Biannual Open Access Journal
Peer-Reviewed/Refereed International Journal
JOURNAL OF GLOBAL RESOURCES
Published by: ISDESR, Jaipur, India

www.isdesr.org

ISSN: 2395-3160 (Print)
ISSN: 2455-2445 (Online)
January 2023, Volume 09 (01)
DOI Prefix: 10.46587/JGR

07

AGRICULTURAL CHARACTERISTICS IN FLOODPLAIN ZONE OF MIDDLE GANGA PLAIN

Dinesh Kumar
Assistant Professor Govt. M. G. M. Postgraduate College, Itarsi, M.P., India
Email: kumardinesh.bhu2014@gmail.com

How to cite this paper:
Dinesh Kumar (2023) Agricultural Characteristics in Floodplain one of Middle Ganga Plain, Journal of Global Resources, Vol. 09 (01)

DOI:
10.46587/JGR.2023.v09i01.007

Received: 21 Nov. 2022
Reviewed: 30 Dec. 2022
Final Accepted: 09 Jan. 2023

Abstract: *This paper has been attempted to study the difference dimensions of agriculture like crop diversification, cropping intensity, crop combination, crop ranking, irrigation intensity and land use efficiency in floodplain zone of middle Ganga plain. Agriculture plays a very important role in the economic development of our country (India), where 65 percent of rural population is directly or indirectly depended on the agricultural for survival. The largest population of India has been livening in Ganga floodplain so it has necessary to study the different agricultural characteristics. The major objectives of the study are to analyze the spatial pattern of agriculture diversification, crop ranking, crop combination and to calculate the irrigation intensity, cropping intensity, land use efficiency of Jaunpur district. The present study has been exclusively based on secondary data which collected from different offices and websites. Crop diversification measure by Singh (1976) formula which was slightly modified the Bhatia (1965) formula, cropping intensity analyzed with the help of Singh (1974) method and crop combination determined by Kikukazu Doi (1959) method. In the Jaunpur district the irrigation intensity has been 140.10, crop diversification index has been 38.69, cropping intensity index has 100.07. In study area wheat is the dominant crop, paddy dominated as the second crop and maize is the third crop. There are three types crop combinations like wheat-rice, wheat-rice-maize and wheat-maize- rice.*

Key words: Crop Diversification, Cropping Intensity, Crop Combination, Crop Ranking, Irrigation Intensity.

Introduction

Today, India has facing two most vital problems which are directly related to agricultural development like increasing population and agricultural development disparities. Despite different scientific developments in other sectors of economy, agriculture is still the backbone of the rural economy, dependent on the physical endowments of environments (Mishra, 1985). While agriculture plays a very important role in the economic development of the country where 65 percent of rural population is directly or indirectly depended on the agricultural for survival. Agriculture and allied sectors contribute nearly 17.8 percent and 17 percent of gross domestic product (GDP) of India (Siddiqui, et al. 2012). The largest population of India has been livening in Ganga floodplain. In the present time the shrinkage of agricultural land due to development process and shortage of land due to increasing of population put tremendous pressure upon the existing pieces of cultivated land (Mishra and Sarkar 2013). Therefore, it has been necessary to study the different dimension of agriculture in middle Ganga plain. Due to which how to fulfill the increasing demand. In this dimension. There are various authors who made efforts agricultural development either in the form of individual aspect or as an indicator of socio-economic development. A few may be mentioned as Tiwari (1986), Mishra (1988), Tyagi (1994), Talib et al. (1995), Banarjee (1997), Siddiqui (1999), Dutta et al. (2001), Agarwala and Hazarika (2002), Gaikwad and Pawar (2007), Bisani and Aneja (2008), Sharma (2014), Kumar and Mishra (2017).

Study area

Jaunpur district (25˚ 26' N to 26˚ 11'N and 82˚ 8' E to 83˚ 5' E) is situated in Eastern Uttar Pradesh of the Middle Ganga Plain. Total area of the district is 4038 km^2 having population of 44,94,204 persons (Census 2011). There are eight rivers which flow in district namely Gomati, Sai, Varuna, Basuhi, Pili, Tambura, Mongar and Gangi. The Gomati and Sai Rivers flow in middle part of the district (Figure 1). Physiographically Jaunpur is divided in six floodplain zone namely floodplain zones (Active Channel, New Flood Plain Zone I, New Floodplain Zone II, Old Floodplain Zone I, Old Flood Plain Zone II, Depressed Low Land . The surface of district is about flat and some undulation is seen in the part of riverine areas. The slope of the district is towards the south east and relief varies from 77 meters to 89 meters from mean sea level. The district is covered by mainly two type soils like loam (Domat) and clay (Matiyar). The loamy soil found in Jaunpur, Kerakat and some part of Shahganj Tahsil. Clay soil found in Shahganj, Machhalishahar and Kerakat Tehsil. Most of the people engaged in agricultural work.

