

STUDY AREA:

Jashpur district is taken to be as unit of study which is basically tribal area and here most of the peoples are lived in rural area. Economic structure of the study area are mainly depends on agricultural activities which are characterized by monsoon climate and predominantly agro-based industry. It is situated in north-eastern corner of Chhattisgarh state in India and it is located between $22^0 17'$ north to $23^0 15'$ north latitudes and $83^0 30'$ east to $84^0 24'$ east longitudes. The total geographical area of Jashpur district is 5838.00 Sq.km. In the study area paddy is the most dominated crop and the Matasi (Red yellow soil) soil has considered as the best soil for paddy cultivation in the study area. As a main crops Paddy, Wheat, Jowar and Maize are sown in the study area. The total cultivated area of Jashpur district is 326700 hectares where 267200 hectares is 'net sown area' and 59500 hectares is 'Area sown more than once' (According to census -2011). The total cropped area or gross cropped area is 254937 hectares in the observation year 2019-20 under the major crops cultivation of Jashpur district.
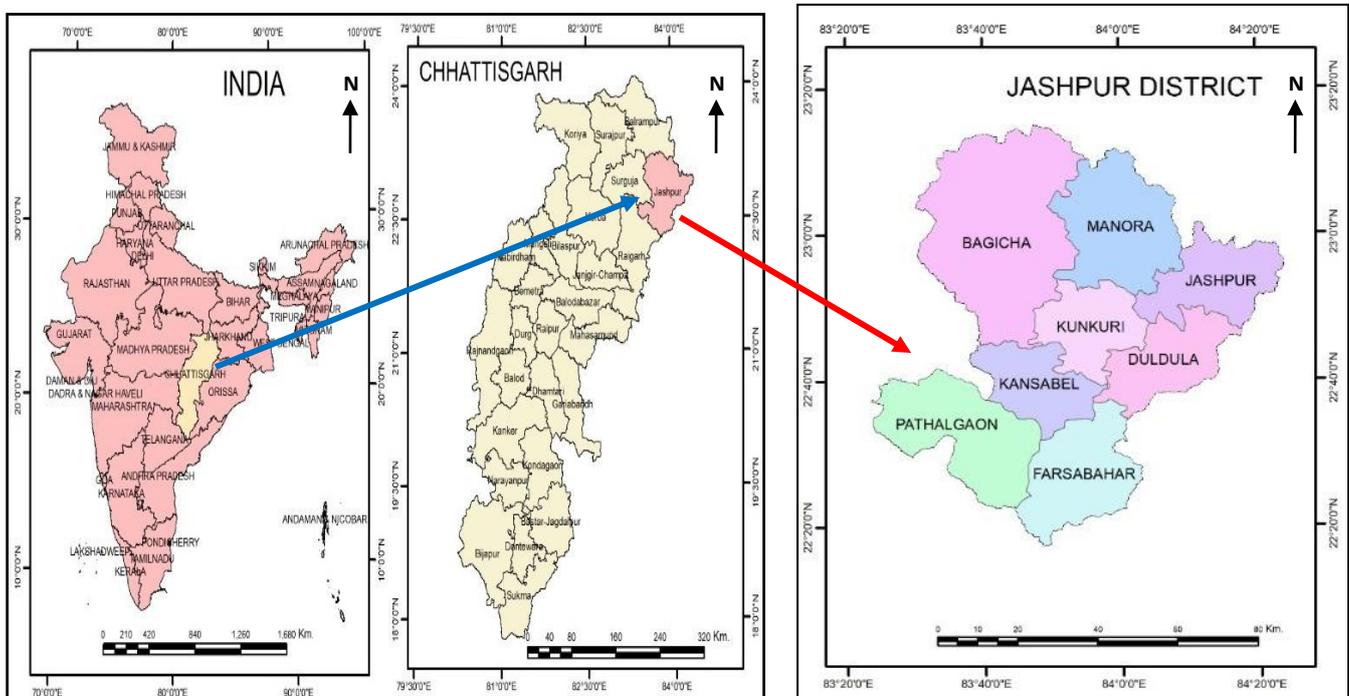
Fig. no.1: Showing the Location map of the study area (Jashpur District)

OBJECTIVES:

The main objectives of the present study are as follows –

(i) To find out the crop combination regions in the study area.

