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# Status of crop diversification in Uttar Pradesh: Evidence from primary data

## KS Rao, Manoj Kumar Sharma and Shwetank Pandey

**Abstract**
Crop Diversification is more remunerative and high valued crops has been reckoned as an important strategy to increase the income and employment opportunities of the farmers in the state of Uttar Pradesh. In view of this, the present paper aims to explain the crop diversification in Uttar Pradesh on the basis of primary data collected from all 9 Agro-Climatic Zones on a sample basis. Data mainly used for this paper were collected during the years 2009-10, 2010-11 and 2011-12. On the basis of primary data, crop diversification explained with regard to trends in the area of crops diversified during the above period, the significance of crop area diversified measured through F test and HHI and also analyzed the data in each agro-climatic zone. Further the data corroborated while explaining the productivity trends and agriculture income of the farmers in each agro-climatic zone due to crop diversification. Hence, crop diversification is a must for the growth of incomes of the farmers among all size categories in all the agro-climatic zones. The trends are significant from the crop area, production and agricultural income point of view.

**Keywords:** Crop Diversification, Cultivated Area, Household Income, Productivity, Remunerative Crops, and Total value of Output

## Introduction
Uttar Pradesh is known as agriculture prone area and the farmers are using crop production for their livelihood. It is quite common during the last few decades the urbanization and industrialization are keeping up rapidly. This type of activities is transferring from urban area to the rural area. This process is directly affected the land fragmentation and also increasing the number of marginal land holders. Due to the above fact the crop diversification is remaining the only tool that is useful to fulfill the food requirement from the farm business of small land holders. Uttar Pradesh Agricultural Policy has adopted and emphasized the need for diversification of existing agriculture towards high-value crops and develop appropriate infrastructure to accomplish regional specialization in production of commodities best suited to their respective bio-physical endowment and improving the sustainability of soil and water resources (Fahimuddin, 2013) [6]. Crop diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. Crop Diversification refers to the addition and substitution of new crops or cropping systems to agricultural production on a particular farm of an agricultural region, taking into account the different returns from value-added crops with complementary marketing opportunities. The crop shift (diversification) also takes place due to governmental policies and thrust on some crops over a given time, for example creation of the Technology Mission on Oilseeds (TMO) to give thrust on oilseeds production as a national need for the country's requirement for less dependency on imports. Market infrastructure development and certain other price related support also induce crop shift. Often low volume high-value crops like spices also aid in crop diversification. Higher profitability and also the resilience/stability in production also induce crop diversification, for example sugar cane replacing rice and wheat. Crop diversification and also the growing of a large number of crops are practiced in rain-fed lands to reduce the risk factor of crop failures due to drought or fewer rains. Crop substitution and shift are also taking

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place in the areas with distinct soil problems. For example, the growing of rice in high water table areas replacing oilseeds, pulses and cotton; promotion of soybean in place of sorghum in vertisols (medium and deep black soils) etc.

Horizontal expansion of area in favour of agriculture is a remote possibility in the state of Uttar Pradesh. The most promising options to increase farm income and accelerate agricultural growth are diversification of agricultural enterprises, and intensification of land and other inputs. As per Census 2011, 59 percent of its workforce was engaged in agriculture; average holding size was just 0.76 ha with 92 percent of holdings being small and marginal; and 29 percent of its population was below the poverty line in 2011-12. As per the Situation Assessment Survey of NSS (2012-13), the average monthly income of an agri-household in UP was the third lowest in the country. UP's agri-GSDP grew at 2.5 percent per annum over the period FY2001 to FY2015. The drivers of agri-growth in UP indicates that UP has the potential to double its agri-growth from 2.5 percent to 5 percent per annum. This can be achieved if the UP government focuses on erecting a robust procurement system of wheat and paddy ensuring the Minimum Support Price to farmers; propelling the dairy sector by raising milk processing levels from about 12 to at least 30 percent over the next five years; rationalizing sugarcane pricing based on the Rangarajan Committee (2012) formula and freeing up molasses from all reservations; and finally introducing innovative farming practices and technologies in cultivation of fruits and vegetables. These policies can be backed by infrastructural investments in rural roads, power supply to rural areas, and improved irrigation, especially in the Bundelkhand region. (Working paper no.335, Gulati) As a result of the primary data also reveals that Bundelkhand farmers' income has also grown due to the diversification of crops.