Objectives

The major objectives of the study are as follows:

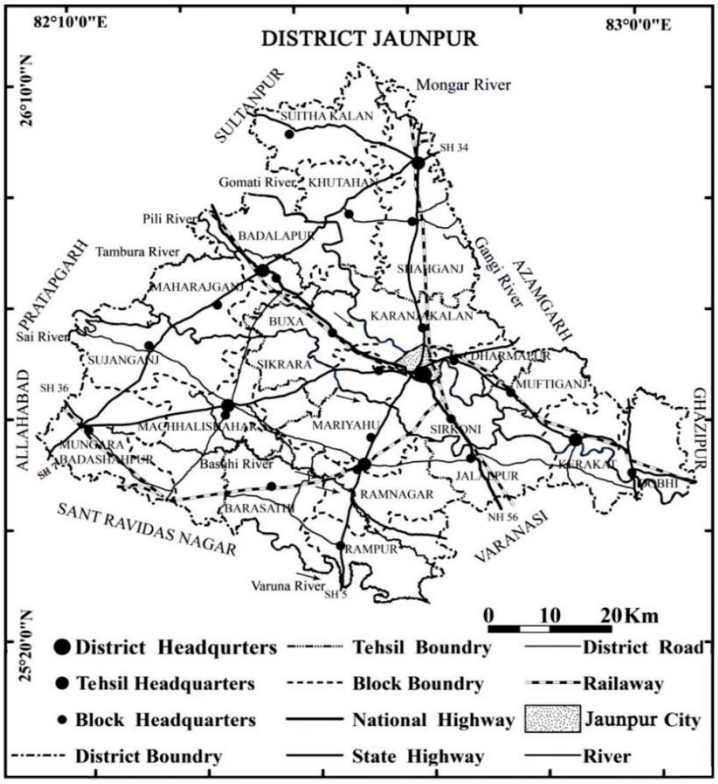
1. To analyze the spatial pattern of agriculture diversification, crop ranking, crop combination and in Jaunpur district.
2. To calculate the irrigation intensity, cropping intensity, land use efficiency of study area.

Methodology

The present study is exclusively based on secondary data collected from the different offices like District Census Handbook, Agriculture Report from Krishi Bhavan, Zila Sankhikiya Patrika from Vikas Bhavan and different websites. In this study crop diversification measure by Singh (1976) formula which is slightly modified the Bhatia (1965) formula, cropping intensity analyzed with the help of Singh (1974) method and crop combination determined by Kikukazu Doi (1959) method. Apart from this irrigation intensity measure with the help of gross irrigation area and net shown area and land use efficiency calculated with the help of three positive variables like

NSA, cropped area shown more than once and irrigated area and two negative variables like land not available for cultivation and another uncultivated land. The data were tabulated and analyzed by using statistical methods, like mean, standard deviation (SD) and inter correlation matrix. Mean and SD methods has been used for dividing the blocks into three categories, i.e., high (above mean + ½ SD), medium (Mean + ½ SD to Mean- ½ SD) and low (Below mean - ½ SD). The correlation measurement has been completed with the help of Carl Pearson correlation method. Micro soft Excel and Arc GIS 10.2 software used for computation and cartographic presentation of regional variation and development.

Figure 01: The Study Area



Result and Discussion

Irrigation Intensity

Irrigation is the most important factor for agricultural works, and it helps to increase the production by facilitating higher intensity of cropping. Higher intensity shows that the farmers do not depend on monsoon for irrigation and vice versa. It is observed that the use of a higher level of modern agro-input is almost limited to irrigated land. It is mathematically expressed as:

$$I_1 = \frac{GIA}{NSA} X\ 100$$

Where Ii= Irrigation Intensity GIA= Gross Irrigation Area NSA= Net Shown Area

Based on the above formula after calculation of the irrigation intensity. The average irrigation intensity of district is 140.10. High irrigation intensity found in Karanjakala block while lowest intensity shows in Sirkoni block because of the canal irrigation absent in the Sirkoni block. All blocks categorised in three groups. The northern and southern blocks have high irrigation intensity because here, the canal and ponds are used for irrigation. While the surrounding blocks of Jaunpur city have moderate irrigation intensity but the tract of Sai-Gomati

River is less irrigated area because the primary source the area is the pump set and about these blocks are demarked as red zone block by the government (Figure 2 A).

Crop Diversification

Crop Diversification denotes the multiplication of agricultural activities where the crops compere each other for occupying space. Several Agricultural scientists and geographers have developed the formula to measure the diversification magnitude. However, the work of Bhatia (1965) is more precise, Singh (1976) has slightly modified Bhatia's Formula (Icd) as Given Below:

$$Icd = \frac{\text{Per cent of total harvest area under 'n' crops}}{\text{Number of 'n' crops}}$$

Where

'n' crops are those crops which individually occupy more than 5 per cent of the total cropped area.

