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SPATIAL ANALYSIS OF CROP CONCENTRATION, CROPPING INTENSITY AND AGRICULTURAL EFFICIENCY IN JAMMU AND KASHMIR-A DISTRICT LEVEL STUDY

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ABSTRACT

The present study is an attempt to analyze some important attributes of the cropping land use system of Jammu and Kashmir. Crop concentration is an important indicator of prevalent cropping pattern in any geographical unit and hence the key determinant of the agricultural economy. Similarly, cropping intensity is also a vital indicator of agricultural development. Agricultural efficiency explains the yield per unit area of land and thus is an important attribute of agricultural system. The analysis of the data reveals that paddy and orchard cultivation are dominant in Kashmir valley and show high levels of concentration, while as wheat and maize dominate the agricultural landscape of Jammu and Ladakh province of the state. The cropping intensity is more in the districts of Jammu province than Kashmir valley and Ladakh province because of favourable climate in the former for double cropping. Since agricultural efficiency is function of productivity, therefore on account of high levels of productivity, agricultural efficiency is more in Kashmir valley and Ladakh province than Jammu region of the state.

Keywords: Cropping pattern; crop concentration; agricultural efficiency; Cropping Intensity; productivity

I. INTRODUCTION

Agriculture is one of the most important economic activities of the world. The science and art of crop cultivation, domestication of animals and raising of livestock is known as agriculture. According to Zimmerman (1915) agriculture would mean the cultivation of the land [1], [2], [3], [4], [5], [6], [7], [8], [9]. The cultivation of different crops means different land uses. One of the first land use patterns that geographers studied is the pattern of crops across an agricultural landscape [10]. This pattern of crops results in differential crop concentrations. The different cropping pattern is shaped by various factors, viz; *physical factors* such as soil, climate, *technological factors* like irrigation, improved varieties of seeds, availability of fertilizers and plant protection chemicals; *Institutional factors* like land reform, consolidation of holdings, credit facilities, price structure, procurement policies and storage

facilities and other factors like the rate of return, agro-climatic conditions, farm programmes, conservation programmes, and environmental regulations [11], [12], [13], [14]. Cropping intensity depicts the feasibility of land for cultivation more than once in a year. Cropping intensity is an indicator of agricultural development. The high cropping intensity means that all the factors affecting crop cultivation are favourable for double or triple cropping, while as low cropping intensity reflects the same in opposite direction [15]. Agricultural efficiency is a vital indicator of the agricultural development as it is a scientific device to study the inherent fertility, productivity and capability of land. There are numerous factors which influence the agriculture efficiency of land including physical, social, economic and techno-organizational. The combined effect of these factors manifests itself in per acre yields as well as the volume of production in any given region [12]. Agriculture is the main occupation for the people of Jammu & Kashmir. About 65 percent of the people are directly or indirectly dependent on agriculture and allied activities for their livelihood. Agriculture and its allied activities are the predominant sector of the economy of Jammu and Kashmir and this sector contributed more than 31.29 per cent of Gross Domestic Production (GDP) in 2007 [16]. Thus the study of these important indicators of agricultural development becomes all the more important for raising domestic production, achieving food security, enhancing state income and finally ensuring the sustainable agriculture in the state.

II. STUDY AREA

The state of Jammu and Kashmir constitutes northern most extremity of India and is situated between 32^{o} 17′ to 36^{o} 58′ N latitude and 73^{o} 26′ to 80^{o} 30′ E longitude (Fig. 1). It falls in the great northwestern complex of the Himalayan Ranges with marked relief variation, snow-capped summits, antecedent drainage, complex geological structure and rich flora and fauna [17]. The state is 640 km in length from north to south and 480 km from east to west. It consists of the territories of Jammu, Kashmir, Ladakh and Gilgit and is divided among three Asian sovereign states of India, Pakistan and China [18]. The total area of the State is 2, 22, 236 km^2 comprising 6.93 per cent of the total area of the Indian territory including 78,114 km^2 under the occupation of Pakistan and 42,685 km^2 under China [19].

