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# A SPATIO-TEMPORAL ANALYSIS OF CROP DIVERSIFICATION OF HARYANA STATE

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**ABSTRACT**

*Agriculture is one of the oldest and most important occupations of man. For balanced agricultural development, agricultural diversification is necessary in the technologically backward countries like India where 50.2 % of population is directly or indirectly dependent on agriculture for their livelihood. Agricultural and allied sectors contribute nearly 17.8 and 17% of Gross Domestic Product (GDP) of India. Moreover, agriculture fetches substantial amount of valuables foreign exchange. It mostly covers farming practices is one of the potential endowments for some regions .As Indian agriculture is mainly rain-fed in nature, that why farmers had to face risk coming from natural as well as economic factors. The natural factors are difficult to control, but an economic factor related to changes in price commonly occurs and such risks are predictable. So diversification of products is an important way to reduce both natural and economic suspicions. Present study is confined on Haryana state. Such an analysis focuses on the identification of crop diversification regions that provide a clear areal differentiation in case of crop grown and also give avenue to future planners to establish more economically sustained agricultural system.*

**KEYWORDS:***crop diversification, Areal differentiation, Monoculture, rural economic development.*

## INTRODUCTION :

The concept of crop diversification is a scientific devise to study the existing spatial relationship of crops in association with each other in agricultural geography and land utilization. Crop diversification leads to a movement of low-value agriculture to high-value agriculture and this is an important way to enhance agricultural output. Cropping pattern implies the proportion of area under different crops at appoint of time. A change in cropping pattern or crop diversification implies a change in the proportion of area under different crops. The cropping pattern in an area depends mostly up on agro climatic, technical and institutional factors (Vaidyanathan, 1992).

Crop diversification simply means rising of different varieties of crops in the arable land. It is also found that the higher the technical inputs, lesser the degree of diversification. In present day developmental paradigm of agrarian economy specifically in case of developing country like India, this concept is applied to individual farmers and to different farms as well as to regions. In the third world country like India where man-land ratio is high enough, agricultural diversification

especially in term of crop diversification is very much necessary (Let, Bhattacharya, 2011). At the same time, Indian agricultural is gamble in monsoon i.e., to get rid from helpless dependency on seasonal monsoonal rainfall, irrigation facilities –one of the most efficient infrastructure technological aids are earnestly required so that agricultural economy is established in the strong relative platforms (Let & Bhattacharya,2010).

So, Governmental programmers also promoted the widespread diversification in the field of agricultural production. But due to several constrains like diversified socio-cultural traditions as well as economic profiles, inadequate knowledge about crop diversification promote rice monoculture at different parts of Haryana which gives a declining status of crop diversification in State as well as district level. Even agriculturally developed districts like kurukshetra,Rohtak etc. do not enjoy the significant effects of this diversification system due to their traditional monoculture system. The study of crop diversification is very much important due to following reasons (Hussain, 2009):

(i) In the monsoonal country (e.g., India, Bangladesh), where whole agriculture system mainly depends of monsoon-rain; farmers often prefer to plough different crops in different seasons because of variability of rainfall and inadequacy of source of irrigation.

(ii) In the tradition bound subsistent farming systems, the farmers grow several crops to meet the family requirements. In such areas, one may find a high degree of crop diversification.

