



## PROPOSED ECO-FRIENDLY CROP PLANNING REGIONS IN PUNJAB: A SPECIAL REFERENCE ON BEHALF OF 1984-85 TO 2014-15

**Dr. Gorakh Singh**

*Assistant Professor of Geography, Department of Geography, G.S.S.D.G.S. Khalsa College, Punjab.*

### Introduction

Growing of crops goes on all the year round in Punjab, provided water is available. In Punjab, there are two distinct seasons, namely *Kharif* (July to October), and *Rabi* (October to April). But crops grown between April and June are known as *zaid* crops. Cropping pattern of any region is a function of the interplay between physical environment and human environment. In other words, it is action, reaction and interaction between natural environment and man-made environment. Sohal (1979) observed that cropping pattern in a region is determined by number of ecological, technological and institutional factors. Thus, cropping pattern of the study area is the combined result of physical and man-made factors, which include terrain, climatic conditions, soils, water resources, farm technology, human resource, Government's policy, agricultural infrastructure, etc. It shows that all these factors combined influence the cropping pattern of Punjab. Therefore, the choice of the farmers for selecting crops, are ruled by above mentioned factors.

Moreover, cropping pattern of an area is mainly the product of physical, socio-economic, technological and organizational factors over space and time. Cropping pattern is the most dominant factor of agricultural land use in a region. It is that land which comes under different crops at a specific period. It varies from region to region and from time to time. Singh and Dhillon (2004) have also observed that changes in agriculture of a particular area is reflected not only with a considerable extension of its cultivated area and the improvement of irrigation, but also the trend which have taken place in its cropping pattern.

Agriculture is the main occupation of the dwellers of Punjab state. The economy of the state depends mainly upon agriculture. A number of crops were grown in the study region because of variations in physical and non-physical environment. Before discussing the spatial distribution of individual crops in Punjab, for 1984-85 a brief account of overall cropping pattern of Punjab for 1984-85 is made. It reveals that cropping pattern of Punjab during 2014-15 is dominated by wheat, rice, fodder, cotton, vegetables, maize, sugarcane, oilseeds and pulses. Crop-wise, wheat and rice are the leading crops which cover 42.87 per cent and 32.76 per cent of the total cropped area during 2014-15 respectively. Besides these two crops, fodder comes next with 7.82 per cent of the total cropped area in 2014-15. Whereas, cotton crop covers 7.43 per cent and ranks fourth in the overall cropped area. But area under vegetables, maize, sugarcane, oilseeds, fruits, pulses and other crops is 2.78 per cent, 1.96 per cent, 1.41 per cent, 0.84 per cent, 0.79 per cent, 0.41 per cent and 0.70 per cent of the total cropped area in 2014-15 respectively.

### Objective

1. To capture the cropping patterns and changes therein.
2. To identify the dominant crops in the cropping pattern and changes therein.
3. To demarcate the eco-friendly crop planning regions.
4. To suggest measures for making Punjab Agriculture sustainable.

### Methodology

The present study is empirical in nature and is based on secondary sources of data. Thesis is taken as unit of study. Two time periods i.e. 1984-85 and 2014-15 are taken. The derived results are mapped with the help of cartographic techniques.

#### A. Cropping Pattern: 1984-85

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**Table 1: Overall Cropping Pattern in Punjab:1984-85**

Crops	Hectares	Per cent of Total Cropped Area
Wheat	3180460	44.07



Rice	1711833	23.72
Fodder	7606554	10.54
Cotton	573738	7.95
Maize	273518	3.79
Pulses	212176	2.94
Sugarcane	164547	2.28
Oilseeds	158770	2.20
Vegetable	67838	0.94
Fruit	49074	0.68
Other crops	64229	0.89
Total Cropped	7216837	100.00

Source: Director, Land Records, Punjab, Jalandhar.

The overall cropping pattern of 1984-85 indicates that Punjab had an area of 44.07 per cent under wheat, 23.72 per cent under rice, 10.54 per cent under fodder, 7.95 per cent under cotton, 3.79 per cent under maize, 2.93 per cent under pulses, 2.27 per cent under sugarcane, 2.20 per cent under oilseeds, 0.94 per cent under vegetables, 0.58 per cent under fruits and 0.89 per cent under other crops of the total cropped area respectively. Overall cropping pattern of the study region was dominated by cereal crops. The dominance of cereals in the cropping pattern was due to geographically favourable conditions and demand of food for the increasing population. Apart from wheat and rice, other crops like fodder, cotton, maize, oilseeds, sugarcane, fruits and vegetables were also grown. These crops are discussed individually in the following pages.