Low index shows the high diversification while high index indicates shows the low diversification of crop in the study area. Based on the calculated diversification index, the whole study region is divided into three categories. The average crop diversification index is 38.69. The high group of crop diversification indices sows above 39.93, and high crop diversification found in nine blocks namely Dharmapur, Mariyahu, Muftiganj, Suithakala, Ramnagar, Shahganj, Machhalishahar, Sujanganj, and Jalalpur (Fig. 2 B)

Land Use Efficiency

Land use Efficiency may be defined in terms of the effectiveness of land with which particular land unit produces in response to the successive sees of capital and other inputs that are combined with the term in the production process (Barlowe and Johnson, 1954). We have chosen the five variables like NSA, cropped area shown more than once and irrigated area as a positive indicator while land not available for cultivation and another uncultivated land as negative variables for calculating the land use efficacy (Table 1 and Figure 2 C). The percentage of all positive variable have been arranged in ascending order and percentage of the negative variable have been arranged as descending order. For the positive variable high-rank assign for high value and low-rank assign for low value while for the negative variables, low-rank assign for high value and low-rank assign for high value. After assigning the rank block-wise to add all the rank and divide by no of variables (Five). The ranking co-efficient has been obtained. The value of co-efficient grouped into three categories based on (mean +- ½ sd).

The low land-use efficiency find in the middle part of the study are due to undulating surface, low irrigated are, riverine area etc. while high land-use efficiency shows in north and southwest part of study area due to flat terrain, canal irrigation system, high NSA and less uncultivable land and western part of the district covered by moderate land-use efficiency (Table 1). For the balanced development in the district, adequate emphasis should be given to removing the imbalance in land-use efficiency, which can be done through the improvement in irrigated facilities.

The present study shows that highly irrigated blocks occupied more land under double cropping, indicating, thereby a positive correlation between irrigation facilities and cropping intensity. After a critical analysis of selected variables. It is found that in the context of land-use efficiency, the present condition of Jaunpur district almost satisfactory.

Figure 02: A- Irrigation Intensity. B-Crop Diversification. C- Land use Efficiency. D Cropping Intensity