(ii) To understanding the cropping pattern in different Tahsils of the district.

MATERIALS AND METHODS:

The present research paper has been based on both the primary data and secondary data. Primary data are obtained through schedule method at household's survey whereas as a research tools the observation and interview methods are also included. The secondary data is collected from census of India 2011 and district statistical handbook (reference year 2019-20, Land records branch of Jashpur district, Chhattisgarh state). J.C. Weaver's crop combination technique is used for the delineation of crop combination regions in Jashpur district and to understanding the cropping pattern of different tahsils under the study area. Crop combinations of the study area have been computed on the basis of the deviation of the real percentage of crops for all the possible combinations in the component areal units against a theoretical standard. The collected data had been processed and represented with the help of quantitative and cartographic techniques respectively.
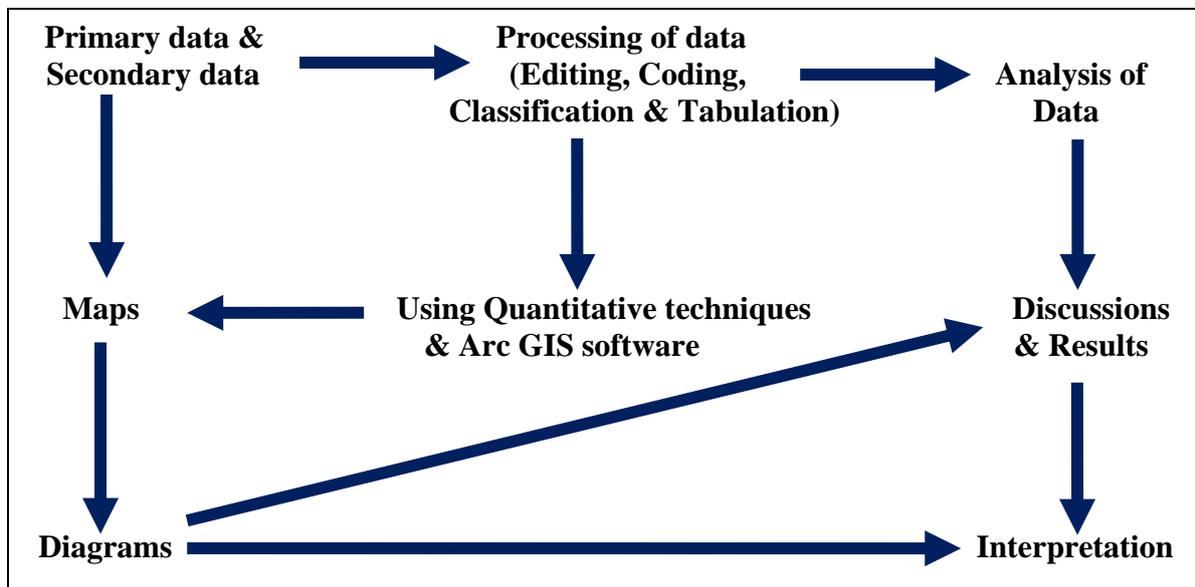
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Primary data &          Processing of data              Analysis of
Secondary data   →     (Editing, Coding,      →            Data
                        Classification & Tabulation)
       ↓                          ↓                           ↓
     Maps      ←        Using Quantitative techniques    Discussions
                          & Arc GIS software              & Results
       ↓                                                     ↓
    Diagrams   ──────────────────────────────→         Interpretation
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Fig. No.2: Flow chat of Data Sources and Research Methodology

DISCUSSION AND RESULTS: In the field of agricultural geography, J. C. Weaver (1954) was the first to use the statistical technique to demarcate the crop-combinations of the mid-west (USA). As an agricultural regionalization the crop combination of the study area has been analyzed with the help of Weaver's Crop Combination Method (1954) who calculated the deviation of the real percentages of crops 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 -

(1) Monoculture (single/one crop) = 100 % of the total harvested crop land in one crop.

