

**RESEARCH PAPER****Inter-Districts Disparity in Agricultural Development in North-Western India****Sanjay Parihar**Department of Geography,
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Email: sanjai_parihar@yahoo.inReceived: 26th June 2017, Revised: 23rd August 2017, Accepted: 25th August 2017**ABSTRACT**

Agricultural Development is defined as the process that creates the conditions for the fulfillment of agricultural potential. This research is devoted to the study of spatio-temporal analysis of levels of agricultural development in North-Western India (Punjab, Haryana and Rajasthan states) at district level. The data have been collected from statistical abstracts of the concerning states. The status of agricultural development is assessed on the basis of the agricultural infrastructure reflected in the indicators like extent of irrigation, irrigation intensity, cropping intensity, use of packaged program etc. Level of agricultural development has been measured by composite value of sixteen indicators of agricultural development of the concerned districts and are grouped into the five categories viz. very high, high, medium, low and very low level of agricultural development. Factor analysis of the determinants of agricultural development and regression model are implemented also. There is considerable disparity in agricultural development in the study region. The study has shown that agricultural development is higher in Punjab followed by Haryana. The eastern and northern parts of Rajasthan also had satisfactory level of agricultural development due to commercial attitude and developed agricultural infrastructure. The western desert part followed by central hilly part of Rajasthan and arid part of Punjab and Haryana had low level of agricultural development due to adverse physical conditions and poor infrastructure.

Key words: Disparity, District, Infrastructure, Packaged Program

INTRODUCTION

Agricultural Development refers to the gradual shift in farming best practices. Agriculture growth is very important for a developing country like India because its large part of population depends on this. Agriculture occupied a place of pride in India's national economy. It has a share of 32 percent in the Gross Domestic Product (GDP) of the country. The economy of study area is agriculture based and more than 70 percent population is dependent upon this sector. Agricultural development in any region means by and large an improvement of land productivity with the application of high degree of inputs. Agricultural development should be assessed not only by levels of productivity or trend in agricultural production but also with reference to various inputs like irrigation, fertilizers, improved seeds and extent of cultivated area (Sharma, 1971). Agricultural development is the result of interaction between physical and human factors. High yielding variety seeds, fertilizers, irrigational facilities, mechanization, training of farmers are factors which contribute to boost agricultural development along with physical conditions. Agricultural development also depends upon land, environment, labor and capital. The classification of areas into various categories i.e., very low, low, medium, high and very high productivity level will be useful for planning of agricultural development and to remove or minimize the regional inequalities. The study area consists of Western Thar Desert, Central Aravali Hilly area, North-Eastern plain area and Haroti plateau. Due to changes in physical and human factors, spatio-temporal changes have been occurred.

Levels of agricultural development in North-Western India has increased since 1980-81, mainly due to increase in yield which is the result of HYVs of seeds, infrastructural development and government policies. Different districts show different growth of productivity, due to different physical and socio-economic conditions. The present study is an attempt to analyze the nature of variations in levels of agricultural development in North-Western India over a period of time.

STUDY AREA

Our study is related with the inter-district disparity in the levels of agricultural development in North-Western India. North-Western India is extended between 23°3' N to 32°32' N latitudes and 69°30' E to 78°17' E longitudes, comprising 72 districts of Punjab, Haryana and Rajasthan states with 4,36,813 square kilometers area which accounts for 13.29 percents of the total geographical area of India. The study area is inhabited by 12,16,78,329 persons (2011) which accounts for 10.05 percents of India's population; out which 6,37,60,035 are males and 5,79,18,294 are females. Density of population is 279 persons per square kilometer.

DATA SOURCE AND METHODOLOGY

The present study is an attempt to analyze the inter district disparity in agricultural development in North Western India. The present study is based on secondary data. The data obtained for the period of 1980-81 and 2010-11 from Statistical Abstracts of the States. To avoid the fluctuations, three years' data is averaged and used for analysis. Composite index of agricultural development is computed on the basis of sixteen indicators. These indicators are- Irrigation Extent (IE), Irrigation Intensity (II), Cropping Intensity (CI), Percent Area Under Improved Seeds (IS), Number of Livestock Per Hectare of NSA (LS), Percent of Agricultural Workers to Total Workers (AW), Number of Pump Sets Per Hectare (PS), Number of Tractors Per Hectare (NT), Consumption of Fertilizer (CF), Percents of Scheduled Caste Population (SC), Percent of Scheduled Tribe Population (ST), Literacy Rate (LR), Productivity of Land (PL), Labor Productivity (LP), Percent Area Under Cash Crops (CC) and Per Capita Agricultural Output (AO). Level of agricultural development has been measured by composite value of above sixteen indicators of agricultural development of the concerned districts and are grouped into the five categories viz. very high, high, medium, low and very low level of agricultural development.

