



punjab geographer

A JOURNAL OF THE ASSOCIATION OF
PUNJAB GEOGRAPHERS, INDIA

VOLUME 2

OCTOBER 2006



REGIONAL DISPARITIES IN AGRICULTURAL MODERNIZATION IN PUNJAB: 1971 TO 1999

K.S. Sohal
Shivjeet Kaur

Abstract

The main objective of the present paper is to highlight the patterns of regional disparities in agricultural modernization and changes therein during 1971 to 1999 in Punjab. The study has observed contrasting disparities in it as the central parts of the state were highly agriculturally modernized, while the areas lying along the Shiwaliks and piedmont plains in north-west remained lagging behind during the study period. It is further found that gap in agricultural modernization between highly and retarded areas has been reduced during 1971 to 1999. For calculating the composite index of agricultural modernization, the selected indicators are: extent of net sown area; extent of irrigation; number of tubewells per hundred hectares of net sown area, number of tractors per hundred hectares of net sown area, use of chemical fertilizers in kgs/ hectare of net sown area, area under high yielding varieties, and number of wheat thrashers per hundred hectares of wheat cropped area. Tehsil is taken as a unit of study. Data is based on secondary sources. Statistical techniques are used for deriving the results and cartographic method is applied for mapping the results. Conclusions are drawn and suggestions are made for further reducing the gap in regional disparities in agricultural modernization in Punjab, so as to achieve sustainable agriculture

Introduction

Agricultural modernization means adoption of the new scientific methods or techniques (Johl, 1996) Morgan and Munton (1971) stated that agricultural modernization comprises improved ploughing implements, wheat thrashers, tubewells, tractors, chemical fertilizers and high yielding varieties of seeds. They further said that the presence of each of these factors of production in terms of quantum, quality and price varies spatially affecting relationship between them and their effects on the development of individual farms as well

as of different regions. Similarly, Eddowes (1969) has also listed the factors affecting agricultural modernization in a given environment are seeds, chemical fertilizers, manures, mechanical power, chemical plant protection products and sequencing of crops. For demarcating levels of agricultural modernization in India Singh and Dhillon (2004) have selected seven indicators, namely, pumping sets, tractors, HYV of seeds, chemical fertilizers, harvesting implements, plant protection equipments and tractors operated implements. Frankel (1971) has also stated that no state is more closely identified with gains

of agricultural modernization than Punjab. He further observed that these gains of agricultural modernization are not uniform over space and time which he considered mainly the result of spatio-temporal variations in levels of agricultural modernization. Sohal (1990) has observed that agricultural productivity is high in the central parts of Punjab as compared to south-western parts and areas lying along the Shiwaliks and piedmont plains. He further stated that main reason for these regional disparities is the level of adoption of new farm technology by farmers. Sidhu and Johl (2002) emphasised that Punjab

agriculture has undergone a significant change since the advent of green revolution in the mid-sixties. Traditional agriculture has progressively given way to modern and commercial agriculture. It was due to factors like adoption of HYVs of wheat and rice, consolidation of landholdings, tubewells and pumping sets, liberal use of chemical fertilizers, farm mechanization, development of produce markets, power and road infrastructure backed by strong institutional support of research and extension, easy accessibility to inputs and outputs and support prices. All this made Punjab agriculture highly modernized.