#### B. Cropping Pattern: 2014-15

The overall cropping patterns of the study region. It reveals that cropping pattern of Punjab during 2014-15 is dominated by wheat, rice, fodder, cotton, vegetables, maize, sugarcane, oilseeds and pulses. Crop-wise, wheat and rice are the leading crops which cover 42.87 per cent and 32.76 per cent of the total cropped area during 2014-15 respectively. Besides these two crops, fodder comes next with 7.82 per cent of the total cropped area in 2014-15. Whereas, cotton crop covers 7.43 per cent and ranks fourth in the overall cropped area. But area under vegetables, maize, sugarcane, oilseeds, fruits, pulses and other crops is 2.78 per cent, 1.96 per cent, 1.41 per cent, 0.84 per cent, 0.79 per cent, 0.41 per cent and 0.70 per cent of the total cropped area in 2014-15 respectively.

**Table 2: Overall Cropping Pattern in Punjab: 2014-15**

Crop Category	Area in Hectares	Total Percentage of the Cropped Area
Total Reporting area	7758524	100.00
Wheat	3326079	42.87
Rice	2541692	32.76
Fodder	606717	7.82
Cotton	576458	7.43
Vegetables	215686	2.78
Maize	167584	2.16
Sugarcane	109395	1.41
Oilseeds	65172	0.84
Fruits	61292	0.79
Pulses	34137	0.44
Other Crops	54312	0.70

Source: Director, Land Records, Punjab, Jalandhar

#### C. Changes in Cropping Patterns, 1984-85 to 2014-15

The agricultural landscape in the study region has changed dramatically with the advent of HYV's seeds of rice and wheat, expansion of irrigation through canals and tubewells, adoption of new agricultural methods, changes in socio-economic and factors expansion of agricultural institutions, increased utilization of farm-labour, use of chemical fertilizers, consolidation of land holdings, developed transport network, increasing storage facilities, marketing, banking and credit facilities. As a result of these developments the entire agriculture production system in the study region got revolutionized. The farmers have found that rice-wheat crop rotation is most profitable. Patterns of distribution of crops vary time to time and region to region. Some crops have gained area under their cultivation, while others have lost during 1984-85 to 2014-15.



**Table 3: Overall Changes in Cropping Patterns in Punjab: 1984-85 to 2014-15**

Crops	Percentage of Total Cropped Area		Changes in Percentage
	1984-85	2014-15	
Wheat	44.07	42.87	-1.20
Rice	23.72	32.76	+9.04
Fodder	10.54	7.82	-2.72
Cotton	7.95	7.43	-0.52
Maize	3.79	2.16	-1.63
Vegetables	0.94	2.78	+1.84
Sugarcane	2.28	1.41	-0.87
Oilseeds	2.20	0.84	-1.36
Fruits	0.68	0.79	+0.11
Pulses	2.94	0.44	-2.50
Other Crops	0.89	0.70	-0.19