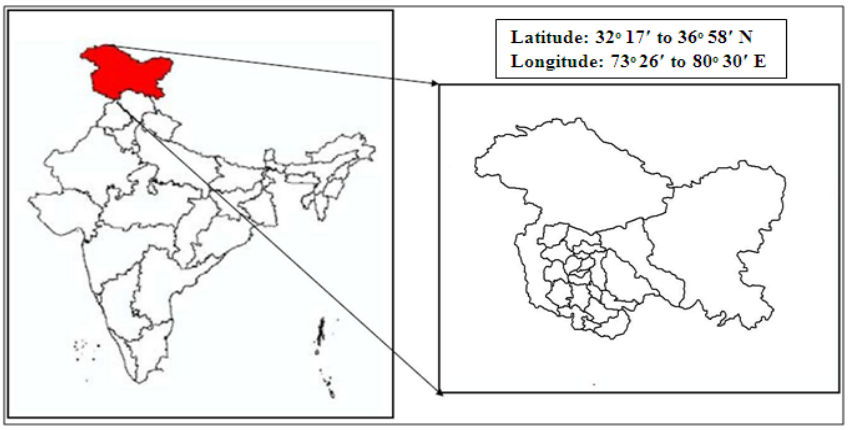

Fig. 1

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III. MATERIALS AND METHODS

Materials

- Survey of India toposheets on 1:50000 scale were used for generating the base map of the study area
- Data related to cropping land use variables has been obtained from concerned government and private departments.

Methods

Step 1: ***Identification of the variables*****:** The area under three major crops, *viz*, Paddy, Maize, Wheat and area under orchards has been taken for the accomplishment of the objective taken for the study.

Step 2: For the study of distributional pattern of crops, an index of crop concentration has been worked out. The index has been calculated by the formula;

$$\text{Index of concentration} = \frac{\text{Area of crop 'a' in the district 'a'} / \text{Area of all crops in the district 'a'}}{\text{Area of crop 'a' in the state} / \text{Area of all crops in the state}} \quad \ldots\ldots \text{(i)}$$

Step 3: Bhatia's method (1963) has been used to find out the district wise agricultural efficiency in the state and thus regional variations have been found. Agricultural efficiency was calculated by the following formula;

$$I_{ycrop} = \frac{Ycrop}{Yr} \times 100$$

$$\text{Agricultural efficiency } 'E_i' = \frac{IYCa + IYCb + IYCc + IYCd}{Ca + Cb + Cc + Cd} \quad \ldots\ldots\ldots \text{(ii)}$$

Where 'Ei' is the agricultural efficiency; 'Iy*crop*' is the yield index of various crops; Ca, Cb, Cc and C_d is the percentage of crop land under different crops; Y*crop* - hectare yield of crop in an enumeration; Yr - hectare yield of crop in the entire region.

Step 4:

The levels of concentration and agricultural efficiency have been worked out and the maps generated from survey of India (SOI) toposheets using Arc view 3.2a software have used to depict spatial variations in the variables taken for the study.

IV. RESULTS AND DISCUSSION

(I) Crop concentration (2015-16)

The relationship between density of individual crops in the district and the corresponding density for the state as a whole has been studied. The objective of the study of crop concentration pattern is to differentiate the areas of high and low density of the individual crops in the different parts of the state. The details of crop concentration are presented in the table 1 and 2.

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TABLE 1: INDEX OF CONCENTRATION OF MAJOR CROPS GROWN IN JAMMU AND KASHMIR

District	Index value of crop concentration				Cropping Intensity
	Paddy	Maize	Wheat	Orchards	
Srinagar	1.41	0.06	0.01	5.64	126.8
Ganderbal	1.50	0.84	0.01	1.30	112.8
Budgam	1.59	0.73	0.14	1.13	114.2
Baramulla	1.17	1.23	0.13	0.86	105.1
Bandipora	1.57	0.80	0.26	0.61	104.5
Kupwara	0.92	1.62	0.04	0.39	100.2
Anantnag	1.47	0.74	0.01	1.95	135.6
Kulgam	1.94	0.38	0.01	1.31	142.8
Pulwama	1.73	0.34	0.04	2.55	158.1
Shopian	0.08	0.24	0.06	11.55	102.3
Jammu	1.35	0.32	2.12	0.20	202.9
Samba	1.04	0.37	2.84	0.03	198.6
Kathua	0.87	0.78	2.29	0.06	190.9
Udhampur	0.66	1.39	1.38	0.02	159.4
Reasi	0.61	1.47	1.33	0.01	125.5
Doda	0.25	1.80	1.38	0.15	133.4
Kishtwar	0.32	1.64	1.62	0.02	120.5
Ramban	0.22	1.73	1.66	0.02	112.4
Rajouri	0.27	2.29	0.20	0.08	185.0
Poonch	0.23	1.64	1.84	0.01	166.3
Leh	0.00	0.00	5.52	1.58	104.0
Kargil	0.00	0.00	5.40	1.82	108.3
State Average	**0.87**	**0.93**	**1.29**	**1.42**	**136.8**