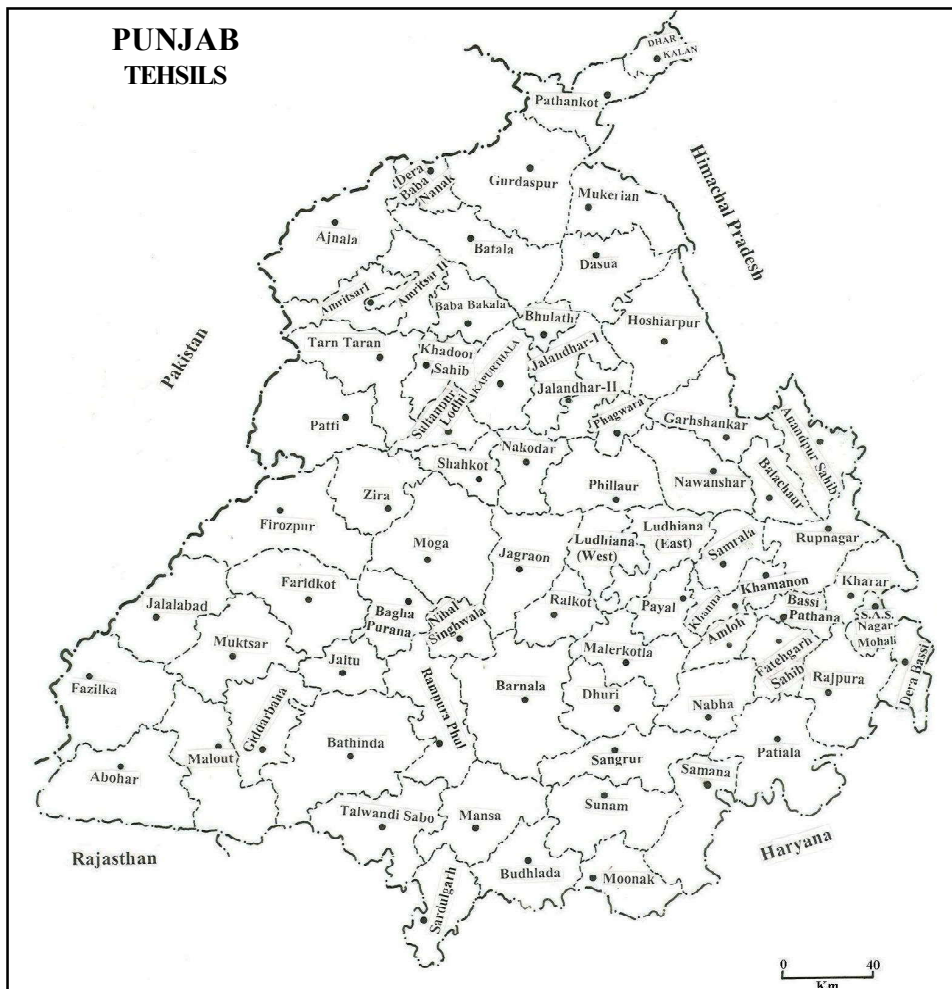


Fig. 1

Study Area (Figs. 1 & 2)

Punjab accounts for 1.53 per cent of total geographical area of India and is situated in the north-west of the country. It is flanked by the states of Haryana in the south and south-east, Rajasthan in the south-west, Himachal Pradesh in the north-east and J&K in the north. It forms international boundary with Pakistan in the west. According to 1991 census, its average density of population was 403 persons per sq. km. Its sex ratio was 882 females per 1000 males. It comprised 72 tehsils. It contributed 48.6 per cent of wheat and 39.1 per cent of rice to the central pool in 1999.

Objectives

The present study has the following objectives:

- (i) To know the regional disparities in agricultural modernization in 1971 and 1999.
- (ii) To find out the changes in the patterns of agricultural modernization during 1971 to 1999.
- (iii) To highlight the factors responsible for regional disparities in agricultural modernization and changes therein.
- (iv) To make suggestions for minimising the disparities among lagging behind and advanced areas of agricultural modernization.