**Source:** Director, Land Records, Punjab, Jalandhar

### Proposed Eco-Friendly Crop Planning Region

The economic resource base of Punjab varies widely from one corner to the other as becomes evident from the disparity in agricultural development and economic growth of different parts of the state. In order to plan for a harmonious development, it is essential to pinpoint the problems and potentials of different areas. This is possible only when the spatial variations in the resources base, in terms of climate, physiography, soil type and underground water reservoir are thoroughly assessed (Mavi and Tiwana, 1993). Region is one of the basic concepts of geography. It has been defined differently by different geographers. A widely accepted definition of region is "an area that is differentiated from other areas according to the specified criteria." It has also been defined as "a differentiated segment of the Earth surface" (Whittlessey, 1929). Husain (1982) stated that geographers identify regions based on typical and cultural characteristics. The landform regions, climatic regions, rainfall regions, pedological regions and biotic regions are some of the examples of physical regions, while population regions, linguistic regions, industrial regions, agricultural region and trade and commerce regions are the example of cultural regions. Buchanan (1959), however, suggested that the agricultural regions, if these are to be defined at all, must be defined in terms of agricultural elements, i.e. by crop, livestock or enterprise data or by measurement of farming process or of farming organization. In agricultural geography, it is a short step from the mapping of such data and the recognition of areas of dominance by a particular enterprise, association of enterprises or farming type, to the recognition of such areas as distinctive regions (Morgan and Munton, 1971). These are readily recognizable on the ground even to the untrained eye (Symons, 1967), dominated by an enterprise having a sort of natural monopoly or natural region (Baker, 1925), and possessing a landscape including many distinctive identifiable agricultural elements. Eventually, an area of homogenous character of its own emerges, to which different names have been given, such as 'belt', 'zone', 'region, or even ' economic landscape' (Losch, 1954), when an area has a high degree of homogeneity of one or more criteria (Spencer and Horvarth, 1963), it becomes a region. Farmer's crop planning decision have an impact on the spatial and temporal crop organization at farm and landscape levels, which in term strongly impact many environmental issues such as soil erosion, bio-diversity, co-existence between Genetically Modified (GM) and Non Genetically Modified (NGM) crops, crop pest management, etc. It is generally accepted that managing landscape organization, considering both landscape composition and configuration, is a way to reconcile agricultural production and preservation of ecosystem services at the landscape scale (Foley et al., 2005). Thus, we consider it necessary to understand farmers' crop planning decision in their spatial and temporal dimensions, to anticipate their potential consequence on landscape organization. These decisions include choosing crops, allocation of crops to plots and splitting agricultural plots (Schaller et al. 2010). The spatial dimension of cropping plan decisions is particularly important for understanding the spatial arrangement of crops in agricultural regions.

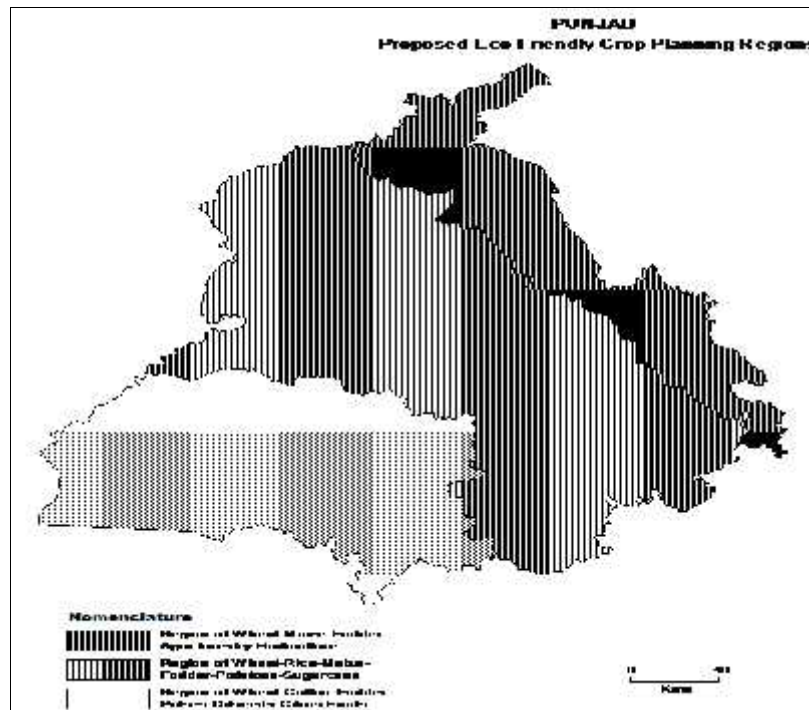
Crop planning regions often walks a fine line between serving the needs of the community, protecting the environment, crop sowing management of the region and taking into account the rights of individual land owners and community members. The study of crop planning is an important aspect in agricultural geography. The agricultural regionalization, a process of dividing an area into uninterrupted areas having some kinds of homogeneity with specific outer limit may be done with the help of crop planning method. The study of crop planning helps in understanding the cropping pattern and crop concentration in a particular area. It further helps to make plan for inclusive production in agriculture. The concept of crop planning is a scientific technique to study the existing spatial relationship of crops in association with other crops and to establish the



boundaries of agricultural region based on statistical finds and also study the dominance crops in an orderly basis (Das, 2013).