Source: *Using the formula (i) for data obtained from financial commissioner's office Srinagar/Jammu, 2015*

TABLE 2: LEVELS OF CONCENTRATION

Crop Name	Index value	Levels of concentration	Districts under zone
Paddy	>1.6	High	Pulwama, Kulgam
	1.6-0.8	Medium	Anantnag, Budgam, Srinagar, Baramulla, Kupwara, Bandipora, Ganderbal, Samba, Jammu, Kathua
	< 0.8	Low	Leh, Kargil, Doda, Poonch, Rajouri, Udhampur, Ramban, Kishtwar, Reasi, Shopian
Maize	>1.8	High	Rajouri, Doda
	1.8-0.9	Medium	Poonch, Ramban, Kishtwar, Reasi, Udhampur, Kupwara, Baramulla
	< 0.9	Low	Srinagar, Ganderbal Budgam, Shopian, Pulwama, Kulgam, Anantnag, Bandipora, Jammu, Samba, Kathua, Leh, Kargil,
Wheat	> 2	High	Jammu, Samba, Kathua, Leh, Kargil
	2-1	Medium	Poonch, Ramban, Kishtwar, Doda, Reasi, Udhampur
	< 1	Low	Srinagar, Ganderbal, Budgam, Baramulla, Bandipora, Kupwara, Anantnag, Kulgam, Pulwama, Shopian, Rajouri
Orchards	> 2	High	Shopian, Pulwama, Srinagar
	2-1	Medium	Kulgam, Budgam, Anantnag, Ganderbal, Leh, Kargil
	< 1	Low	Poonch, Rajouri, Ramban, Kishtwar, Doda, Reasi, Kathua, Udhampur, Baramulla, Kupwara, Jammu, Samba, Bandipora

Source: *Generated from table 1.1*

(II) Cropping Intensity (2015-16)

Cropping intensity depicts the feasibility of land for cultivation more than once in a year and is calculated by using the following formula;

$$\textit{Cropping intensity} = \frac{\textit{Gross sown area}}{\textit{Net sown area}} \times 100$$

Cropping intensity is an indicator of agricultural development. The high cropping intensity reveals that all the factors affecting crop cultivation are favourable for double or triple cropping, while as low cropping intensity reflects the same in opposite direction. The cropping intensity in Jammu and Kashmir is shown in table 1. It is evident from the table that on an average the cropping intensity for the state is 136.8 means the double cropping is practiced on forty percent of net sown area. The maximum cropping intensity is found in Jammu district (202.9) followed by Samba (198.6), Kathua (190.9), Rajouri (185.0) and Poonch (166.3) etc. while as lowest cropping

intensity is found in Kupwara (100.2), Shopian (102.3), Leh (104.0), Bandipora (104.5), Kargil (108.88), Baramulla (105.1) and Kargil (108.3). The variation in cropping intensity is because of differential climatic regimes found in Jammu, Kashmir and Ladakh. While Jammu has the sub-tropical type of climate with warm winters, Kashmir valley has temperate climate with severe winters and Ladakh has cold desert type climate with short growing season of five months in a year (Hussain, 2006). The spatial variation in cropping intensity is depicted in figure 2.