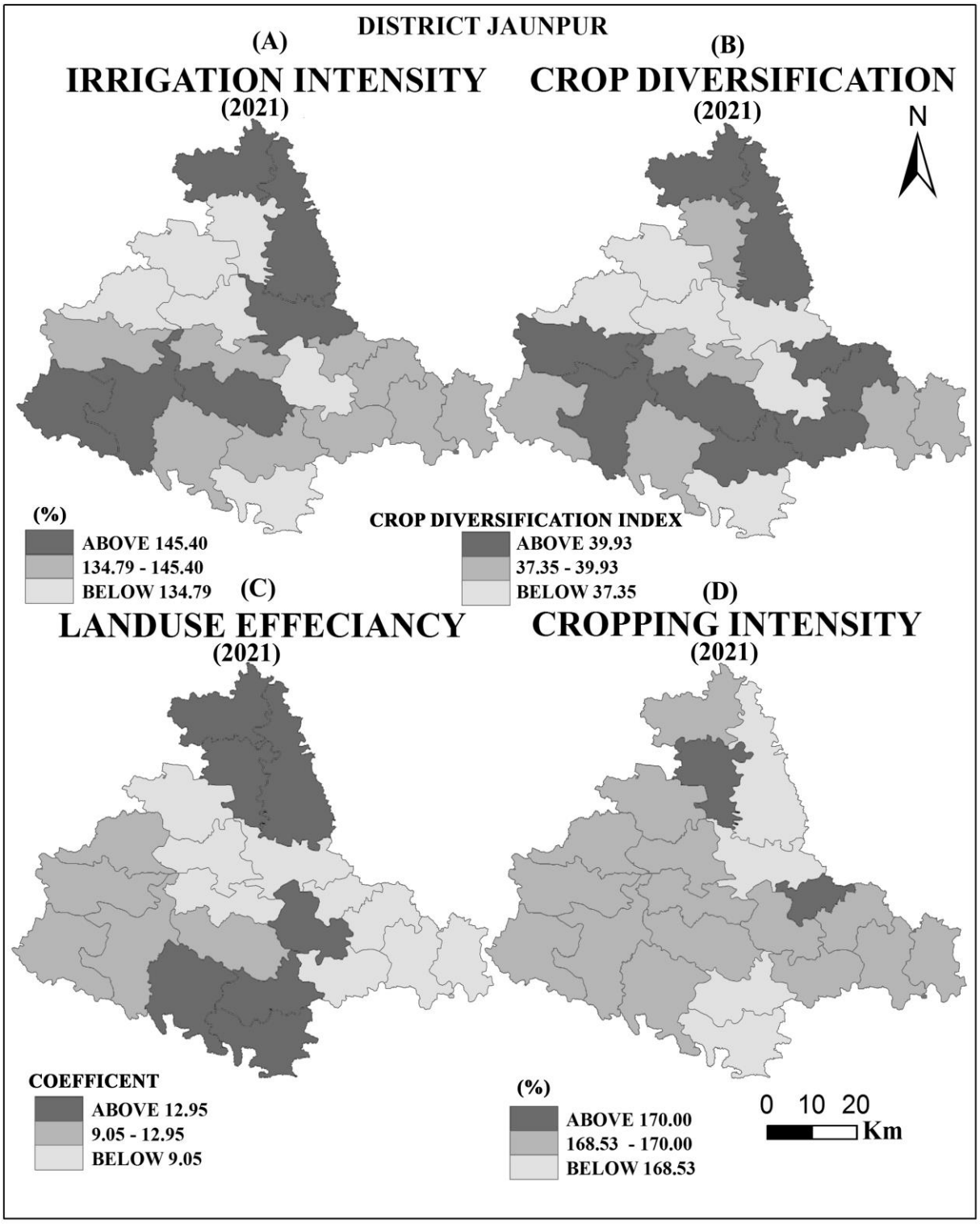


Table 01: Block wise Land use Efficiency

Block	NSA		More Than once		NIA		Land not Available for Agriculture		Other Uncultivated Land		Efficiency
	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	Co-efficient
Suithakala	60.83	21	42.44	21	58.45	16	2.10	12	1.52	11	16.2 (H)
Shahganj	62.93	19	42.97	20	58.39	17	2.40	17	1.92	14	17.4 (H)
Khuthan	61.79	20	44.70	18	49.00	20	2.27	15	1.59	5	15.6 (H)
Karanjakala	74.57	2	49.44	10	74.95	1	2.44	18	2.32	12	8.6 (L)
Badlapur	74.16	3	50.98	4	60.53	14	2.17	14	1.56	2	7.4 (L)
Mahrajganj	70.52	13	49.12	12	59.11	15	1.66	8	1.25	3	10.2 (M)
Baksha	74.98	1	51.88	2	55.38	18	0.99	1	0.75	1	4.6 (L)
Sujanganj	70.13	14	48.94	14	63.10	11	1.70	9	1.29	8	11.2 (M)
M. Badshahpur	70.88	12	49.20	11	70.52	2	1.01	2	0.97	21	9.6 (M)
Machhalishahar	71.03	11	49.01	13	69.60	3	1.58	7	1.22	20	10.8 (M)
Mariyahu	71.11	10	49.76	9	66.44	6	2.35	16	1.90	17	11.6 (M)
Barsathi	68.67	16	47.31	15	61.69	13	3.13	21	3.90	18	16.6 (H)
Sikrara	73.62	4	51.00	3	67.17	4	1.93	11	1.35	10	6.4 (L)
Dharmapur	72.19	9	52.93	1	65.75	7	2.10	13	1.54	6	7.2 (L)
Ramnagar	69.38	15	46.40	16	61.87	12	2.91	20	3.26	19	16.4 (H)
Rampur	66.21	17	44.91	17	53.83	19	2.85	19	2.42	9	16.2 (H)
Muftiganj	72.99	6	50.66	5	66.67	5	1.40	6	1.22	15	7.4 (L)
Jalalpur	72.61	7	50.52	6	65.19	8	1.31	5	1.20	16	8.4 (L)
Kerakat	72.54	8	50.13	7	64.03	10	1.77	10	1.34	7	8.4 (L)
Dobhi	73.06	5	50.07	8	64.96	9	1.12	3	1.16	13	7.6 (L)
Sirkoni	63.79	18	44.34	19	48.78	21	1.29	4	1.19	4	13.2 (H)

Source: Calculated by the author based on Zila Sankhikiy Patrika, 2021

Cropping Intensity

The intensity of cropping indicates the yield raising capacity of land, which is increased by raising more than one crop in the same area or field during an agriculture year (Singh, 1974). The cropping intensity is expressed in terms of the total cropped area as a percentage of the net shown area in the agricultural year: it can be expressed as

Cropping intensity = $\frac{GSA}{NSA} X\ 100$

Where GSA = Grass Shown area and NSA = Net Sown Area

The cropping intensity in the district increased by 15.12 percent during 2001-2021. Higher the index grater is the efficiency of land use. The spatial pattern of cropping intensity in the Jaunpur district varies significantly and the average cropping intensity index is 100.07. Dharmapur and Khuthan block have maximum cropping intensity means these blocks maximum used of their sown area due to agricultural knowledge and means of irrigation. While the middle and east part of blocks namely Khuthan, Mariyahu, Sujanganj, Suithakala, Mahrajganj, Jalalpur, Sirkoni, Muftiganj, Mungra Badshahpur, Sikrara, Baksha, Kerakat, Machhalishahar, Barsathi, Badlapur and Dobhi block counted in the medium category due to some positive factors irrigation sources and agricultural inputs and some North East and Southern two blocks use their minimum land due to wetland problems (Table 2 and Figure 2 D).