(2) Double crop combinations (two crop combination) = 50 % in each of the two crops.

(3) Three crop combinations = 33.33 % in each of the three crops.

(4) Four crop combinations = 25 % in each of the four crops.

(5) Five Crop Combinations = 20 % in each of the five crops.

Table no. 1

Crop combinations and hypothetical percentage of Jashpur district (J.C. Weaver Method, 1954).

Crop Combinations	Hypothetical Percentage
Monoculture (Single crop / One crop)	(100 /1) = 100 %
Double Crops (Two crops) Combination	(100 /2) = 50 %
Three Crops Combination	(100 /3) = 33.33 %
Four Crops Combination	(100 /4) = 25 %
Five Crops Combination	(100 /5) = 20 %

The standard deviation method was used by weaver for the determination of the minimum deviation, applying the following formula:

$$S.D. = \sqrt{\Sigma\, d^2 / n}$$

Whereas, **d** = it is the difference between the actual crop percentages in a given area unit and the appropriate percentage in the theoretical curve, **n** = it is the number of crops in a given combination of the study area. As Weaver pointed out that the relative, not absolute value being significant and square roots were not extracted, that's why the following actual formula was used:

$$d = \Sigma \, d^2 \, / \, n$$

Weaver's method has admirably been accepted and applied for the demarcation of crop combination regions in the study area. In the study area the percentage of crop area to the total cropped area has been taken under the consideration. From Jashpur district, the percentage share of first five dominated crops in the total cropped area in a reference year 2019-20 was as follows in descending order: **Paddy** is 72.28 %, **Oilseeds** is 10.64 %, **Pulses** is 8.90 %, **Vegetables** is 3.78 % and **Maize** is 2.19 %.

Table no. 2

Area & Percentages under major crops in Jashpur district (Reference year: 2019-20)

Year	Area under major crops (Hectares)														Total Cropped Area (Hectares)
	Paddy	Wheat	Jowar	Maize	Kodo-kutki	Other cereals	Pulses	Sugarcane	Fruits	Vegetables	Chili Spices	Oilseeds	Fibers	Drugs & Narcotics	
2019 - 20	184271	928	80	5587	1547	1234	22698	111	861	9624	812	27117	67	00	254937
%	72.28	0.36	0.03	2.19	0.61	0.48	8.90	0.04	0.34	3.78	0.32	10.64	0.03	0.00	100

Source: District statistical handbook, reference year 2019-20, Land records branch of Jashpur district.
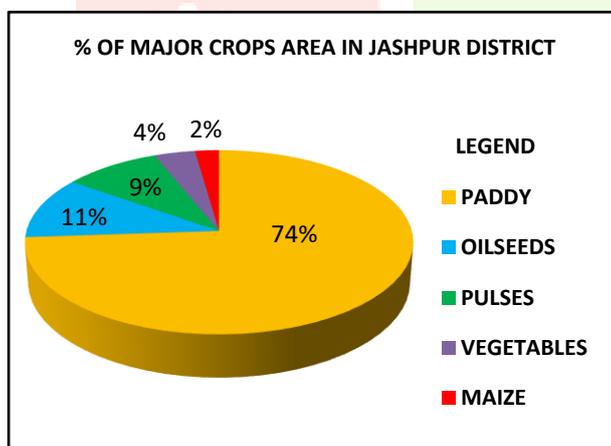