The determinants of agricultural development are further analyzed by factor analysis and regression model. The analysis gives the proper understanding of the levels of agricultural development and relevant aspects which can provide the base for further investigation. Before we proceed to analyze the agricultural development it will be useful to describe the agricultural scenario of the study area.

AGRICULTURAL SCENARIO OF THE STUDY AREA

The study area comprises three states of north-western India viz. Punjab, Haryana and Rajasthan. The study area is agricultural dominant area as most of the population depends on agriculture for their livelihood. Total geographical area of north-western India is 43681 thousand hectares which constituted 13.29 percent of country's area.

In the study area 7.4 percent is forest land, 7.15 percent is fallow land, 59.28 percent is net sown area and 92.4 percent is total cropped area. If we compare percents of net sown area and total cropped area to country's percent which are 43.07 percent and 60.53 percent respectively; we can see the higher agricultural development in north-western India. Percent of net area irrigated to net sown area is 72.08 percent which is much higher than country's percent of 44.92 percent. It also reflects higher level of agriculture in the study area.

The major crops of the study area are wheat, rice, Bajra, rapeseed-mustard, cotton and maize. Pulses and oils seeds are grown mainly in Rajasthan state. Area under cereals in the study area is 20920 thousand hectares which is 20.86 percent of the total area under cereals cultivation in India. Pulses have 19.04 percent of the country's total pulses area while oilseeds have 19.87 percent area. The study area produces 26.11 percent of total cereals, 15.06 percent of total pulses and 22.09 percent of total oilseeds production of India. The productivity of cereals is 3223 kg/ha in north-western India which is higher than country's average of 2260 kg/ha. In case of pluses, the productivity of the study area is 802 kg/ha which is higher than country's average of 690 kg/ha. Productivity of oilseeds is 1453 kg/ha which is also higher than India's average of 1190 kg/ha. The north-western India produces 13.82 percent of total rice production, 41.41 percent of total wheat production and 56.18 percent of total Bajra production of India. It shows that the study area is agriculturally developed and contribute higher share to central food pool.

Table 1: Levels of Agricultural Development

Category	Index Value	1980-81						2010-11					
		Punjab		Haryana		Rajasthan		Punjab		Haryana		Rajasthan	
		1	2	1	2	1	2	1	2	1	2	1	2
Very Low	<0.23	0	0.00	1	8.33	4	15.38	0	0.00	1	5.00	4	12.50
Low	0.23-0.35	2	16.67	3	25.00	8	30.77	3	15.00	4	20.00	7	21.88
Medium	0.36-0.48	4	33.33	5	41.67	9	34.62	7	35.00	7	35.00	13	40.63
High	0.49-0.61	4	33.33	1	8.33	3	11.54	5	25.00	4	20.00	4	12.50
Very High	>0.61	2	16.67	2	16.67	2	7.69	5	25.00	4	20.00	4	12.50
Total		12	100.0	12	100.0	26	100.0	20	100.0	20	100.0	32	100.0