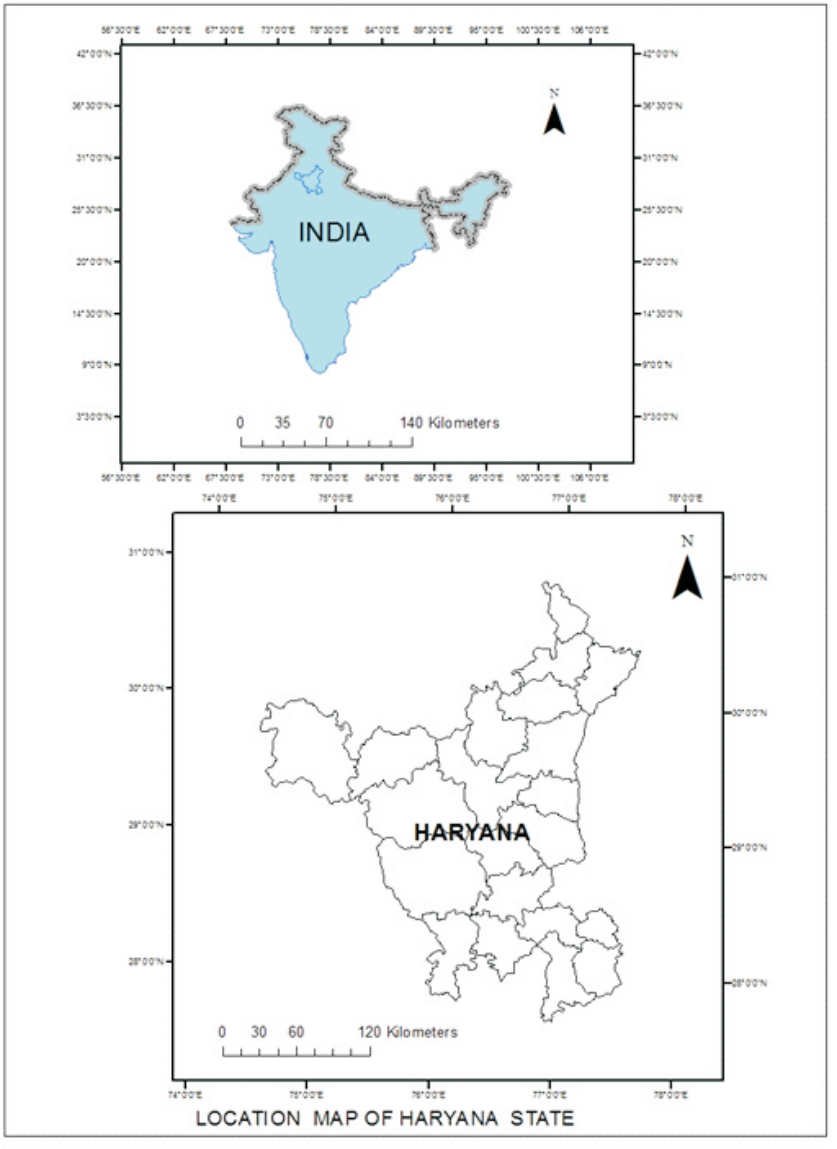
(iii) Diversification has usually been done by the farmers to enhance nitrogen in the soil and to replenish the soil fertility. Crop diversification increases the sustainability of arable soil.

(iv) The diversification of crops also generates more employment as the farmers and agricultural workers remain busy in the sowing, weeding, harvesting and marketing of different crops throughout the year.

Diversification of crops also enables the farmers to provide a reasonable quantity of the costly inputs to their crops as different crops need different quantities of inputs (e.g., chemical fertilizers, insecticides, pesticides and irrigation).

## STUDY AREA-

Haryana state is one of the prosperous states of India. It lies between to 27°12 north to and 31°30' northern latitude and 74°28' east to 77°36' eastern longitude. it occupies a geographical area of about 44,212 sq.km . Haryana is a land locked state located in the northern part of India. The state shares its boundary with Uttar Pradesh in the East, Punjab in the West, Himachal Pradesh in the North and Rajasthan in the South. According to 2011 census, its population is 2.53 carore out of which 13494734 males and 11856728 females. The density is 573 persons per square kilometer. The sex ratio recorded 877 females per thousand males which is lowest in national average sex ratio . Haryana state has 76.64% literacy rate with differential of 85.4 male literacy and 66.8% female literacy.



LOCATION MAP OF HARYANA STATE

| Indicators | Year | Unit | India | Haryana |
|---|---|---|---|---|
| Geographical Area | 2011 | Lakh Sq. Km | 32.87 | 0.44 |
| Population | 2011 | Crore | 121.01 | 2.53 |
| Decadal Growth Rate | 2011 | Percentage | 17.64 | 19.90 |
| Density of population | 2011 | Population/Sq. Km. | 382.00 | 573.00 |
| Agricultural workers | 2011 | Percentage (total population) | 31.16 | 51.79 |
| Sex Ratio | 2011 | Females/1000 Males | 940.00 | 877.00 |
| Literacy Rate | 2011 | Percentage | 74.04 | 76.64 |
| Birth Rate | 2011 | Per 1000 Mid-year Pop. | 21.80 | 22.30 |

## DATABASE AND METHODS

The entire work is mainly based on secondary data i.e., collected from state statistical abstract of

Haryana (2008) and many others literature and research papers. To undertake the scientific investigation for crop diversification, first method was formulated by Jasbir Singh in 1984. It suggests the formula:-

Index of Crop Diversification = (Percentage of total cropped area under 'n' crop ÷ Number of 'n' crops)

Where 'n' denotes those crops which individually occupied at least 5 % or more of total cropped area in the Tahsil.