Table 02: Block wise Irrigation intensity and Cropping intensity (Percent)

	Irrigation Intensity			Cropping Intensity		
Block	**2001**	**2021**	**Change**	**2001**	**2021**	**Change**
Suithakala	127.37	151.02	23.65	154.47	169.77	15.29
Shahganj	122.77	147.08	24.31	147.63	168.28	20.64
Khuthan	124.53	124.68	0.15	151.52	172.35	20.83
Karanjakala	143.19	159.48	16.29	159.27	166.30	7.03
Badlapur	99.75	130.35	30.60	149.49	168.75	19.26
Mahrajganj	113.67	131.52	17.85	155.84	169.66	13.81
Baksha	123.65	120.57	-3.08	161.83	169.19	7.36
Sujanganj	117.11	140.82	23.71	148.41	169.78	21.37
Mungra Badshahpur	107.90	155.21	47.31	151.91	169.41	17.50
Machhalishahar	107.47	153.63	46.16	144.87	169.00	24.12
Mariyahu	96.58	148.36	51.78	148.40	169.97	21.58
Barsathi	88.17	140.42	52.25	154.05	168.90	14.85
Sikrara	125.05	143.29	18.24	164.97	169.28	4.32
Dharmapur	143.01	145.22	2.21	158.44	173.33	14.88
Ramnagar	139.47	139.07	-0.40	160.72	166.88	6.17
Rampur	85.72	130.89	45.17	147.40	167.82	20.42
Muftiganj	136.45	142.34	5.90	156.79	169.41	12.62
Jalalpur	119.84	140.43	20.59	153.40	169.58	16.17
Kerakat	130.64	139.83	9.20	152.48	169.10	16.63
Dobhi	137.25	138.39	1.14	155.40	168.54	13.13
Sirkoni	150.80	119.52	-31.28	160.05	169.52	9.46
	120.97	140.10	19.13	154.16	169.28	15.12

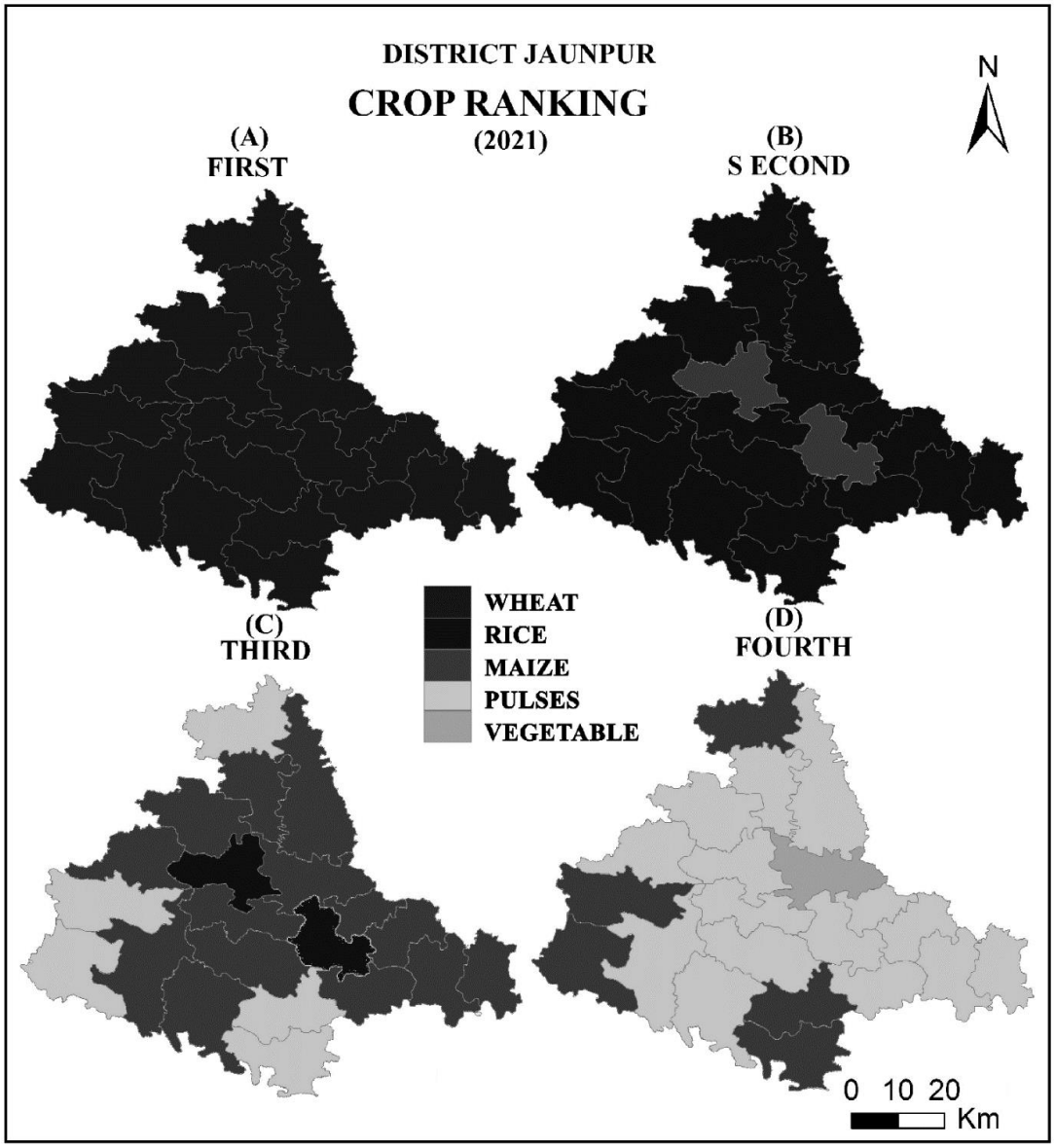
Source: Calculated based on Zila Sankhikiy Patrika, 2021

Crop Ranking

The ranking of crops is decided by the areal coverage of crops, which gives a clear-cut picture of the relationship between crops and soil with cropping structure. In present study, crops have been ranked at the block level based on available data of percentage coverage of the cropped area by different crops. We have chosen seven crops which are covered the more than 95% area of the total cropped area then calculate the average cropped area between 2011 to 2021, therefore, we chosen the best four crops according to their cropped area.