Note-

1. Number of Districts, 2. Percents to Total Districts

Source: Computed

Table 2: Rotated Component Matrix

S.No.	Variable	Factor-1	Factor-2	Factor-3	Factor-4	Communality
1.	IE	.842 (.241)	.168 (.632)	.901 (.632)	.201 (.816)	.869
2.	II	.878 (.219)	.291 (.30)	.235 (.188)	.484 (.614)	.811
3.	CI	.749 (.201)	.208 (.081)	.324 (1.24)	.618 (.621)	.841
4.	IS	.799 (.289)	.854 (.56)	.018 (.192)	.241 (.154)	.761
5.	LS	.614 (.318)	.477 (1.36)	.204 (.161)	.869 (.169)	.854
6.	AW	.714 (1.282)	.614 (1.84)	0.41 (0.81)	.581 (.241)	.742
7.	PS	.928 (1.04)	.856 (.266)	.458 (1.29)	.584 (.331)	.882
8.	NT	.818 (0.982)	.621 (.418)	.298 (1.28)	.649 (.342)	.712
9.	CF	.791 (.384)	.624 (1.281)	.348 (.161)	.618 (.338)	.541
10.	SC	.641 (.184)	.613 (1.649)	.394 (.246)	.284 (.681)	.862
11.	ST	.518 (.214)	.571 (1.448)	.928 (.462)	.181 (.694)	.852
12.	LR	.792 (1.41)	.109 (.861)	.667 (.519)	.681 (.819)	.899
13.	PL	.624 (2.22)	.208 (.621)	.248 (.618)	.246 (.419)	.729
14.	LP	.282 (.268)	.416 (1.28)	.692 (2.84)	.469 (1.81)	.684
15.	CC	.419 (1.892)	.621 (2.84)	.719 (.86)	.411 (.84)	.719
16.	AO	.284 (.681)	.841 (2.28)	.618 (.286)	.211 (.618)	.849
Eigen Values		4.864	3.298	2.282	3.118	
% of Variance		26.284	22.81	16.84	14.26	

Note :

Extraction Method: P.C.A., Rotation Method: Varimax with Kaiser Normation.

Rotation Converged in 5 iteration.

Figures in Brackets are the factor score coefficients.

Table 3: Results of the Regression Model

Variables	B	t-value	R ²	\bar{R}^2	F-value	P-value	R ²	\bar{R}^2
X ₁	.286	1.28	0.28	.24	16.782	0.00016	0.92	0.902
X ₂	.246	1.26	0.24	.22				
X ₃	.461	0.96	0.46	.40				
X ₄	.491	0.821	0.49	.41				
X ₅	.281	0.684	0.28	.20				
X ₆	.168	1.628	0.16	.11				
X ₇	.668	2.889*	0.66	.582				
X ₈	.496	1.982**	0.49	.412				
X ₉	.746	3.866*	0.74	.704				
X ₁₀	.118	1.008	0.118	.098				
X ₁₁	.126	0.182	0.12	.11				
X ₁₂	.416	1.991**	0.41	.39				
X ₁₃	.681	2.682*	0.68	.602				
X ₁₄	.091	0.012	0.09	.08				
X ₁₅	.482	1.962**	0.48	.384				
X ₁₆	.431	.621*	0.62	.541				

Source: computed

* Significant at 1% level of significance, ** Significant at 5% level of significance