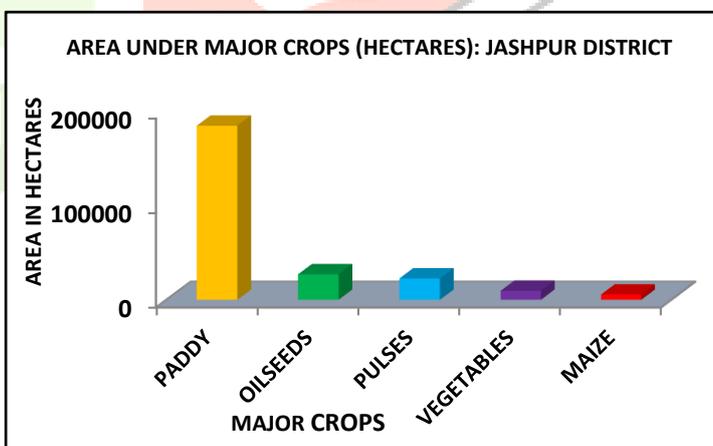**Fig. no. 3:** Percentage of major crops area to the total cropped area in Jashpur district.

Fig. no. 4: Area under major crops to the total cropped area in Jashpur district.

The Weaver's crop combinations technique is applied; for the determination of crop combination regions in the study area and the percentages of five major crops are taken for finding out which types of crop combination regions is found in Jashpur district in a reference year 2019-20. The crop combination table given as follows –

Table no. 3
Crop Combination regions of Jashpur District (By J. C. Weaver's Method, 1954)

Types of Crop Combinations	Mono-culture (single/one crop)	Double Crops (Two Crops)		Three Crop Combinations			Four Crop Combinations				Five Crop Combinations				
Hypothetical % (A)	100	50	50	33.33	33.33	33.33	25	25	25	25	20	20	20	20	20
% of the Crops land occupy (B)	72.28	72.28	10.64	72.28	10.64	8.90	72.28	10.64	8.90	3.78	72.28	10.64	8.90	3.78	2.19
Deviation [d] (A-B)	27.72	-22.28	39.36	-38.95	22.69	24.43	-47.28	14.36	16.1	21.22	-52.28	9.36	11.1	16.22	17.81
d^2	768.40	496.40	1549.21	1517.10	514.84	596.82	2235.40	206.21	259.21	450.29	2733.20	87.61	123.21	263.09	317.20
$\Sigma\, d^2$	768.40	2045.61		2628.76			3151.11				3524.31				
$d = \Sigma\, d^2 / n$	768.40	1022.81		876.25			787.78				**704.86**				

Source: Computed by the Author.

In the table no.3, five crops deviation had been calculated with the help of J. C. Weaver's method. The deviation of the actual percentages from the theoretical curve is seen to be the lowest for a five crop combinations which is 704.86. This result established the identity and the number of crops in the basic combinations for the study area as Paddy - Oilseeds - Pulses - Vegetables - Maize. So, the study area (Jashpur district) falls under the five crop combination regions.

COMPUTING CROP COMBINATION REGIONS OF JASHPUR DISTRICT: The study of crop combination regions constitutes a very significant aspect in the study of agricultural geography, as it provides a good basis of agricultural regionalization. J. C. Weaver's method has been applied for the determination of crop combination regions as well as agricultural regionalization as it application results into suitable and accurate grouping of dominated crops in the study area.

(1) Monoculture (single/one crop): Rice is the leading crop in the study area and it is showing highest coverage in the district. It is grown 184271 hectares (72.28 %) in the reference year 2019-20. It is the result of a most of the peoples of the study area are economically depends on agriculture as well as it is the basic livelihood work of the villagers. Most parts of the district covered with the red -yellow soil (Matashi) which has been considered as the best soil for the cultivation of paddy crop. According to weaver's method the'd' of monoculture crop is lower than the two crop, three crop and four crop

combinations and higher than the five crop combinations. So, it is the second-best crop combinations of the study area.

(2) Double crop (two crops) combinations: According to weaver's crop combination method the paddy crop (72.28 %) and oilseeds (10.64 %) is falls under the two crop combinations in the study area where the'd' of two crop combinations is higher than the other crop combinations which is not a suitable crop combinations for the study area.

(3) Three crop combinations: According to weavers crop combinations method the paddy crop (72.28 %), oilseeds (10.64 %) and pulses (8.90 %) is entered under the three crop combinations in the study area.