For the measurement of diversification of crops Bhatia (1965) also developed a formula based on the gross cropped area. The formula has been expressed as:

Index of crop diversification= (Percent of sown area under x crops ÷ number of x crops)

There are some limitations to adopt this formula since, in this purpose, the quantitative techniques proposed by Gibbs and Martin to measure crop diversification provide a useful index for measuring the degree of diversification in the cropping pattern of an area (Singh & Dhillon, 1984). The formula developed for calculating the Crop Diversification Index (CDI) is as follows:

Crop Diversification Index (CDI) = $1-\{\Sigma X^2/(SX)^2\}$

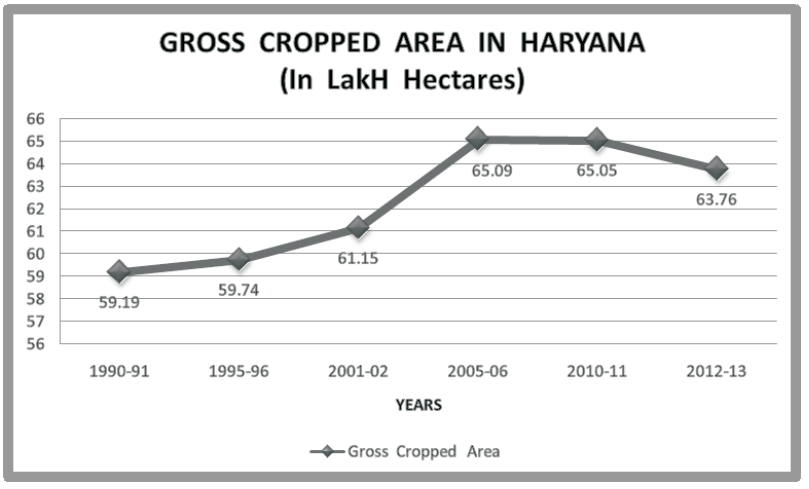
Where, X is the percentages of the total cropped area occupied by each crop or hectare under individual crop. If the total cultivated area in a region is devoted wholly to one crop (i.e., specialization) the index value will be zero (0) and if it is evenly distributed among all crops (i.e., maximum diversification) the index value approaches one (1). This direct and calculation-precise method has taken into consideration both the evenness factor (relative Strength of crops) and number of factors (number of crops) perfectly to form the basis of proper measurement of diversity. On the other hand, the figures can be adjusted into hundreds, thousands, millions etc. which will not alter the results. Therefore, keeping all these advantages in mind, this method of crop diversification has been adopted in this purpose.

## OBJECTIVES

The present study has mainly examined the Spatio-temporal variation of agricultural diversification in different districts of Haryana State which shows the changes in the total cropped area of the districts. Moreover, it envisages the different levels of diversification district-level (i.e., High, moderate, low, etc.) in the state. Mainly the spatial pattern of crop diversification would be the tools for future planning in case of crop production.

## ANALYSIS OF DATA

Total area of Haryana is 42,212 Sq.Km. Out of this total land, only 56.72 Lakh hectares is under agricultural uses in 2012-13. The tendency of total cultivated area is rather fluctuating during the period of 1991 to 2013 (Fig. No. 2), where as irrigated area under different sources of irrigation is also fluctuating during same time span (Fig. 3).



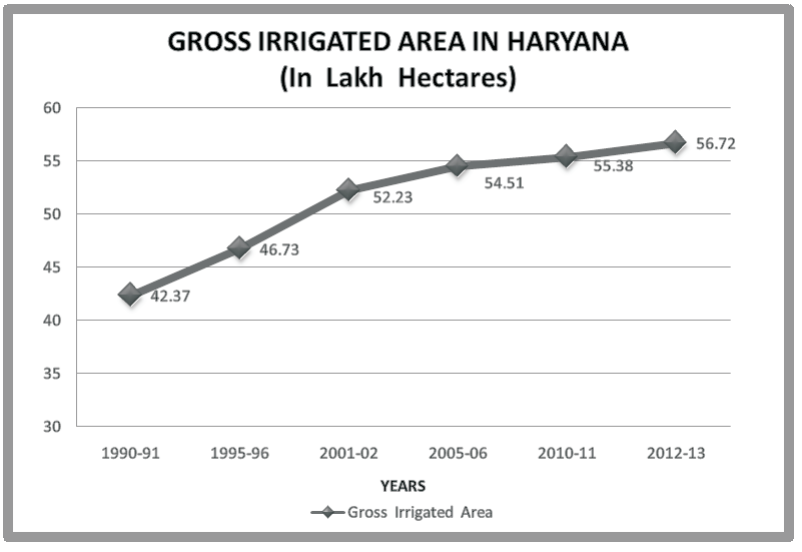




**TABLE: 4, 5 Areas Under principal crops and major sources of irrigation**

| Years | Gross Irrigated Area |
|---|---|
| 1990-91 | 42.37 |
| 1995-96 | 46.73 |
| 2001-02 | 52.23 |
| 2005-06 | 54.51 |
| 2010-11 | 55.38 |
| 2012-13 | 56.72 |

| Years | Gross Cropped Area |
|---|---|
| 1990-91 | 59.19 |
| 1995-96 | 59.74 |
| 2001-02 | 61.15 |
| 2005-06 | 65.09 |
| 2010-11 | 65.05 |
| 2012-13 | 63.76 |