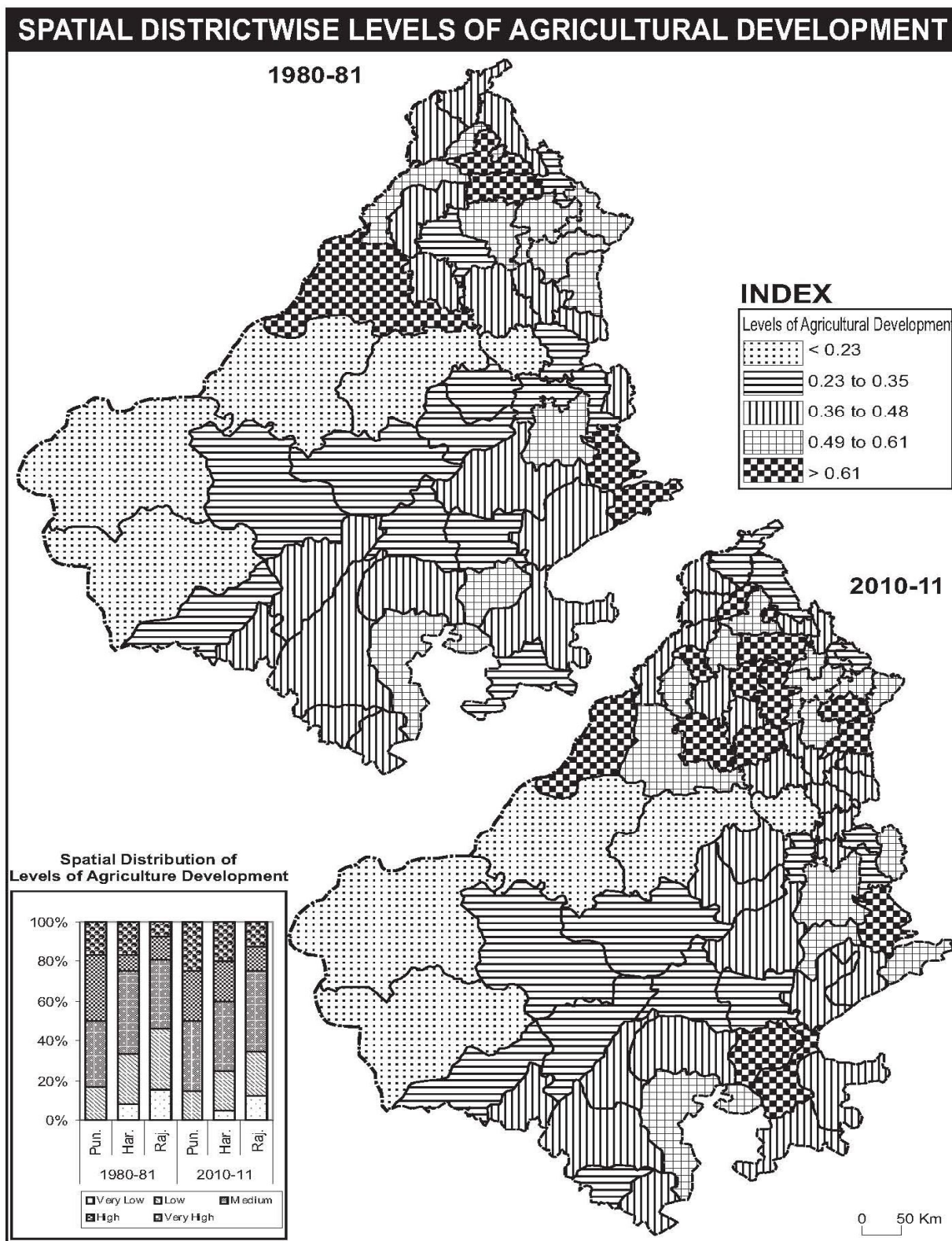


Fig. 1: Spatial Districtwise Levels of Agricultural Development

DISTRICT WISE LEVELS OF AGRICULTURAL DEVELOPMENT

Agricultural development means is to achieve the required amount of agricultural production and a high rate of economic growth in order to bring out a marked improvement in the standard of living of the people. By bringing about the changes in its techno-institutional resources, study areas, Punjab, Haryana and Rajasthan state have increased their production of food grains and raw

materials to agro-based industries. Figure 1 and Table 1 reveal the district wise level of agricultural development of north-western India in 1980-81 and 2010-11.

VERY HIGH LEVEL OF AGRICULTURAL DEVELOPMENT:

In 1980-81, two districts (Jalandhar and Ludhiana) of Punjab, two districts (Kurukshetra and Karnal) of Haryana and two districts (Ganganagar and Bharatpur) of Rajasthan were under this category. In 2010-11, 25 percents districts of Punjab i.e. five districts (Kapurthala, Ludhiana, Faridkot, Sangrur and Barnala), 20 percents districts of Haryana i.e. four districts (Kurukshetra, Karnal, Fatehabad and Sirsa) and 12.50 percents districts of Rajasthan i.e. four districts (Ganganagar, Bundi, Kota and Bharatpur) were under this category. The main reasons for very high level of agricultural development are developed infrastructure, well developed irrigational facilities, fertile soil, high yielding variety of seeds and adoption of the advance farm technology by farmers.

HIGH LEVEL OF AGRICULTURAL DEVELOPMENT:

Kapurthala, Ferozpur, Sangrur and Patiala districts of Punjab; Ambala districts of Haryana; Alwar, Bundi and Chittorgarh districts of Rajasthan had this category in 1980-81, while in 2010-11, 25 percents districts of Punjab and 20 percents districts of Haryana and 12.50 percents districts of Rajasthan were under this category. These districts were (Jalandhar, Muktsar, Moga, Patiala and Fatehgarh sahib (Punjab); Ambala, Yamunanagar, Kaithal, Faridabad (Haryana); Alwar, Dausa, Dholpur and Hanumangarh (Rajasthan). The high level of agricultural development was due to the presence of gentle gradient of land, availability of irrigational facilities and developed agricultural infrastructure.