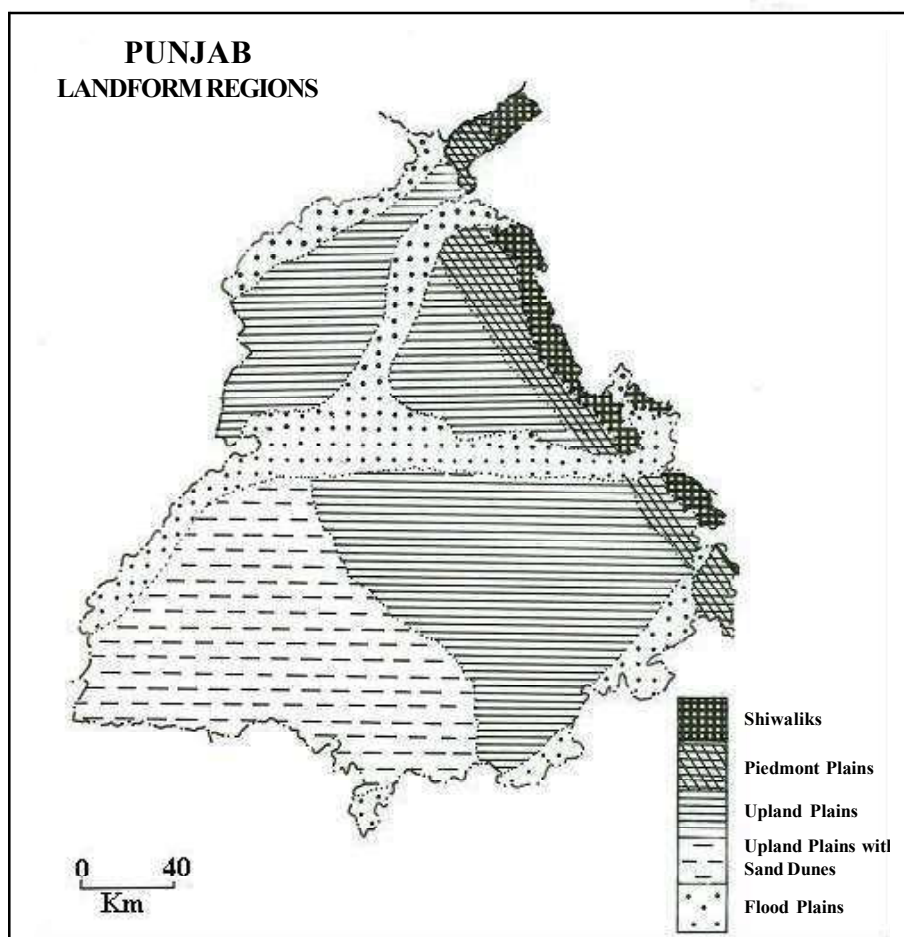


Fig. 2

Methodology and Sources of Data

The present investigation is based on secondary sources of data. The tehsil is taken as an unit of study. Data regarding indicators of agricultural modernization are collected personally from the Offices of Economic and Statistical Organisation, Chandigarh, Director Land Records, Jalandhar, Director Agriculture Punjab, Chandigarh, other State Offices, Libraries, etc.

In this study modified method of Singh and Dhillon used by Kaur (1999) is applied for deriving the degree of agricultural modernization. The following formula is as follow:

$$I_{ma} = \frac{E_{ie}}{E_{ir}} + \frac{HYV_e}{HYV_r} + \frac{C_{fe}}{C_{fr}} + \frac{T_e}{T_r} + \frac{T_{ce}}{T_{cr}} + \frac{w_{te}}{w_{tr}} = LQs$$

$$\text{Degree of agricultural modernization} = \frac{LQs}{N} \times 100$$

Where: I_{ma} means the composite index of the level of agricultural modernization, E_i implies extent of irrigation, HYV stands for area under high yielding varieties of seeds, C_f denotes the use of chemical fertilizers in kilograms per hectare of net area sown, T denotes number of tubewells per hundred hectares of net sown area, T_c means number of tractors per hundred hectares of net sown area, W_t connotes number of wheat thrashers per hundred hectares of wheat cropped area and e and r subscripts symbolize respectively the enumeration unit (tehsil) and the entire region (state). Thus, gives the degree of co-efficient of localization. The higher the index value, the higher the degree of agricultural modernization and vice versa.

By using this method, the index values of agricultural modernization of all the 72 tehsils of Punjab are calculated for 1971 and 1999. These results are mapped in figs. 3 and 4 and are discussed ensuing text as:

- (i) Regional disparities in levels of agricultural modernization: 1971;
- (ii) Regional disparities in levels of agricultural modernization: 1999; and
- (iii) Changes in the levels of agricultural modernization: 1971 to 1999.

Regional Disparities in Levels of Agricultural Modernization: 1971

For knowing the regional disparities in agricultural modernization, six indicators are taken into account. These are: extent of irrigation, per cent share of H.Y.Vs. of wheat, rice and maize to their cropped area respectively; consumption of chemical fertilizers in kilograms per hectare of net sown area, number of tubewells per hundred hectares of net sown area, number of tractors per hundred hectares of net sown area; and number of wheat thrashers per hundred hectares of wheat cropped area. By taking into account the above mentioned indicators, the index of agricultural modernization is derived for all the 72 tehsils with the help of Kaur's method of agricultural modernization. On the basis of derived indices, Figure 3 is mapped which portrays the following three categories.