In the study area, wheat is the dominant crop in all blocks due to productive land, less need for low irrigation rainfall, and suitable climatic condition. Paddy dominated as the second crop in nineteen blocks, but maize is in Sirkoni and Baksha block as a second-ranking crop because it the tract of Gomati and Sai River and with having less irrigational sources and undulating surface and rice need a plain area for water stability and more than irrigation of maize. There is little diversification in third crop ranking. Maize is the third crop in 15 blocks, but in Suithakala, Sujanganj, Mugara Badshahpur, Ramnagar, and Rampur have pulses are dominant while rice is the third crop in Sirkoni and Baksha due to less irrigation. More diversification is found among the fourth crop ranking crops (Pulses, maize, vegetable). Pulses are the dominant as the fourth crop in 15 blocks and its production manly in OFZ II due to higher of Floodplain Zone and need less irrigation, but Suithakala, Sujanganj, Mugara Badshahpur, Rampur and Ramnagar have maize as the fourth crop while Karanjakala has vegetable as a fourth dominating crop because of the demand of urban population and their one mandi of vegetable in Karanjakala block (Figure 3).

Figure 03: Crop Ranking



Crop Combination

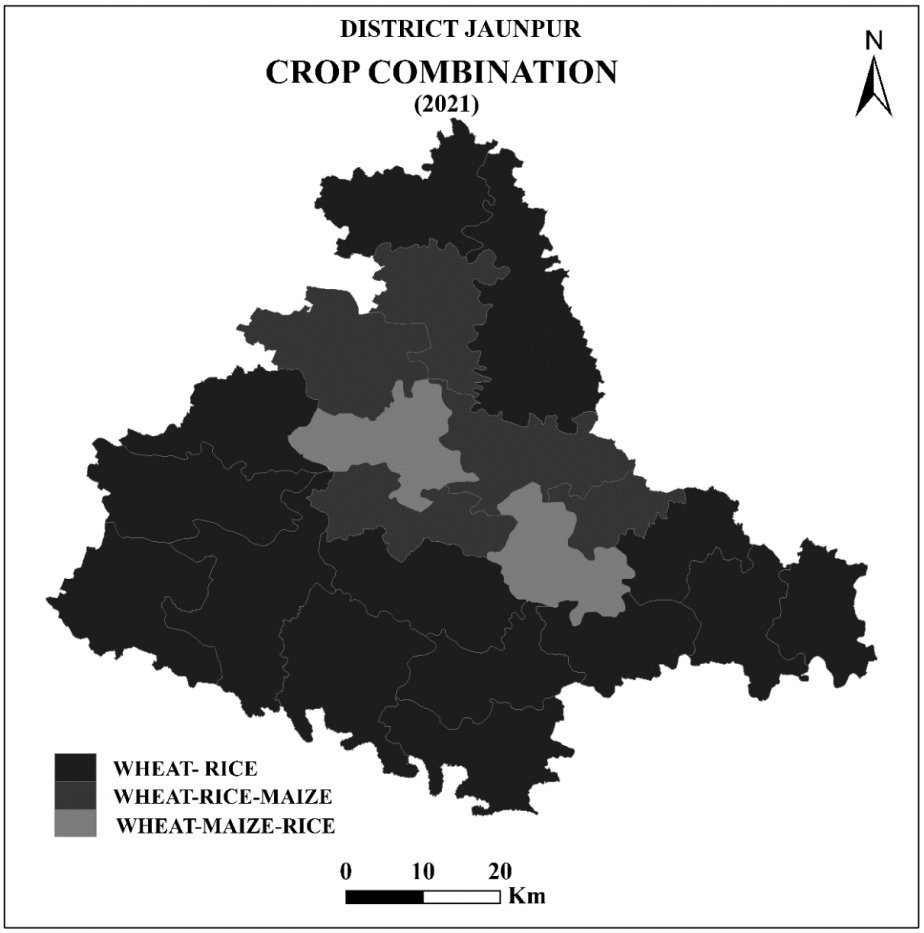
Crops are generally grown in combination (Weaver, 1954). The pattern of crop combination provides rise to spatial predominates of certain crops are combination resulting in the emergence of crop regions, and such analysis would ultimately minimize the changes of oversimplified generalization (Ali. M., 1978). The Distributional pattern of crops have developed crop predominance area, which has given rise to different crop combination units. The crops are generally grown in combination, and it is rarely found that a particular crop occupies a position of total isolation form other crops in each areal unit at a given point of time (Hussain, 1982). Crop combination study in geography is fruitful in many ways; firstly, it provides an adequate understanding of an individual crop; secondary combination regions are essential for the construction of a more complex structure of vivid agriculture regions (Weaver, 1954). Weaver made the study of crop combination first attempt for delineation of agriculture regions in 1954 for studies of Middle East countries, Thomas (1963) modified Weaver formula