(4) Four crop combinations: Under this crop combinations of the study area the four crops are entered which is namely paddy crop (72.28 %), oilseeds (10.64 %), pulses (8.90 %) and vegetables (3.78 %).

(5) Five crop combinations: According to weaver's crop combinations method the paddy crop (72.28 %), oilseeds (10.64 %), pulses (8.90 %), vegetables (3.78 %) and maize (2.19 %) is the dominated crops of this category in the study area for the reference year 2019-20 where the'd' of five crop combinations is lower than the other crop combinations. therefore, it is the best suitable crop combinations (Paddy-Oilseeds-Pulses-Vegetables-Maize) in the study area.

TAHSIL WISE CROP COMBINATION ANALYSIS OF JASHPUR DISTRICT: For the determination of crop combination regions in tahsil wise, the percentages share of five major crops to the total cropped area has been taken in a reference year 2019-20. The percentages of five major crops area are arranged according to descending order which as follows - in Bagicha tahsil the paddy crop is 61.77 %, oilseeds is 16.78 %, maize is 7.26 %, pulses is 5.17 % and vegetables is 2.97. In Kansabel tahsil the paddy crop is 72.89 %, pulses is 12.62 %, oilseeds is 10.76 %, vegetables is 2.25 % and maize is 0.88 %. In Jashpur tahsil the paddy crop is 76.06 %, oilseeds is 10.31 %, pulses is 9.86 %, vegetables is 1.30 % and fruits is 0.80 %. In Manora tahsil the paddy crop is 72.07 %, oilseeds is 17.37 %, pulses is 5.03 %, maize is 2.17 % and vegetables is 1.64 %. In Kunkuri tahsil the paddy crop is 78.37 %, oilseeds is 8.90 %, pulses is 8.88 %, vegetables is 1.70 % and maize is 0.75 %. In Duldula tahsil the paddy crop is 68.21 %, pulses is 14.67 %, oilseeds is 10.03 %, vegetables is 5.19 % and fruits is 0.72 %. In Farsabahar tahsil the paddy crop is 81.34 %, pulses is 9.87 %, oilseeds is 4.31 %, vegetables is 3.48 % and maize is 0.40 %. In Pathalgaon tahsil the paddy crop is 74.01 %, pulses is 9.78 %, vegetables is 8.34 %, oilseeds is 5.93 % and maize is 0.96 %. Five crops deviation had been calculated on the basis of first five dominated crops area (%) to the total cropped area in all eight tahsils under the study area with the help of Weaver's method which as follows in the table no.4

Table no. 4

Calculate the deviation of the real percentage of crops for all the possible combinations in eight tahsils of Jashpur district by Weaver's Crop Combinations Method (1954)

Types of Crop Combinations	Mono - culture (single / one crop)	Double Crops (Two Crops)	Three Crop Combinations	Four Crop Combinations	Five Crop Combinations
Bagicha Tahsil : Five Crop Combination Regions					
$d = \Sigma\, d^2 / n$	1461.53	621.05	587.19	531.89	**485.47**
Kansabel Tahsil: Five Crop Combination Regions					
$d = \Sigma\, d^2 / n$	734.95	960.61	834.43	791.76	**723.56**
Jashpur Tahsil: Monoculture					
$d = \Sigma\, d^2 / n$	**573.12**	1127.21	968.87	903.46	811.55
Manora Tahsil: Five Crop Combination regions					
$d = \Sigma\, d^2 / n$	780.08	775.9	852.13	798.45	**719.46**
Kunkuri Tahsil: Monoculture					
$d = \Sigma\, d^2 / n$	**467.86**	1247.04	1074.41	977.58	871.87
Duldula Tahsil: Five Crop Combination Regions					
$d = \Sigma\, d^2 / n$	1010.60	789.91	702.57	647.59	**608.61**
Farsabahar Tahsil: Monoculture					
$d = \Sigma\, d^2 / n$	**348.20**	1296.31	1232.50	1073.58	953.69
Pathalgaon Tahsil: Monoculture					
$d = \Sigma\, d^2 / n$	**675.48**	1097.07	944.65	818.71	743.60

Source: Computed by the Author.

