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Changing Cropping Pattern in Ganderbal District Of J&K: A Temporal Analysis with Crop Ranking Insights

Dr Syed Binish Gillani[1] & Aalie Jan[2]
[1] *Assistant Professor in the Department of Geography, Amarsingh college Srinagar*
[2] *PG student of Geography, Amarsingh college, Srinagar*

Abstract
In this Study the changing cropping pattern in Ganderbal district of Kashmir valley has been analyzed.. This Study has used primary data and also secondary data. Agricultural land-use pattern and its production is determined by physical, socio-economic, and technological factors. An effort has been made here to study the changing cropping pattern, crop combination, and ranking of the crops in Ganderbal district. The crop data has been computed with the help of weaver's method of crop combination. Various crops have been used for the crop combination and ranking system. The major crops of the area are Paddy, maize, oil seeds, wheat , fodder etc.

Keywords:- *Cropping Pattern, Socio-economic, weaver's crop combination Method, Primary data , secondary data, technological factors.*

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I. INTRODUCTION

Agriculture is the largest private enterprise in India, has been and will continue to be the life line of the Indian economy, at least the foreseeable future .It contributes about 17% to the national Gross Domestic Product, is also livelihood of approximately two-thirds (2/3) of the population, forms the backbone of the agro-based industry. Besides agriculture is a social sector where non-trading concerns like food and nutritional security, employment and income generation, poverty alleviation, gender equity, ecology and environment plays a significant role. In contemporary agricultural practices, farmers are increasingly adopting the cultivation of multiple crops in their fields instead of relying solely on monoculture (khan & Bhat, 2001). The spatial arrangement of crops across a region reflects the dominance of specific crops or crop groupings, which collectively define agricultural regions. To ensure the effective implementation of agricultural planning initiatives, particularly at the micro-level, it is essential to delineate agricultural regions- a process in which crop combination analysis serves as a fundamental tool (Das, 1981). Agricultural development , inherently multidimensional, encompasses various elements such as the utilization of agricultural land, the extent of crop diversification and concentration, crop productivity , commercialization levels, cropping intensity, and the preservation of ecological equilibrium. The study of crop combinations is important to understand the cropping pattern of a particular area. Over time, the cropping pattern in any given region has undergone considerable evolution (Hussain, 1996). This evolution is largely shaped by an interplay of physical conditions-such as soil , topography, climate and socio-economic variables including the size of landholdings accessibility to markets, and transport facility , capital, Administrative policies and technological or institutional factors (Balak & joshi, 1984).

II. LITERATURE REVIEW

The study of general land use and agricultural land use/land cover and cropping pattern, their changes have been completed by many researchers in different parts of the world. Land use has been an important subject of geography since 1930's, when the first land utilization survey was carried out by L.D Stamp in britian. Following the success of this survey, the international Geographical union established a commission in 1949 to examine the world land use survey. Valkenburg S. Van (1950) serving as a chairman of this commission and he put forward the concept of world land use survey. This commission had constructed the world land use maps of 1: 1000,000 for regional development planning by employing the pilot survey and aerial photographs. They classified the world into nine categories. These were settlements and associated non-agricultural lands (dark and light red), Horticulture (purple), tree and other perennial crops(light purple), crop land(brown), improved permanent pasture (yellow), unimproved grazing land(orange and yellow), wood lands(different shades of green), Swamps and marshes (blue) and unproductive land categories (grey). Gupta, A.K. (1963) measured the changes in cropping pattern in all states by taking into consideration the average