by including all crops with zero percent value and Bhatia (1965), and Rafiullah (1956) also studies the crop combination regions. For a comprehensive and clear understanding of the agricultural crops mosaics, agricultural regionalization, and planning, the combinational analysis of crops become a necessary one. Crop combination are directly mirrored the existing physio-socio-cultural environment prevailing area. (For a more objective grouping of crop combination region, several the statistical techniques have invented among which Kikukazu Doi (1959) formula has been found to be quite satisfactory. This can be expressed as:

$$Standerd\ Deviation\ (SD) = \sum d^2$$

Doi has also held the cultivated land is distributed equally among all crops. Doi has greatly simplified the calculation of minimum deviation by creating a table. For this combination, it is not necessary to square the difference of real or theoretical percentage area for a combination form this table. In this table, for determining the combination of crops, it is a critical value for the next crop of the next crop of the combination in terms of the sum of the percentage of all crops. In determining the crop combination based on this table, it is kept in mind that if the percentage area of the next crop is more than that critical value, then it will be included in the combination; otherwise, it is not considered. Based on Doi method, the result shows that there are three types crop combinations in the study area (Figure 4). That are given below

Figure 04: Crop Combination



Wheat-Rice

The OFZ I, OFZ II and wetland area mostly cropped by two crop wheat and rice-wheat is the main crop and rice is the secondary crops of Jaunpur district and Suithakala, Shahganj,

Mahrajganj, Sujanganj, Mungra Badshahpur, Machhalishahar, Mariyahu, Barsathi, Ramnagar, Rampur Muftiganj, Jalalpur, Kerakat and Dobhi have wheat rice combination. Due to medium fertile soil, wetland, and other factors.

Wheat-Rice-Maize

Khuthan, Karanjakala, Badlapur, Sikrara, and Dharmapur counts in three crop combination. These blocks have NFZ I, and NFZ II and maize also considered as main crops due to fertile soil and undulating surface because maize wants less irrigation.

Wheat-Maize- Rice

Baksha and Sirkoni block are maize dominated area after wheat because these are less irrigated crops. Rice production less quantity in these areas because it is waterlogged cope and this zone are negatively considered for water availability.

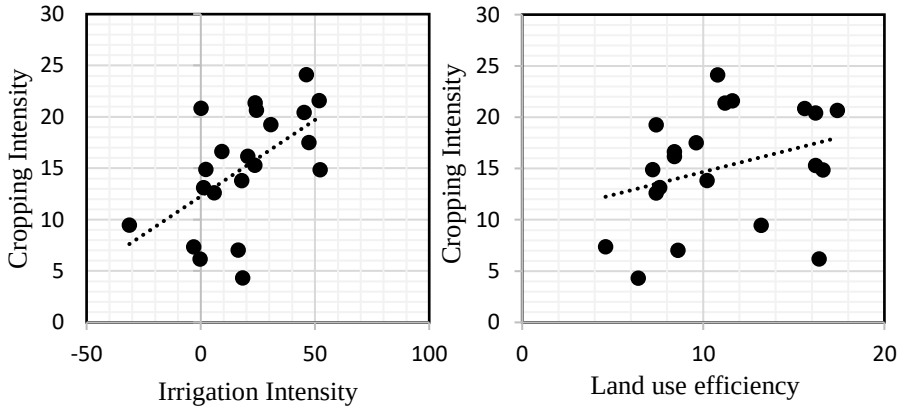
Correlation matrix of variables

Correlation matrix shows the inter-correlation among all the dimension. All the dimension has positively correlated by each other. Irrigation intensity is moderate positively correlate with cropping intensity, low moderate correlation found between cropping intensity and land use efficiency while rest of the aspects low positively correlate (Table 3 and Figure 5).

Table 03: Correlation between different aspects of agriculture

Category	Irrigation Intensity	Cropping Intensity	Land use efficiency	Crop diversification
Irrigation Intensity	1			
Cropping Intensity	0.56	1		
Land use efficiency	0.21	0.31	1	
Crop diversification	0.19	0.22	0.09	1

Figure 05: Correlation between Cropping intensity, Irrigation intensity and Land use



Conclusion

A study related to agricultural characteristics of Jaunpur district during year 2021 shows that there are many disparities in agriculture diversification, crop ranking, crop combination and to calculate the irrigation intensity, cropping intensity, land use efficiency. High irrigation intensity found in Karanjakala block while lowest intensity shows in Sirkoni block because of the canal irrigation absent in the Sirkoni block. The present study shows that highly irrigated blocks occupied more land under double cropping, indicating, thereby a positive correlation between irrigation facilities and cropping intensity. Dharmapur and Khuthan block have maximum cropping intensity means these blocks maximum used of their sown area due to agricultural knowledge and means of irrigation. While the middle and east part of blocks namely Khuthan, Mariyahu, Sujanganj, Suithakala, Mahrajganj, Jalalpur, Sirkoni, Muftiganj, Mungra