### I. Region of Wheat-Maize-Fodder-Agro Forestry-Horticulture

This region is laying along the Shiwalik foot hills and runs in northwest to south-east direction. It comprises the tehsils of Dhar kalan, Pathankot, Mukerian, Dasuya, Hoshiarpur, Garhshankar, Nangal, Balachaur, Anandpur Sahib, Rupnagar, Chamkaur Sahib, Kharar, S.A.S. Nagar and Derabassi. This region covers landform regions of Shiwalik foot hills and Piedmont plains. The average gradient is very steep, i.e. 1 to 300 which ranges from 1:75 to 1:600. Mean annual rainfall exceeds 800 mm, while about 80 per cent out of it is received from monsoons and remaining from western disturbances and cyclones. Soils are silty clay and sandy which are mixed with pebbles. Generally these soils are called Shiwalik soils which are poor in fertility and subjected to water erosion owing to occurrence of numerous swift flowing seasonal torrents. The characteristic of relief is undulating and dissected. Here, sub-soil water aquifers are inadequate and are very deep, which are not within the economic reach of the poor farmers for pumping out for irrigation purposes. Size of land holding varies from small to marginal, degree of farm mechanization is low. For instance, the density of tractors ranges between 10 to 12 tractors per 100 hectares of net sown area. Main source of irrigation is tube-wells, but some areas are also irrigated by canals, like bari-doab, kandi canal, and bist-doab canal. It is problematic area, socio-economic environment is comparatively less developed because of unfriendly relief. The magnitude of crop diversification is noted high. In such prevailin conditions, main proposed crops for this region are wheat, maize, fodder, agro-forestry and horticulture. Agro-forestry can be developed in this region on large scale. Because, most of the land is either hilly or dissected and undulating, which can bear plantation. Moreover amount of annual rainfall is also high which is quite sufficient for the development of agro-forestry and consequently will certainly increase the income of the farmers. This region is also highly suitable for horticulture crops, especially for the plantation of mango, lichi, kinnow, etc. The piedmont plain of this region is highly suitable for potato cultivation. If all these suggestions are implemented, then this region can emerge as a major agro-forestry and horticulture area. It requires levelling of lands, construction of bridges and roads in rural areas, installation of fruit processing plants and cold storages, special incentives should be given to the development of marketing for agro-forestry and horticultural products.



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## II. Region of Wheat-Rice-Maize-Fodder-Potatoes-Sugarcane

It comprises the central parts of the state and contains Gurdaspur, Batala, Dera Baba Nanak, Amritsar-I & II, Baba Bakala, Ajnala, Tarn Taran, Patti, Khadur sahib, Kapurthala, Bholath, Sultanpur Lodhi, Jalandhar-I & II, Phagwara, Shahkot, Nakodar, Phillaur, Nawan Shehar, Ludhiana East & West, Jagraon, Raikot, Payal, Samrala, Khanna, Fatehgarh Sahib, Khamanon, Amlah, Bassi Pathana, Malerkotla, Dhuri, Sangrur, Snuma, Lehra, Moonak, Samana, Patran, Patiala, Nabha, Rajpura, Firozpur, Zira and Moga tehsils, which contain 58.44 per cent of the total occurrences. It is the region of suitable relief with gentle gradient which varies between 1:1000 to 1:2800. Here, rainfall decreases from north-east to south-west and ranges between 500 to 800 mm. It covers upland plains as well as flood plains. A variety of soils are found which are silty-clay, clayey-silt, loamy, loamy-clay and loamy sand. These soils are well known for their fertility. The sub-soil water aquifers are fresh and free from impurities and are having shallow to medium depth. But in recent years, owing to excessive pumping out of water for irrigation purposes, the depth of sub-soil water has increased. The major source of irrigation is tube well which is found throughout the region. The secondary source of irrigation is canal which is predominant in bari-doab of this region where its share is noted 35 per cent of the net irrigated area. But share of canal irrigation is noted less than 5 per cent in bist-doab. But, in rest of the area of this region, share of canal irrigation is found less than 15 per cent. All this shows that agriculture is largely dependent on tube-well irrigation. Here, agriculture is highly mechanized. The average number of density of tractors is 16 tractors per 100 hectares of net sown area and density of tube-wells is 28 tube-wells per 100 hectares of net sown area. Average use of chemical fertilizer is 400 kg. per hectare of net sown area. The extent of irrigation varies between 95 to 100 per cent. Agricultural infrastructure is well developed. Major crops are wheat and rice. Degree of crop diversification is low. All the major urban centres, like Patiala, Ludhiana, Jalandhar, and Amritsar fall in this region. Marketing facilities are excellent. Thus, this region is highly agriculturally developed and cropping pattern is also highly specialised and commercialised. Therefore, proposed eco-friendly crops for this region are wheat, rice, maize, fodder, potatoes and sugarcane. For sugarcane cultivation, more sugar mills with large capacity should be installed more milk plants are required for boosting dairy farming and for potatoes cultivation, chain of cold storages should be made and export of agricultural products dry ports should be established so that farmers can divert some area from wheat-rice crop rotation to proposed crops. In this way, the region which has highly specialized agriculture can be diversified on commercial lines which will certainly lead to increase the farm income per unit area and will also save the bio-diversity and ecology of this proposed region.