percentage over the previous year . It was analysed that the area under cereals had declined whereas the area under cash crops had increased due to irrigation and fertilizers. The study on " Changes in Land use pattern in Punjab" by Giri (1969) focused on analyzing of the recent shifts in land use pattern across various districts of the former composite Punjab state. He found out that the rising population, construction of buildings, roads, factories and extent of canal irrigation are the driving factors of the loss of arable lands. The cropping pattern in India is dependent on various factors like climatic conditions , soil conditions and rainfall, topography etc. In addition this , Government policy can also affect changes in the cropping pattern. Although the impact of green revolution is uneven, yet it has led to new cropping pattern. At the start of the century, more than 83% of land was used for food crops and nearly 17% for non-food crops, the latter increased by around 26%. This shift in food grains was mainly due to the higher profitability of no- food grains.Cropping activities go on all around the year in india provided water is available for crops. The regional survey of land use and its mapping was made by Patrick Geddes. But the practical work on land use study was carried out in 1930 by late L.D. Stamp in Britian. This was perhaps first exercise to survey the land by many Geographers, Economists and Planners who attempted for land use planning. Agricultural department in United States (1935), Buck (1929), Shafi (1960), Mohammad Ali (1967), Ganguli (1964), Karimi (1950) and Lahiri (1950) have attempted to study land use survey and its studies. Later, S. Van-Volkenberge, Clark university, Massachusets brought world land use survey ion 1949. The United Nations Educational Social and Cultural Organisation, Supported this idea and appointed a commission in December 1953 under the chairman ship of Van-volkenberge at the international Geographical congress and proposed to carry out land use survey in many parts of the world. The first credit in india for making and intensive land use study goes to shafi (1977) in this direction needs special mention. He assessed von- Thunres theory in Indian conditions. On the basis of the study of cropping pattern in 35 villages of Koli tehsil in Aligarh district of Uttar Pradesh (INDIA), he concluded that intensity of land use does not decrease with increase in distance from market city; rather it is affected more by distance from the source of irrigation. His idea was strongly supported by Fakhruddin and Khan (1981) in their locational analysis of agricultural land use in case of Unnao tehsil of Unnao district (UP) india. They also proved that thunes model has little relevance in indian conditions. In 1954 weaver applied least standard deviation method to compute crop combination regions. This method is based on the comparison of the actual percentage of cropped areas occupied by different field crops with theoretical distribution. Is calculated for all possible crop and and a regional unit is designated with crop combination or combinations showing least variance or standard deviation using the same principle of least square. Raffiullah (1956), Doi's (1959), Thomas (1963), coppack (1964), Johnson (1958), Bhatia (1960), Athawale (1966), Ayyar (1909) and singh (1974) and many others have modified crop combination formula. Weaver 1954 proposed an objective statistical technique of combinatorial analysis the establish crop, livestock or enterprise combinations involving both the qualitative and quantitative aspects of crop production, livestock husbandry and functioning forms of agriculture. This pioneer work holds immense value and importance for agricultural geography worldwide. It has been observed that the technique of least deviation (minimum standard deviation) from the abstract theoretical combination value fails to operate in the enumeration units where the actual regional share of crops is quite close to one another (Jasbir singh, 1967) or it is more discriminating when there are a few high but unequal percentage and less discriminating when there are many low but nearly equall percentage (Dikshit, 1973). To overcome this difficulty the least squares techniques may be adopted. The use of this technique was suggested by Coppack (1964) and jasbir singh (1976) applied it for the derivation of crop combination The techniques of identifying crop concentration are largely comparable to the methods employed by some urban geographers like pownall (1953), webb (1959) etc. For determining the functional character of urban areas. Review of literature on relevant aspects under study forms an integral part of systematic research work. This review helps in highlighting the methodology as well as results obtained by different research workers and serve as guidelines for the research to be carried. The literature closely related to the present investigation has been briefly presented.

III. DATABASE AND METHODOLOGY

The study has been based on primary as well as secondary sources of information. The primary data source was collected in the form of questionnaire, filled up by the individual's involved in primary activities. The secondary data on changing land utilization and cropping pattern and production has been collected from the different issues of Digest of statistics of Jammu and Kashmir Government, as well as the digest of statistics of Ganderbal district. In the study all developmental blocks has been taken as unit. The information about land use , cropping pattern and production of a study area has been obtained by extensive investigation and processing of concerned data. The analysis has been presented in tabular form.

IV. RESULTS AND DISCUSSION

Cropping pattern refers to the proportion of area under different types of crops at a given point of time. According to Kanwar (1972) cropping pattern means both time and sequence of crops. It includes the identification of most efficient crops of the region which is considered a homogenous soil and climate belt, the intensity of cropping. A shift in Cropping pattern would mean a variation in the proportional area allocated to various crops. If the proportion of area under a high value crop increases, it is likely to result in increase in the total return even if there is no increase in the yield rate or price provided. A shift in the cropping pattern could be advantageous or disadvantageous according to the nature of the shift.

Area (in hectares) sown under					
Year	**Paddy rice**	**Maize**	**Wheat**	**Pulses**	**Total food crops**
2007-2008	*8363*	*3397*	*0*	*163*	*11923*

Source: Financial Commisioner's Office Srinagar

Area Grown Under Various Crops (2020-21)

Name of the crop	**Gross Area (in hectares)**
Rice (paddy)	8600
Maize	4373
Pulses	900
Wheat	50
Total Food Crops	**13923**

Source: Disaster management plan of District Ganderbal

From the above table it is clearly seen that the area under paddy cultivation, Maize cultivation, Wheat cultivation, pulses has been increasing to a greater extent between 2007-2008 and 2020-2021. The food crops like maize and rice are the most important crops easily grown in mid altitude lands, because of the abundant water in the soil throughout the year.