Badshahpur, Sikrara, Baksha, Kerakat, Machhalishahar, Barsathi, Badlapur and Dobhi block counted in the medium category due to some positive factors irrigation sources and agricultural inputs. In study area wheat is the dominant crop in all blocks while paddy second dominated in nineteen blocks and maize is in Sirkoni and Baksha block as a second-ranking crop because it the tract of Gomati and Sai River. The OFZ I, OFZ II and wetland area mostly cropped by two crop wheat and rice-wheat, Khuthan, Karanjakala, Badlapur, Sikrara, and Dharmapur counts in three crops.

References

1. Agrawala, A. K. and Hazarika P. L., (2002), Regional Disparities in Economic Development of Assam: A District level study, *Indian Journal of Regional Science*. Vol. 44(2): pp. 121-136.
2. Ali, M., ed., (1978), *Dynamic of Agricultural Development in India*, Concept Publication, New Delhi: p. 56.
3. Banarjee, S., (1997), Determination of Agricultural Development: An Inter-District Analysis, *National Geographical Journal of India*, Vol.42 (1): pp. 53-57.
4. Barlowe R. and Johnson V.W., (1954), *Lands Problem and Practices*, Mac Graw Hill Book co. inc. New York: pp. 106.
5. Bhatia, S. S., (1965), Pattern of Crop Combination and Diversification in India, *Economic Geography*, Vol. 41(1): pp. 9-56.
6. Bisani, N. K. and Aneja, R. A., (2008), Regional Variations of Socio-Economic Development in Haryana: A District Level Analysis, *Indian Journal of Regional Science*. Vol. 40 (2): pp. 28-36.
7. Doi, K. (1959), The Structure of Japans Perfect uses, Proceedings of International Geographical Union, Regional Conference in Japan: pp. 310-360.
8. Dutta, P. C. et al., (2001), Identification of Backward District for the Regional Agricultural Development, *The Indian Journal of Regional Science*, XXXIII (1): pp. 14-21.
9. Gaikwad, S. D. and Pawar, C. T., (2007), Delineation of Land Complex and Agricultural Development, *Indian Geographical Journal.* Vol. 82 (1): pp. 43-50.
10. Hussain, M., (1982), Crop Combination in India, Concept Publishing, New Delhi: p. 40.
11. Kumar, D. and Mishra, S. P., (2017), Regional Development and Disparities in Jaunpur District, Uttar Pradesh, *National Geographical Journal of India.* Vol. 63, No. 4, December, pp. 78-91.
12. Mishra S.P. and Sarkar S., (2013), Agricultural productivity and Level of Agricultural Development in Chandauli District, U.P, *National Geographical Journal of India.* Vol. 59, No. 2, June, pp. 51-62.
13. Mishra S.P., (1981/1985), Integrated Rural Area development and Planning: A Geographical Study of Kerakat Tahsil District Jaunpur, Ratan Publication, Varanasi U.P.
14. Mishra, S.P., (1988), Agricultural Productivity and Its Spatial Variation in Eastern Uttar Pradesh, National Geographical Journal of India, Vol. 34(2): pp. 113-125.
15. Rafiullah S.M., (1956), A New Approach to Functional Classification of Town. *Geographer* Vol. 12.
16. Sharma, R., 2014, Regional Disparities in the Level of Agricultural Development in Aligarh District of Western Uttar Pradesh, *International Journal of Scientific and Resource Publication*, 4(8): pp. 1-7.
17. Siddiqui, S. H. et al. (2012), Crop diversification in Dadri block of Gautam Buddh Nagar of Uttar Pradesh: A spatio Temporal Analysis, *National Geographical Journal of India.* Vol. 58, No. 4, December, pp. 65-72.
18. Siddiqui, S. H. et al., (1999), Trends of Agricultural Development in U. P. Himalaya, *National Geographical Journal of India*, Vol. 45(1-4): pp. 185-194.
19. Singh, J., (1974), *An Agricultural Atlas of India: A Geographical Analysis*, Vishal Publication, Kurukshetra: p. 79.
20. Singh, J., (1976), *An Agricultural Geography of Haryana,* Vishal Publication, Kurukshetra: pp. 63-67.
21. Talib, A. et al., (1995), Agricultural Development and Poverty Alleviation in Trans Ghaghara Plain of Uttar Pradesh India, Indian Geographical Journal, Vol. 70 (2): pp. 81-91.
22. Tiwari, P. S., (ed.) (1986), *Agricultural Geography*, Heritage Publication, New Delhi.
23. Tyagi, S., (1994), Level of Agricultural Development in Aligarh district, Indian Journal of Regional Science, Vol. XXVI (1): pp. 9-16.
24. Weaver, J. C., (1954), Crop Combination Region in the Middle West, the Geographical Review, Vol 44: pp. 175-200.