Source: Statistical Abstract of Haryana, 2013-14 and Calculated by author

**Table: 6 Crop Diversification Categories, Haryana State, 2008**

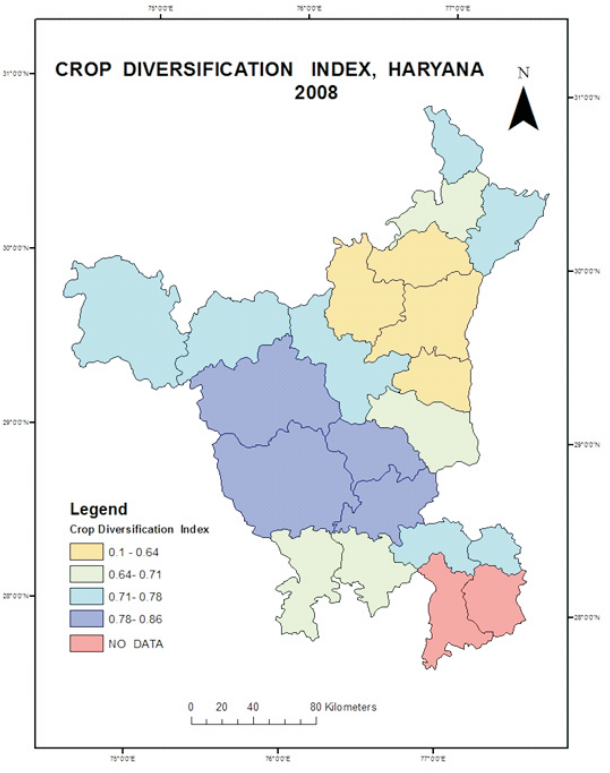
| SL. No. | Districts | Crop Diversification Index |
|---|---|---|
| 1 | Ambala | 0.71 |
| 2 | Panchkula | 0.78 |
| 3 | Yamunanagar | 0.74 |
| 4 | Kurukshetra | 0.64 |
| 5 | Kaithal | 0.62 |
| 6 | Karnal | 0.62 |
| 7 | Panipat | 0.64 |
| 8 | Sonipat | 0.71 |
| 9 | Rohtak | 0.81 |
| 10 | Jhajjar | 0.8 |
| 11 | Faridabad | 0.74 |
| 12 | Gurgaon | 0.73 |
| 13 | Rewari | 0.7 |
| 14 | Mahendragarh | 0.69 |
| 15 | Bhiwani | 0.86(Maximum) |
| 16 | Jind | 0.73 |
| 17 | Hisar | 0.81 |
| 18 | Fatehabad | 0.74 |
| 19 | Sirsa | 0.77 |
| | Region | 0.71 |

Source: Statistical Abstract of Haryana, 2013-14 and Calculated by author

**TABLE: 7**

| Diversification Categories | Range of crops diversification index | Districts Sl. No. | Number Of districts |
|---|---|---|---|
| Very Low | <0.64 | 4, 5, 6,7 | 4 |
| Low | 0.64-0.71 | 13,14,1,8 | 4 |
| Moderate | 0.71-0.78 | 18,19,16,2,3,11,12 | 7 |
| High | 0.78-0.86 | 15,17,9,10 | 4 |

Source: Statistical Abstract of Haryana, 2013-14 and Calculated by author




## RESULT AND DISCUSSIONS

(i) It is quite clear from the analysis (table no. 3-A & B) that crop diversification is not so much promising rather it is moderate in character. Within the whole state, crop diversification is very high (CDI>0.71) only in four districts namely Bhiwani, Hisar,Rohtak, Jhajjar. These are the sandy areas with low annual rainfall and poor agricultural infrastructure. Thus farmers grow more crops which have resulted into high magnitude of crop diversification.

(ii) Midium level crop diversification (CDI=0.64-0.71) is found within seven districts Fatehabad, Jind, Sonipat, Gurgaon,Sirsa,Faridabad, Ambala and Yamunanagar. The main reasons for moderate crop diversification are presence of Shiwalik hills, Steep gradient, undulating and dissected topography,comparatively high rainfall, poor soils, low extent of irrigation, small size of landholding etc.

(iii) In rest of the districts, crop diversification index range below 0.64, whereas in Mahendragarh, Rewari, Sonipat, Kurukshetra, Kaithal, Karnal, Panipat. In these districts, well developed network of transport, high extent of irrigation, high degree of mechanization, diffusion of agricultural innovations, fertile soils, availability of sub-soil water, high degree of crop commercialization etc compel the farmers to grow wheat during rabi and rice during kharif season which resulted in low magnitude of crop diversification.

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