Table no. 5

Tahsil wise Crop Combination regions in Jashpur District by J.C. Weaver's Method
(Reference year: 2019-20)

| Sl. No.	Name of Tahsils	Types of Crop Combination Regions	Name of the Crops
1	Bagicha	Five crop combination Regions	Paddy, Oilseeds, Maize, Pulses, Vegetables
2	Kansabel	Five crop combination Regions	Paddy, Pulses, Oilseeds, Vegetables, Maize
3	Jashpur	Monoculture	Paddy
4	Manora	Five crop combination Regions	Paddy, Oilseeds, Pulses, Maize, Vegetables
5	Kunkuri	Monoculture	Paddy
6	Duldula	Five crop combination Regions	Paddy, Pulses, Oilseeds, Vegetables, Fruits
7	Farsabahar	Monoculture	Paddy
8	Pathalgaon	Monoculture	Paddy

Source: Computed by the Author.
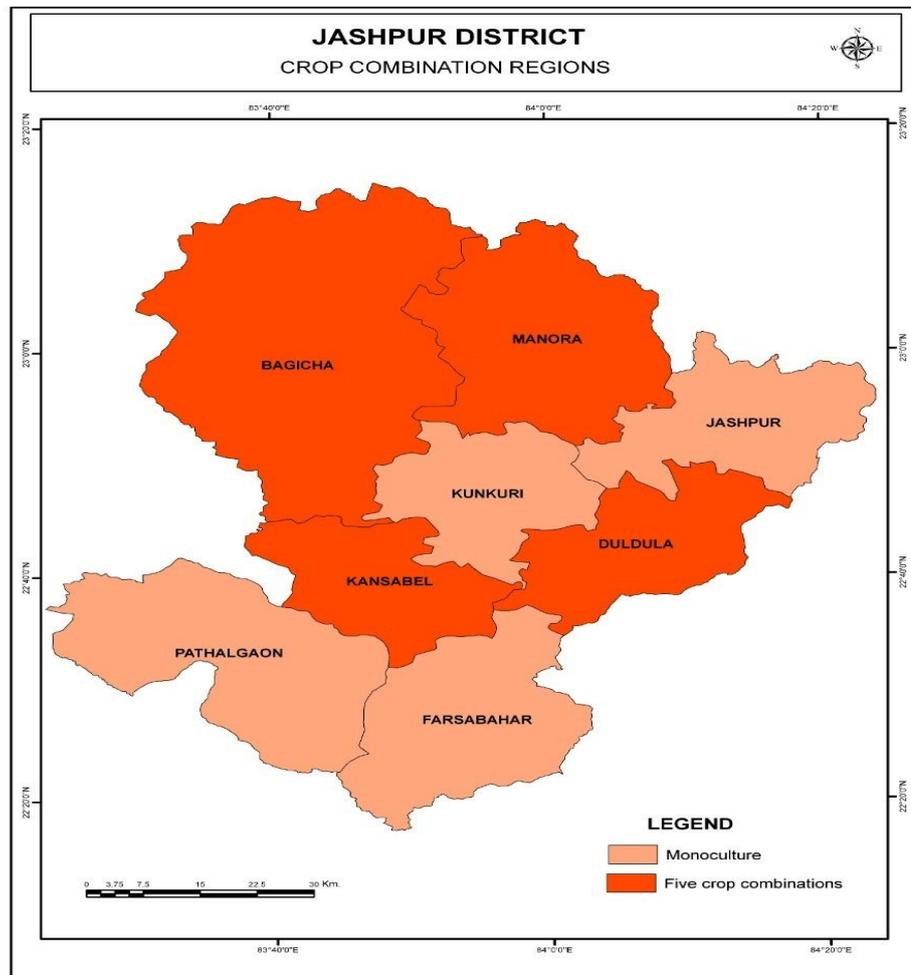
Fig. no.5: Showing the Tahsil wise crop combination regions in Jashpur district according to J.C. Weaver's Method (Reference year: 2019-20)