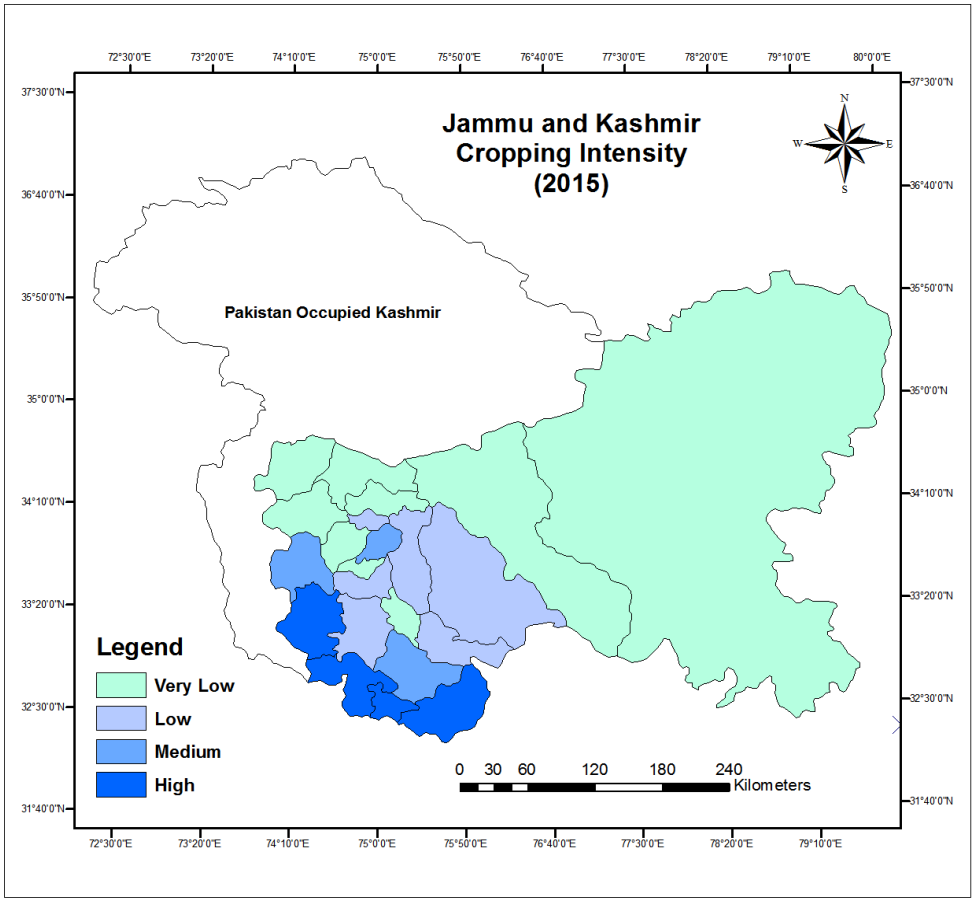

Fig. 2: Cropping Intensity in J&K

(III) Agricultural efficiency (2015-16)

Agricultural efficiency is a scientific measure to analyze the inherent fertility, productivity and capability of land. There are various factors which influence the agriculture efficiency of land including physical, socio-economic and techno-organizational. The combined and cumulative effect of these factors manifests itself in per unit yields as well as volume of production in any given geographical area/region [12]. Bhatia's method (1963) has been used to find out the agricultural efficiency. The details are given in the figure 3 table 3.

Table 3: Levels of agricultural efficiency (2015-16)

District	Yield Index of Crops			Agricultural Efficiency
	Paddy	Maize	Wheat	
Srinagar	118.69	92.39	80.14	117.23
Ganderbal	108.13	95.06	85.70	103.34
Budgam	111.42	85.67	97.28	102.96
Baramulla	116.70	87.51	105.68	101.95
Bandipora	109.83	85.90	105.16	102.11
Kupwara	97.68	99.56	101.76	98.92
Pulwama	120.03	107.72	89.90	117.56
Shopian	107.27	111.72	87.17	106.64
Anantnag	119.59	95.11	82.12	111.24
Kulgam	117.39	95.72	84.45	113.69
Jammu	110.12	119.71	108.97	110.28
Samba	99.23	117.99	105.68	105.17
Kathua	88.91	100.61	100.91	98.20
Doda	80.66	95.67	108.51	99.76
Ramban	78.59	87.01	101.99	93.40
Kishtwar	81.88	90.17	103.35	95.40
Udhampur	83.14	108.00	108.51	103.42
Reasi	80.05	106.16	107.83	102.15
Poonch	84.76	99.28	106.13	101.78
Rajouri	86.14	118.93	108.97	115.01
Leh	0.00	0.00	110.44	110.44
Kargil	0.00	0.00	109.65	109.65
State Average	**90.92**	**90.90**	**100.01**	**105.47**