## III. Region of Wheat-Cotton-Fodder-Pulses-Oilseeds-Citrus Fruits

This region is confined to the south-western parts of the state and covering the tehsils of Jalalabad, Fazilka, Abohar, Faridkot, Jaito, Muktsar, Gidderbaha, Malout, Bagha Purana, Nihal Singh Wala, Barnala, Tapa, Bathinda, Rampura Phul, Talwandi Sabo, Mansa, Budhlada and Sardulgarh. It has upland plains with frequent occurrences of sand dunes land farm region. Though, presently most of sand dunes have been levelled by the farmers but still their remnants are visible and having 2 to 3 meters elevation from the surrounding land. The gradient of land is comparatively gentle with the rest of Punjab. It is of an average of 1 to 3000. The sand content in soils decreases from south-west to north-east. Mean annual rainfall is less than 500 mm. It is recorded lowest of 220 mm in Abohar tehsil. Soils are coarse and range between sandy to sandy loam in texture which is highly suitable for the cultivation of cotton, wheat, pulses, oilseeds, citrus fruits, etc. The aquifers of sub-soil water are brackish in nature, which are unfit for irrigation and drinking purposes. Thus, this region is facing serious problem of drinking water as well as water for irrigation purposes. Extent of irrigation varies from 97 to 100 per cent, average density of tractors is 18 tractors per 100 hectares of net sown area. Size of land holdings is comparatively larger and varies from 4 to 10 hectares, density of tubewells is 14 per 100 hectares of net sown area. Main source of irrigation is canal in this region and the secondary source is tube-wells. Owing to excessive canal irrigation, the water-logging problem has emerged in major parts of the region which has affected the agriculture, especially cotton cultivation which cannot be done successfully on wet lands. The region is lying far away from the developed areas of the state, urbanisation is low and farm mechanization is moderate. From ecological and economic viability point of view, the proposed crops are wheat, cotton, oilseeds, pulses, fruits, especially citrus for this region. The requirement of the region is the installation of cotton mills, fruit processing plants, oil-seeds processing plants, development of infrastructure, especially rural roads, markets, etc. In this way, the regions which are highly agriculturally specialised can be diversified on commercial lines and their proposed cropping pattern can become ecologically as well as economically viable while will certainly lead to sustainability of Punjab agriculture in the future.

## Findings and Suggestions

The following suggestions are made for making Punjab's cropping pattern sustainable:





1. It suggested that area from wheat and rice crops which dominating the Punjab cropping pattern should be diverted to other crops which reduce less water like fodder, maize, vegetables, oilseeds, etc. because, there are depleting the water resources, nutrients and other micro nutrients of the specific soil.
2. Agro forestry should be encouraged along the Shiwalik foothills and along the river courses.
3. High value crops like sugarcane, spices, fruits, vegetable, etc. should be encouraged by setting up more milk plants, vegetable and fruit processing plants, cold storages, modern silos, dry airports, etc.
4. Stress should be given for the development of sprinkle irrigation and drip irrigation, particularly in south-western and along the Shiwalik foothill areas.
5. Canal system should be strengthened particularly in central parts of Punjab where more than 90 per cent of the total irrigated area is irrigated by tube wells. In this way, there would be less stress on sub-soil water resources.

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