Areas of high magnitude of agricultural modernization (>120 per cent): This category was found in central parts of the state in a north-west to south-east direction. It was a continuous belt which was running along the National Highway No. 1, right from Amritsar to Sirhind. It covered the districts of Amritsar (except Patti and Ajnala tehsils), Kapurthala, Jalandhar (except Nakodar and Shahkot tehsils), Ludhiana, Fatehgarh sahib and tehsils of Batala and Derababa Nanak of Gurdaspur District. Here, the index of agricultural modernization was more than 120 per cent. It varied between 120.11 per cent in Kapurthala tehsil to 160.37 per cent in Ludhiana east and Ludhiana west tehsils. In these areas,

extent of irrigation, number of tubewells per hundred hectares of net sown area, number of tractors, number of wheat thrashers, consumption of chemical fertilizers per hectare and area under H.Y.Vs were high. The main reasons for high agricultural modernization were flat lands, rich aquifers of sub-soil water, impact of Punjab Agricultural University, Ludhiana, the existence of urban centres like Amritsar, Jalandhar and Ludhiana, well-developed transport network, awakening among farmers about agricultural innovations, high number of regulated markets, etc.

Areas of moderate magnitude of agricultural modernization (80 to 120 per cent): It comprised the tehsils of Rupnagar, Rajpura, Patiala, Dera Bassi, Nabha, Samana, Sangrur, Barnala, Rampura Phul, Moga, Nihal Singhwala, Bagha Purana, Shahkot, Nakodar, Ajnala and Gurdaspur. Here, the index of agricultural modernization varied between 84.26 per cent in Rajpura tehsil to 118.52 per cent in Samana tehsil. This category was lying between areas of high and low categories of agricultural modernization. In these areas, the magnitude of agricultural modernization