Source: *Using the formula (ii) for data obtained from financial commissioner's office Srinagar/Jammu, 2015*

From the table 3, it is evident that the value of agricultural efficiency for the state is 105.47 though it is more in Pulwama (117.56) and Srinagar (117.23) districts followed by Rajouri district (115.01). The minimum agricultural efficiency is observed in Ramban (93.40), Kishtwar (95.40) and Kathua (98.20) etc. Since agricultural efficiency is the function of productivity, therefore, the variation in the efficiency is explained by the productivity differences between the different districts of the state. The levels of agricultural efficiency in that state are shown in the figure 3.

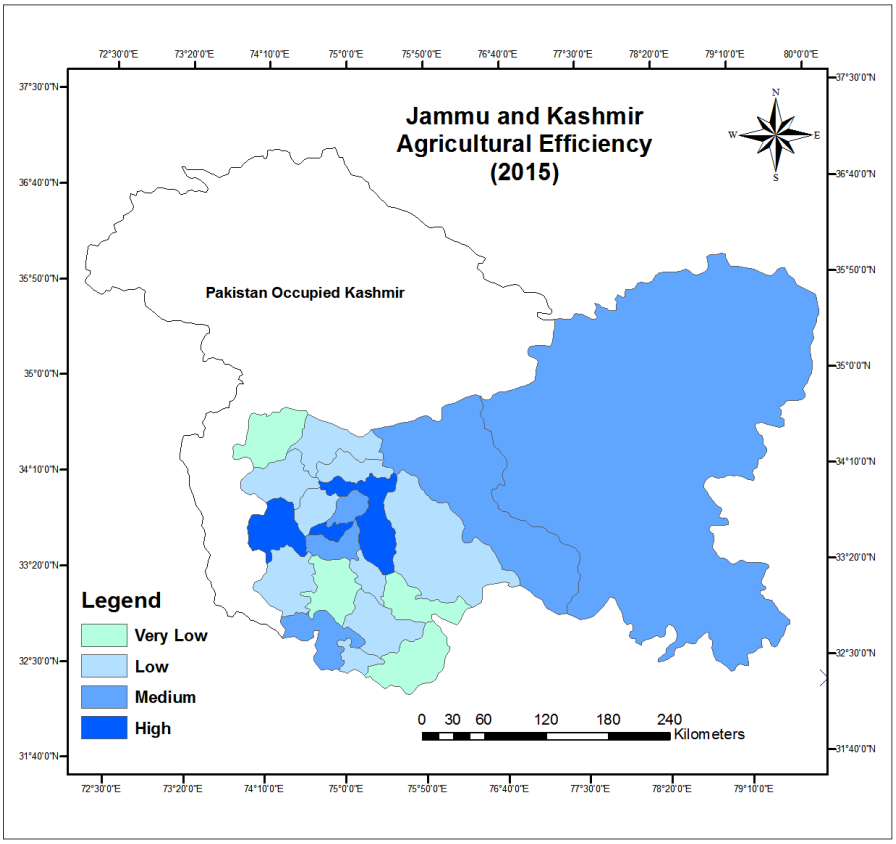

Fig. 3: Agricultural Efficiency in J&K

V. CONCLUSION

The technique for measuring cropping intensity and agricultural efficiency is very useful tool for generalizing the relationship between acre-yield and share of cropland. The cropping intensity analysis reflects the impact of physical and socio-economic factors affecting the cropping land use. The crop concentration analysis reflects that paddy and orchards dominate the agricultural landscape of the six districts of Kashmir valley (Srinagar, Budgam, Pulwama, Anantnag, Baramulla and Kupwara), while as wheat shows high levels of concentration in Jammu and Ladakh divisions of the state because of the geo-climatic and physical variations. The districts lying in Jammu province of the state have more cropping intensity than the districts of Kashmir valley and Ladakh division (Leh and Kargil district) of the state because of geo-climatic differences. The agricultural efficiency shows regional variations because of productivity differences between the districts of the state. The high agricultural efficiency in Ladakh division and Kashmir valley is on account of comparatively higher productivity than Jammu province.