MEDIUM LEVEL OF AGRICULTURAL DEVELOPMENT:

One third districts of Punjab; more than 41 percents districts of Haryana and more than 34 percents districts of Rajasthan were having this category in 1980-81. According to table 1, in 2010-11, 35 percents districts of Punjab and Haryana; and about 44 percents districts of Rajasthan were under this category. These districts were Amritsar, Taran Taran, S.B.S Nagar, Rupnagar, Ferozpur, Bhatinda, Mansa of Punjab; Panipat, Sonapat, Rohtak, Jhajjar, Rewari, Jind, Hisar of Haryana; and Banswara, Baran, Bhilwara, Jaipur, Jhalawar, Jhunjhunu, Karuali, Rajsamand, Sawai Madhopur, Sikar, Sirohi and Udaipur of Rajasthan. Here rugged physiography, moderate fertile soils, less irrigation facilities, moderate consumption of fertilizers presence of seasonal torrents etc were the main reasons for medium level of agricultural development.

LOW LEVEL OF AGRICULTURAL DEVELOPMENT:

Low level of agricultural development was recorded in Rupnagar and Bhatinda districts of Punjab; Gurgaon, Faridabad, Jind and Sonapat districts of Haryana; Ajmer, Jalore, Jhalawar, Jhunjhunu, Jodhpur, Nagaur, Sikar, Tonk districts of Rajasthan state in 1980-81 whereas Gurdaspur, Hoshiarpur (Punjab); Panchkula, Gurgaon, Mahendragarh, Mewat (Haryana), Ajmer, Dungarpur, Jodhpur, Nagaur, Pali, Tonk (Rajasthan) districts had this category in 2010-11. The presence of rocky surface, deep inadequate aquifers of sub-soil water, presence of sand dunes, low extent irrigation were responsible for low level of agricultural development.

VERY LOW LEVEL OF AGRICULTURAL DEVELOPMENT:

No district of Punjab was under this category during the study period. Only Bhiwani district of Haryana; and Barmer, Bikaner, Churu and Jaisalmer districts of Rajasthan had this category during the study period. These were agriculturally backward areas where inadequate irrigational facilities unfriendly topography as well as the adverse climatic factors especially desert area have low amount of rainfall, high temperature etc. were found. Owing to these reasons, most of the land was left unsown and had very low level of agricultural development.

FACTOR ANALYSIS OF THE DETERMINANTS OF AGRICULTURAL DEVELOPMENT

This analysis is very important for several reasons, first there is no denying about the policy importance to determine agricultural development and their relationship with the overall development. If agriculture terms out to have significantly influenced the growth performance of

these states (Punjab, Haryana and Rajasthan), this may call more capital formation in agriculture. Second this study examines the inter linkages between agriculture and development performance of the economy.

Here the agricultural development is termed as a dependent variable and four agricultural development indicators; reduced by factor analysis using principal component Analysis (P.C.A.) and various with Kaiser Normalization as independent variables. Furthermore we have ranked all the sampled districts of the three states on the basis of composite indices of agricultural development indicators. The factorial investigation facilitates the linkages and helps to select the relevant variables for to construct the composite indices. The opposite indices will help in identification of the agricultural sensitive that need to be concentrated to upgrade the level of developments.

Here we have made an attempt to rank the 32 districts of Rajasthan 20 districts of Punjab and 20 districts of Haryana on the basis of composite index based on the agricultural development indicators. We have used K.M.O. and Bartlett's test to see the strength of the relationship among variables. Large values for K.M.O measure indicate that a factor analysis is good. Here the measure of sampling adequacy is 0.682, indicating that the value is large enough to proceed factor analysis for the data. Bartlett's test of sphericity is another indicator of the strength for the data relationship among the variables that the population correlation matrix is uncorrelated. Here the level of significance is .001. Factor scores are extracted for all the districts of the study area. It depicts the underlying sectoral dimensions of development and we have obtained the index of overall agricultural development with the help of four factor scores.

The factors solution reveals that the first factor (F-1) factor includes productivity of land, irrigation extent, irrigation intensity, cropping intensity, improved or H.Y.V. seeds and use of livestock. All these variables are found to be positive and significantly contributing to the agricultural development.