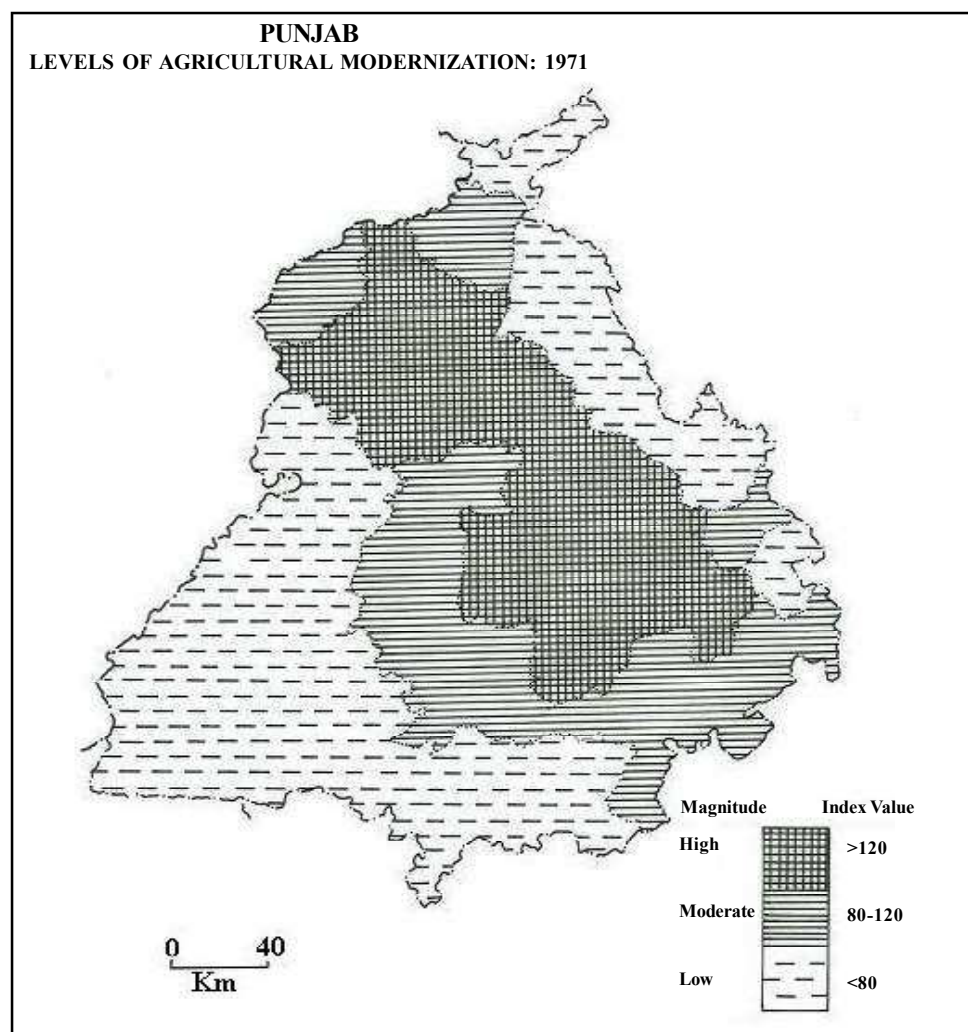


Fig. 3

was moderate due to low number of tubewells per hundred hectares of net sown area, moderate number of wheat thrashers and tractors, area under H.Y.Vs. of seeds varied between low to moderate, occurrence of sand dunes in the districts of Faridkot and Sangrur and floodplains in case of Gurdaspur, Afnala, Rupnagar, Patiala and Samana tehsils.

Areas of low magnitude of agricultural modernization (< 80 per cent): This category was confined in two belts. One belt was lying along the Shiwaliks and piedmont plains and comprised the tehsils of Dharkalan, Pathankot, Mukerian, Dasuya, Hoshiarpur, Garhshankar, Balachaur, Anandpur Sahib, Mohali and Kharar. Here, index value of agricultural modernization was less than 80 per cent. The low magnitude of agricultural modernization was largely due to unfavourable physical environment, such as undulating and dissected topography, steep gradient, deep and inadequate aquifers of sub-soil water, severe problem of water erosion, etc. Due to these reasons, the extent of irrigation, the number of tubewells, number of tractors, number of thrashers, area under H.Y.Vs and consumption of chemical fertilizers were comparatively low. All this hampered the process of modernization of agriculture in this belt. The second belt of this category was located in the south and south-western parts of Punjab. It covered the districts of Firozpur, Muktsar, Bathinda, Faridkot, Mansa and tehsils of Moonak, Sunam and Patti. These areas were facing problems like water-logging, frequent occurrences of sand dunes, low rainfall, brackish sub-soil water, poor sandy soils, far away from major urban centres and Punjab Agricultural University, Ludhiana. Owing to these reasons, low degree of agricultural modernization was found in this belt.

From the forth going discussion, it is observed that central areas of the state which were lying along the Grand Trunk

Road and Delhi-Amritsar Railway-line were having high degree of agricultural modernization. From this belt, as one moves towards the north-east and south-west, the magnitude of agricultural modernization started decreasing. It decreased abruptly in the areas lying to the north and north-east from this belt. But the declining magnitude was relatively gradual towards the south and south-west from this belt.

Regional Disparities in Levels of Agricultural Modernization:1999

Figure 4 is mapped for showing the regional disparities in agricultural modernization in Punjab during 1999. The index value varies between 43.19 per cent in Dharkalan tehsil to 183.92 per cent in Khanna tehsil. These figures show very high disparities in agricultural modernization in the study area. These disparities are the combined result of physical and non-physical environments. A detailed comparison of figs. 2 and 4 shows the impact of physical environment, particularly of relief on the magnitude of agricultural modernization. Areas having rough terrain in the north-east and south-west are having low magnitude of agricultural modernization, while the central areas of Punjab, which are flat plains, have high magnitude of agricultural modernization. For knowing the spatial patterns of agricultural modernization, fig. 4 is mapped which shows the following three categories:

Areas of high magnitude of agricultural modernization (> 120 per cent): It includes the districts of Fatehgarh Sahib, Ludhiana, Jalandhar and Kapurthala and tehsils of Batala, Tarn Taran, Baba Bakala, Amritsar I and II, Zira, Firozpur, Khadoor Sahib, Moga, Malerkotla, Sangrur, Nabha, Patiala and Nawanshahr. All these areas are having featureless relief, fertile soils, fresh aquifers of sub-soil water supplemented by highly developed agricultural infrastructure. Grand Trunk Road and Amritsar-Delhi Railway-line also pass through these areas. Moreover, the

impact of Punjab Agricultural University, Ludhiana and the presence of large urban centres like Amritsar, Jalandhar, Ludhiana, Patiala, etc. are also providing impetus to this effect. All these factors have led to the development of irrigation, sinking of tubewells, adoption of H.Y.V. of seeds, high number of wheat thrashers, etc. which are responsible for high degree of agricultural modernization in the areas covered by this category.