Tehsil-wise Area Shared by different crops (In Hectares)

Name of the Blocks	**Rice**	**Wheat**	**Maize**	**Moong**	**Pea**	**Mustard**	**Fodder**	**Potato**	**Vegetables**	**Rabi Fodder**	**Kharif fodder**
Ganderbal	3000	15	440	45	120	360	430	32	420	835	125
Wakura	1500	10	1200	60	80	410	470	51	360	910	155
Safapora	1800	12	1400	52	140	520	325	43	528	883	192
Kangan	1200	08	1600	80	180	460	390	58	395	723	108
Lar	1100	14	500	74	90	580	420	49	435	620	175

Source; Computed data

Ranking of crops

Ranking of the crops is influenced by Geographical conditions and the existing cropping structure. It is founded by seeing the percentage of area occupied by a crop to the total cropped area. The ranking of crop show the nature of farmer or cultivator i.e weather the farmer is traditional or market oriented or partly subsistent and partly market oriented farmer.

Ranking of the crops in District Ganderbal in 2020-21

S. No.	Name of the Blocks	First crops rank	Second rank Crops	Third rank crops
01	Ganderbal	Rice	Rabi Fodder	Maize
02	Wakura	Rice	Maize	Rabi fodder
03	Safapora	Rice	Maize	Rabi fodder
04	Kangan	Maize	Rice	Mustard
05	Lar	Rice	Rabi fodder	Mustard

Source; Data calculated by Author

Crop Combination

Crops are typically cultivated in combinations, and it is rare to find a single crop occupying an area in complete isolation from others at any given time. Physical factors play a major role in determining the shape and distribution of crop areas, while socio-economic conditions influence their overall extent. Government policies significantly impact the choice of crops cultivated. The advancement of irrigation facilities and the introduction of improved crop varieties have enabled a shift from traditional systems toward more profitable and modern agricultural practices.

Crops are arranged in order of their area occupancy

No of Crop combination	Crops in combination	Name of the block
09	R, W , MZ , MO, MA,PE,MU, FD, Pt	Ganderbal
02	R ,W	Wakura
02	R, W	Safapora
02	R, W	Kangan
05	R, W, MZ, MO, MA	Lar

Source; Data is calculated by Author with the formula of crop combination developed by Weaver. (crops W=wheat, R=rice, MZ= Maize, Pt= potato, FD= Fodder, PE= peas, MO=Moong, V= vegetables, MU= mustard)

The statistical analysis of cropping patterns using weaver's method, has led to the identification of eleven distinct crop combination regions in the study area. For the agricultural year 2010-2011, out of a total of twenty cultivated crops, only ten major crops namely, rice, wheat, maize, pulses, mustard, and vegetables- were found to be involved in various crop combinations. These crop combinations range from four to ten crops per region. The district exhibits considerable spatial variation in cropping patterns across its blocks. A ten crop combination, representing the highest level of crop diversity, was found to dominate in five blocks: Ganderbal, wakura, safapora, kangan, lar. Notably, the Ganderbal block exhibited the largest number of crops -nine in its dominant combination, lar with five crops, and kangan, wakura, safapora with 2 crops in its dominant combination. The data reveals a clear absence of crop specialization across the district. A striking feature of the crop combination regions is the recurrent dominance of certain staple crops across almost all region

V. CONCLUSION

In most parts of Ganderbal District, agriculture continues to reflect a subsistence nature. As a result, food grains dominate, occupying over 60% of the total cultivated area. Among cereal crops, rice holds the top position, closely followed by wheat, while maize ranks third in preference. Cash crops such as potatoes and mustard are significant although fruits have long been cultivated as the primary cash crop and now stand third in terms of total cropped area. Among pulse crops, moong remains most prominent. The prevailing cropping pattern relies largely on the natural fertility of the soil, with minimal application of modern agricultural techniques and inputs. Land areas that have been influenced by the green revolution , where high yielding varieties, fertilizers, assured irrigation and advanced technology are adopted, are usually cultivated by larger landholders . Expanding agriculture horizontally is limited due to high capital requirement . Therefore, only strategic and efficient land use, through the adoption of more profitable cropping systems, scientific crop

rotation, and multiple cropping methods can help meet the growing demand for food and raw materials in the district. Shifting towards a dynamic cropping pattern and incorporating crops that contribute to soil enrichment is essential for making farming practices both economically viable and ecologically sustainable. The district must embrace innovation and sustainable intensification to transform its traditional agrarian setup into a more productive and resilient agricultural economy.

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