The second factor (F-2) includes labour productivity, percent of agricultural workers and literacy rate. All these variables are found to be positive and significantly affecting the agricultural development.

The third factor (F-3) includes the percent area under cash crops, uses of pumps and oil engines, use of tractors, consumptions of fertilizers etc. All these variables led positive impact on the agricultural development.

The Fourth factor (F-4) includes per capita agricultural output, S.C. population and S.T. Population. All of these factors are positively associated with the agricultural development of the study region.

REGRESSION MODEL

Here we have also made an attempt of simple linear regression to analyze the cause and effect relationship between the agricultural development and the selected explanatory variables. Following model equation has been adopted.

$$Y_i = \alpha + BX_i$$

Where,

- Y_i = Agricultural development
- α = Constant
- X_i = Independent Variable (X_1 to X_{16})
- X_1 = Irrigation Extent (IE)
- X_2 = Irrigation Intensity (II)
- X_3 = Cropping Intensity (CI)
- X_4 = Percent Area under Improved Seeds (IS)
- X_5 = Number of Livestock per Hectare of NSA (LS)
- X_6 = Percent of Agricultural Workers to Total Workers (AW)
- X_7 = Number of Pump Sets per Hectare (PS)
- X_8 = Number of Tractors per Hectare (NT)
- X_9 = Consumption of Fertilizer (CF)
- X_{10} = Percents of Scheduled Caste Population (SC)
- X_{11} = Percent of Scheduled Tribe Population (ST)

X ₁₂	= Literacy Rate (LR)
X ₁₃	= Productivity of Land (PL)
X ₁₄	= Labour Productivity (LP)
X ₁₅	= Percent Area under Cash Crops (CC)
X ₁₆	= Per Capita Agricultural Output (AO).

Here the null hypothesis is $H_0: B=0$ means explanatory variables do not led any significant effect on the agricultural development.

Here the B- value obtained for the explanatory variables are 0.28, 0.24, 0.46, 0.49, 0.28, 0.16, 0.66, 0.49, 0.74, 0.11, 0.12, 0.41, 0.68, 0.09, 0.48 and 0.62. The Joint R^2 is 0.92 which shows that all the explanatory variables bring 92 percent variations in agricultural development.

The table 3 presents the results of the estimated model.

Our model is found to be best fitted here because the value of R^2 and \bar{R}^2 is quite high. Our null hypothesis is rejected as calculated p-value is less than 5 percent or 1 percent therefore it can be concluded that explanatory variables are significant by affecting the agricultural development of the study region.

CONCLUSION

The status of agricultural development in north-western India is assessed on the basis of various sixteen indicators like extent of irrigation, irrigation intensity, cropping intensity, use of improved seeds, fertilizer, mechanization, population aspects, productivity etc. This assessment has shown considerable disparity in agricultural development in the study region. Disparity in agricultural development in North-Western India across different districts is a matter of deep concern. The regional variation in agricultural development across various districts of the study region may be attributed to differential resource endowment in terms of soil fertility, land utilization pattern, average annual rainfall, irrigation, infrastructural facilities and also socio-cultural and economic conditions of farmers. The study has shown that agricultural development is higher in Punjab followed by Haryana; eastern and northern parts of Rajasthan also had satisfactory level of agricultural development. In these parts farming is generally carried out with commercial attitude and by adopting advance farm technology, with irrigational facilities such as canal irrigation, well irrigation and tube well irrigation. Thereby large areas have irrigational facilities. This high development is due to high fertility of soils, intensive cultivation and assured water supply. These were the areas that were much influenced to green and technical revolution, resulted high level of agricultural development whereas the western desert part followed by central hilly part of Rajasthan and arid part of Punjab & Haryana had low level of agricultural development. The reasons for agricultural backwardness of these parts are not difficult to understand. In these parts, the agricultural sector is largely depends on rainfall which has been erratic and it is supplemented by groundwater which is not adequate. Sandy or coarse soil and less use of new farm technology and less use of fertilizers are contributing factors for low level of agricultural development. Agriculture is diverse, complex, under-invested, risky and vulnerable in these parts. The region also lacks of alternate sources of water for irrigation. Further harsh and worsening bio-physical conditions exacerbate the region's vulnerability. All these factors are responsible for the under growth and poor performance of agriculture there. In future these parts may attain faster development when water made available.

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