Areas of moderate magnitude of agricultural modernization (80 to 120 per cent): This category is largely concentrated in the southern parts of the

state. It comprises the tehsils of Faridkot, Jaito, Muktsar, Rampura Phul, Mansa, Fazilka, Jalalabad, Bagha Purana, Nihalsinghwala, Samana, Barnala, Dhuri, Sunam, Moonak, Rajpura, Mohali, Kharar, Hoshiarpur, Rupnagar, Dasuya, Gurdaspur, Dera Baba Nanak, Patti and Ajnala. All these areas are having moderately developed agricultural infrastructure. Moreover, these areas are either having sand dunes or undulating and dissected topography. Such factors are responsible for comparatively low level of agricultural modernization. Because of

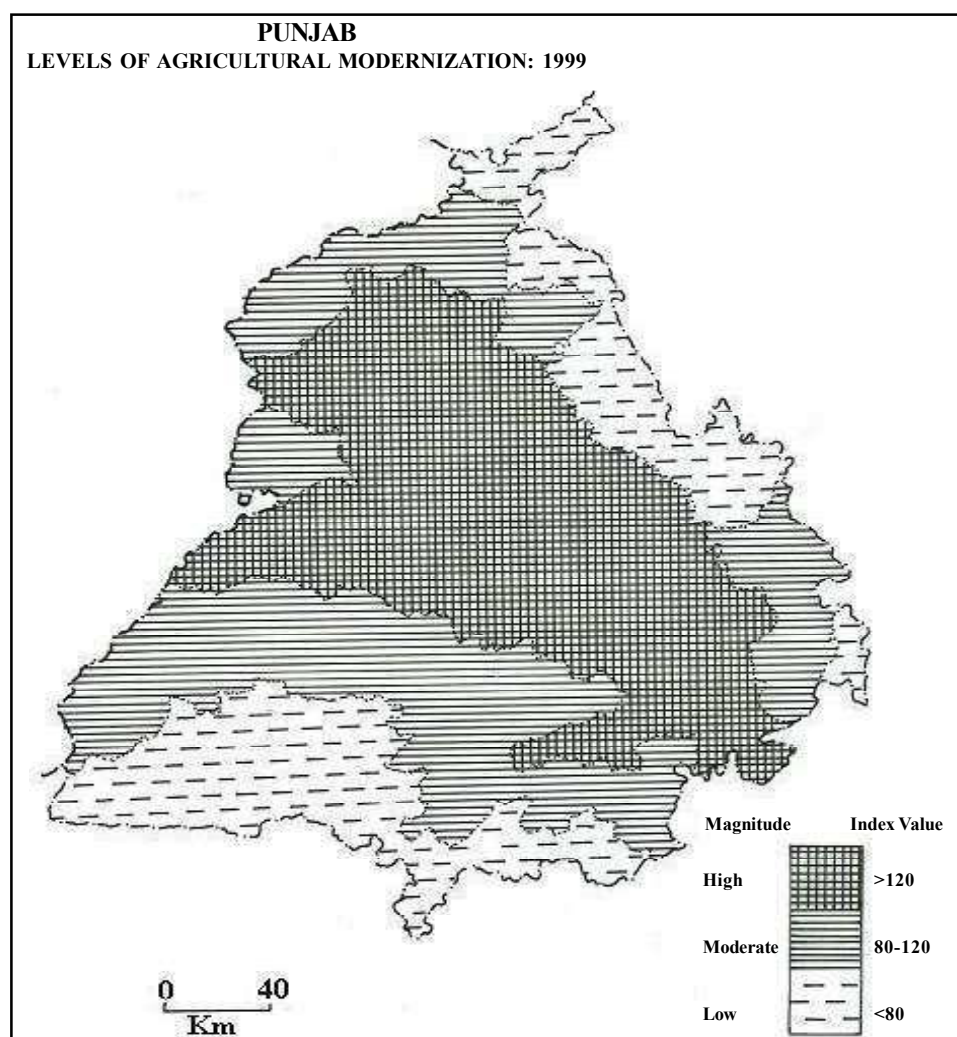


Fig. 4

these reasons, this category has witnessed moderate degree of agricultural modernization.