On the basis of weaver's technique in **Bagicha tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest for five crop combinations. This result established the identify and the number of crops in the basic combination for the Bagicha tahsil as paddy (61.77 %) - oilseeds (16.78 %) - maize (7.26 %) - pulses (5.17 %) - vegetables (2.97 %). So, Bagicha tahsil falls under the five crop combination regions. In **Kansabel tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest for five crop combinations. This result established the identify and the number of crops in the basic combination for the Kansabel tahsil as paddy (72.89 %) - pulses (12.62 %) - oilseeds (10.76 %) - vegetables (2.25 %) - maize (0.88 %). So, Kansabel tahsil falls under the five crop combination regions. In **Jashpur tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest in monoculture (one/single crop dominated) type of combinations. This result established the identify and the number of crop in the basic combination for the Jashpur tahsil as paddy crop (76.06 %). So, Jashpur tahsil having monoculture. In **Manora tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest for five crop combinations. This result established the identify and the number of crops in the basic combination for the Manora tahsil as paddy (72.07 %) - oilseeds (17.37 %) - pulses (5.03 %) - maize (2.17 %) - vegetables (1.64 %). So, five crop combination regions are found in Manora tahsil. In **Kunkuri tahsil** the deviation of the actual

percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest in monoculture (one/single crop dominated) type of combination. This result established the identify and the number of crop in the basic combination for the Kunkuri tahsil as paddy crop (78.37 %). So, Kunkuri tahsil falls under the monoculture. In **Duldula tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest for five crop combinations. This result established the identify and the number of crops in the basic combination for the Duldula tahsil as paddy (68.21 %) - pulses (14.67 %) - oilseeds (10.03 %) - vegetables (5.19 %) - fruits (0.72 %). So, five crop comination regions have been found in Duldula tahsil. In **Farsabahar tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest in monoculture (one/single crop dominated) type of combination. This result established the identify and the number of crop in the basic combination for the Farsabahar tahsil as paddy crop (81.34 %). So, Farsabahar tahsil having monoculture. In **Pathalgaon tahsil** the deviation of the actual percentages from the theoretical curve (hypothetical percentages) is seen to be the lowest in monoculture (one/single crop dominated) type of combination. This result established the identify and the number of crop in the basic combination for the Pathalgaon tahsil as paddy crop (74.01 %). So, monoculture type of combination is found in Pathalgaon tahsil.

According to weaver's formula that the minimum deviation from the normal curve is found in the five crop combination regions and therefore the study area fall under the five crop combination regions (Paddy, Oilseeds, Pulses, Vegetables and Maize). The main goal of agricultural land utilization as revealed by the compositions and the distribution pattern of crop combination regions is the maximum production of paddy (rice) crop, particulars for the consumption by the local villagers in the study area. The crop combinations based on statistical technique is a very important device to access the dominating position of various crops in different tahsils of Jashpur district.

CONCLUSION: The study of crop combinations is a greater significance in respect to Agricultural Geography. In present day the concept of crop combinations has enjoyed the attention of geographers and agricultural land use planners. A crop combination helps to the cultivators for harvesting the more than one crop in different crop seasons. Crop combination provides a good fundamental basis for agricultural regionalization of a study area and it is also helps to the formulation of strategy for the agricultural development in the study area. Five crop combination regions have been found with paddy, oilseeds, pulses, vegetables and Maize in the study area. Under the study area monoculture (Single crop / one crop dominated) is found in four tahsils (Jashpur, Kunkuri, Farsabahar and Pathalgaon) out of the eight tahsils while five crop combination regions are found in four tahsils which are namely Bagicha, Kansabel, Manora and Duldula. Crop combination regions are influenced by the physical and socio-economic factors in the study area. The application of Weaver's method shows the realistic picture of crop combination regions in the study area. J.C.Weaver's crop combinations method has admirably been accepted and applied for the demarcation of crop combination regions and agricultural regionalization as its application results into the suitable crop combinations and accurate grouping of dominating crops in the study area.

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