VI. SUGGESTIONS

(i) The infrastructural facilities must be improved especially in Kupwara, Budgam and Poonch district to enhance their agricultural efficiency.

(ii) High yielding varieties (HYV) of seeds and seeds which require short growing season must be introduced in agriculturally backward districts in order to raise the productivity.

(iii) A comprehensive agricultural policy is the need of the hour to look into the loopholes confronting agricultural development of the state.

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REFERENCES

[1] Varsha V. and V. S. Datye. (1976). Influence of some selected variables on the agricultural productivity of Maharastra. *Economic and political weekly*, New Delhi.

[2] W.B. Moran, R.J. Mounton. (1981). Agriculture geography- relationship between agricultural activities and physical environment and the pattern of distribution.

[3] Kurosaki, T. (1999). Agriculture in India and Pakistan, 1900-95: Productivity and Crop Mix, *Economic and Political Weekly*, Vol. 34, pp. A160-A168.

[4] Timmer, M.P., and A. Szirmai. (2000). Productivity Growth in Asian Manufacturing: The Structural Bonus Hypothesis Examined Structural Change and Economic Dynamics, Vol.11, pp. 371-392.

[5] Huffman, W.E., & R.E. Evenson. (2001). Structural and productivity change in US Agriculture,1950-1982, *Agricultural Economics*, Vol. 24, pp. 127-147.

[6] Kurosaki, T., and M. Fafchamps. (2002). Insurance Market Efficiency and Crop Choices in Pakistan, *Journal of Development Economics*, Vol. 67, pp. 419-453.

[7] Misra, V.N. and M. Govind Rao. (2003). Trade Policy, Agricultural Growth and Rural Poor: Indian Experience, 1978-79 to 1999-2000, *Economic and Political Weekly*, Vol. 38, Pp. 4588-4603. *Development Economics*, Vol. I, Amsterdam: Elsevier Science, pp. 203-273.

[8] Hayami,Y.(2003), From the Washington consensus to the post-Washington consensus: Retrospect and Prospect, *Asian Development Review*, Vol. 20, pp. 40-65.

[9] Ainsworth, E.A., Leakey, A.D.B., Ort, D.R., Long S.P. (2000). Facing the facts: inconsistencies and Inter-dependence among field, chamber and modeling studies of elevated [CO2] impact on crop yield and food supply. *New Phytol*. 179, 2008b 5–9. doi:10.1111/j.1469- 8137.2008.02500.x.

[10] Bednarz, R. (2005). Understanding land use patterns. A & M, University College station, Texas USA.

[11] Duffy, M. (1996). Factors affecting cropping pattern. Department of Economics, Iowa State University, 560 Heady Hall Ames, Iowa 50011.

[12] Shafi, M. (2000). Agriculture Geography. Dorling Kindersley India Ltd. pp. 99-107.

[13] Das, P. (2004). Cropping Pattern (Agricultural and horticultural) in different zones, their average yields in

comparison to National average/ Critical Gaps/ Reasons Identified and Yield Potential, ICAR, New Delhi.

[14] Adhikari, B., Bag M. K., Bhowmick M. K and Kundu, C. (2005). Status Paper on Rice in West Bengal. Rice Research Station, Govt. of West Bengal Chinsurah – 712102.

[15] Hussain, M. (2010). Systematic Agricultural Geography. Rawat Publications, Jaipur.

[16] Govt. of J&K. (2007). Economic Survey Report. Directorate of Economics & Statistics, Planning and Development Department, Srinagar. Pp.73-100

[17] Raina, A.N. (2002). Geography of Jammu and Kashmir State. Radha Krishan Anand and Co. Pacca danga road, Jammu. Pp. 3-9

[18] Nandy, S. N., Pant, R. and Rao, K. S. (2001). Indian Himalaya- A Demographic Database. G. B. Pant Institute of Himalayan Environment and Development.

[19] Qazi, S.A. (2005). Systematic Geography of Jammu and Kashmir. APH Publishing Corporation, New Delhi-110002