Areas of low magnitude of agricultural modernization (< 80 per cent): This category is found in two separate belts. One belt is confined to the areas lying along the Shiwaliks and piedmont plains. It includes the tehsils of Dharkalan, Pathankot, Mukerian, Hoshiarpur, Garhshankar, Balachaur, Anandpur Sahib and Derabassi. In all these areas, the physical environment particularly relief is hostile to the adoption of green revolution technology and for the development of agricultural infrastructure. The second belt contains the tehsils of Abohar, Malout, Gidderbaha, Bathinda, Talwandi Sabo, Sardulgarh, Budhlada and Moonak. Here, frequent occurrences of sand-dunes, saline and alkaline sub-soil water, sandy soils, water-logging due to excessive canal irrigation, far away from urban centres, less awakened farmers, etc. are responsible for poor development of indicators of agricultural modernization which ultimately resulted into low magnitude of modernization of agriculture.

From the above discussion, it can be concluded that areas having friendly relief for the application of green revolution technology and developed agricultural infrastructure have experienced high degree of agricultural modernization. While areas with hostile topography, less developed socio-economic environment and less developed indicators of agricultural modernization have embraced low degree of agricultural modernization.

Changes in Agricultural Modernization (1971 to 1999)

The process of agricultural modernization which was set in motion with the introduction of H.Y.Vs. of seeds of wheat and rice in 1966 was in its infant

stage during 1971. But with the efforts of the government, agricultural scientists and farmers, the adoption of green revolution technology which includes irrigation, H.Y.Vs. of seeds, chemical fertilizers, tube-wells, and wheat thrashers, has reached at its mature stage in 1999. As a result significant increases are recorded in number of tractors, thrashers, pumping sets, consumption of chemical fertilizers, extent of irrigation, area under H.Y.Vs. seeds, etc. in Punjab during the study period. For instance, the extent of irrigation has increased from 71.3 in 1971 to 95.6 per cent in 1999. The number of tractors per 100 hectares of net sown area has increased from 1.34 in 1971 to 5.62 in 1999. Area under H.Y.Vs. of seeds was 40.40 in 1971 which has increased to 97.75 per cent in 1999. The consumption of chemical fertilizers has increased from 53 kg. in 1971 to 326 kg. per hectare of net sown area in 1999, similarly number of wheat thrashers has also increased from 2.6 in 1971 to 8.7 in 1999 per hundred hectares of wheat cropped area. All this could become feasible only with the improvements in agricultural research and extension services, development of village link roads, rural electrification, favourable government policy in terms of liberal credit facilities, remunerative prices, assured marketing, etc. Due to all these improvements, the state agriculture which was on threshold of modernization during 1971 has transformed into highly modernized in 1999.

But improvement in agricultural modernization was not uniform in all parts of the state. It varies enormously. The unevenness in spatial distribution of agricultural indicators resulted into spatial variation in agricultural modernization. For understanding the overall changes in the patterns of agricultural modernization during 1971

to 1999, figs. 3 and 4 are compared which yield the following themes:

- a) During 1971, the high category of agricultural modernization had contained 39 per cent of total occurrences and was mainly confined to the Bari-Doab and Bist-Doab regions. But, in 1999 this category records 46 per cent of the total occurrences and has shifted towards the south-east covering the central parts of Punjab and runs in north-west to south-east direction. These areas are highly favourable for modernization of agriculture, because these are having favourable physical environment and developed agricultural infrastructure.
- b) The category of moderate agricultural modernization has also experienced significant changes. It has captured most of the areas which were once under low category of agricultural modernization, particularly in southern parts of the state in 1971. It covered 22 per cent of total occurrences in 1971 which increased to 31 per cent of total occurrences in 1999. The significant feature to be noted is that in 1971, this category was confined mainly to the south-eastern parts and was lying between categories of low and high agricultural modernization, but in 1999 it has shifted towards the south-west by capturing areas from low category. Such a change is the result of awakening about agricultural technification among the farmers and the efforts of the state government and agricultural scientists.
- c) The areas of low agricultural modernization contained 40 per cent of the total occurrences in 1971, which reduced to 23 per cent of the total occurrences in 1999. It reveals that this category has lost its area and has been shrunk in size. At present, this category is mainly confined to

Shiwaliks and piedmont plains, covering the tehsils of Dharkalan, Pathankot, Mukerian, Hoshiarpur, Garhshankar, Balachaur, Anandpur Sahib and Derabassi. While in the extreme southern parts of the state, it embraces the tehsils of Abohar, Malout, Gidderbaha, Bathinda, Talwandi Sabo, Sardulgarh, Budhlada and Moonak. These tehsils could not have been able to improve their position considerably, largely due to physical constraints. In the south-west, it has lost its area to moderate category of agricultural modernization, particularly due to the levelling of sand-dunes and improvements in socio-economic environment. As a result, it has shrunk in size because some of its areas have joined either moderate or high category of agricultural modernization in 1999.

- d) From the preceding discussion, it is observed that during 1971 to 1999, the categories of high and moderate agricultural modernization have expanded in their size, while the low category has been shrunk.

Conclusion

It is observed that during 1971, central areas of the state were having high degree of agricultural modernization. From this belt, as one moves towards the north-east and south-west, the magnitude of agricultural modernization started decreasing. The degree of modernization declined abruptly in case of areas lying to the north and north-east from this belt. But the decline was comparatively gradual towards the south and south-west from this belt. In 1999, it is concluded that areas having friendly relief for the application of green revolution technology and developed agricultural infrastructure have recorded high degree of agricultural modernization. While areas with hostile topography, less developed socio-

economic environment have low magnitude of agricultural modernization. Finally, it is observed that during 1971 to 1999, the categories of high and moderate agricultural modernization have expanded in their areas, while the low category has been shrunked. It is also noted that regional disparities were wider in 1971 as compared to 1999 (cf. figs 3 and 4) which shows that the gap is minimized between the high, moderate and low magnitude of agricultural modernization in Punjab during the study period.

Suggestions

Following suggestions are made in the present study for minimising the regional disparities in agricultural modernization.

1. By giving special emphasis for the improvement of selected indicators in the lagging behind regions, the gap between highly and lagging behind agricultural modernization regions can be minimised.
2. Sprinkle irrigation should be introduced in the Shiwaliks and piedmont plains area and south-western parts of Punjab.
3. Agricultural infrastructure should be developed in agriculturally lagging behind regions.

References

- Eddowers, M (1969): *Crop Technology*, London, Hutchinson Educational, p. 61.
- Frankel, F.R. (1971): *India's green Revolution*, The Macmillian Press Ltd. London, p. 110.
- Johl, S.S. (1996): *Dynamics of Punjab Agriculture*, Proceedings of Indian Science Congress, p. 79.
- Kaur, S (2003): *Regional Disparities in Levels of Agricultural Modernization in Punjab: 1971-1999*. Unpublished Ph.D Thesis, Punjabi University, Patiala, pp. 205-237.
- Morgan, W.B. and Munton, R.J.C. (1971): *Agricultural Geography*, London, Methuen, pp. 65-67.
- Sidhu, R.S. and Johl, S.S. (2002): 'Three Decades of Intensive Agriculture in Punjab: Socio-Economic and Environmental Consequences' In Johl, S.S. and Ray, S.K. (Ed) *Future of Agriculture in Punjab*. Centre for Research in Rural and Industrial Development, Chandigarh. p.16.
- Singh, J. and Dhillon, S.S. (2004): *Agricultural Geography*, Tata McGraw-Hill, Publishing Company Ltd., New Delhi, pp.135-36.
- Sohal, K.S. (1990): 'Regional Disparities in crop Productivity in Punjab, India', *National Geographer*, Vol. XXV, No.2, pp. 107-114.

Dr. K. S. Sohal,
Reader,
and
Dr. Shivjeet Kaur,
Research Associate,
Dept. of Geography,
Punjabi University,
Patiala.