Agriculture's share in UP's Gross State Domestic Product has been declining in the past decade, but it still contributed 29 percent to the state's GSDP in TE 2014-15 at market prices. Growth in agriculture and allied activities in UP has averaged at 2.5 percent per annum between 2000-01 and 2014-15, which is below the all-India average of 2.9 percent during this period, at 2004-05 constant prices. UP is a prominent producer of a wide variety of crops, and is commonly known as the "granary of the nation". Food grains occupy the largest share of the Gross Cropped Area in UP followed by other crops such as sugarcane, oilseeds, vegetables, etc. In Uttar Pradesh, crop diversification has emerged as an important alternative to attain the objectives of output growth and enhancement of farmers' income in this state. Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to enhance the farmer's income while reduction of risk.

**Statement of the Problem**
The strategy to diversify the crops is based on potentialities of the regions through diffusion of agricultural innovations to sustain the livelihood of the small and marginal farmers, to generate employment opportunities, produce remunerative crops, enhancement of agricultural income and provide nutritional foods is the need of the hour. Agriculture diversification is a strategy to achieve desired socio-economic development, which has received increased attention of policymakers in the country during recent years. The

paramount objectives of diversification are to raise per capita income through the opening of avenues of diversified production, employment in farm and non-farm sectors, sustain the livelihood of the small and marginal farmers, to produce remunerative crops, providing nutritional food and to make the broad-based economic growth and sustainable in the long run.

**Review of Literature**
It is well understood from the work done so far that there are several aspects of agriculture diversification. Thus, an attempt has been made in the present study to review some of the important works to contextualize the viewpoints of different scholars used in various studies. Grimes, (1929) [8], have discussed the advantages and limitations of the diversification of agriculture. He argued that diversification of agriculture lowers the production costs of the agriculture products resulting in the stable and large annual farm income. Further he said that the main purpose of the diversification of the agriculture products is to increase the income and improve the agriculture condition. Bhatia, (1965) [2], in his paper entitled "Patterns of Crop Concentration and Diversification in India" analyzed the cropping pattern of India on a regional basis with a view to bringing out the areal concentration and diversification of crops. Pandey and Suthana, (1980) [15], have concluded that the crux of the development of agriculture lies in increasing the productivity of the land. For raising the productivity of land, it is invariably suggested that irrigation should be provided to as much of the cultivable land as possible. Ranade, (1980) [16], used a cropping pattern index to observe its variation and impact on agricultural production over time in India. He examined the effect of cropping pattern, fertilizer and irrigation simultaneously upon agricultural production during 1962-65 to 1970-73, across 54 agro-climatic regions belonging to 14 major states in India and found a positive relationship between cropping pattern index and agricultural productivity. Walker, Singh and Jodha (1983) [18], have found that the kind of diversification and its consequences and implications are strongly conditioned by different regional agro-climatic and soil environments. Differences in the quantity and quality of resource basis were largely responsible for variation in diversification. Johnston, et al., (1995) [9], Studied that diversification always focuses on the economic gains as the economic development is seen as the most potent force to improve the social development, that is why economic benefits are well documented and the social one is omitted. They concluded that the diversity of crops provides the year-round extended employment which provides higher income that can serve the better standard of living for their families than their seasonal counterparts. Beside the extended employment many more benefits can achieve e.g. increased work availability, increased productivity and dependability less training and personal satisfaction. Dorsey, (1999) [5], has tried to provide the direct links between the scale, process, and output of agricultural production by examining the dynamics of intensification, crop diversification, and commercialization. Diversification of agriculture on small farms provides an opportunity to the farmers to choose particular crop or crops for the commercial production in order to increase the farm income. He summarised the relationship between the size of land holdings and income does not necessarily positive while the level of diversification and intensification does. Malik, and Singh, (2002) [13], studied the importance and necessity of crop

diversification in agriculture-based economy. They used the time series data for the analysis (1980-82 to 1996-97) through the Herfindal and Entropy Indices. They analysed that Indian agrarian structure is dominated by small and marginal farmers and due to this it is not possible to improve their income merely by raising the existing crops. They concluded that the districts in the proximity of the metropolitan city were more diversified. In other districts crop diversification was caused by the introduction of sprinkler irrigation rest of the district observed specialization due to lack of infrastructure. Bhatia, and Rai, (2003-04), attempted to analyse the agriculture development, infrastructural facilities and socio-economic development at the block level in Uttar Pradesh with a intention to identify the less privileged region and to improve their condition. Three hundred eighty community development blocks coming from thirty two districts of Uttar Pradesh have been selected for the study. A total of twenty three developmental indicators have been analysed for the estimation of Socio-economic development of different blocks. They concluded that overall Socio-economic development is positively associated with agricultural development, infra-structural facilities and literacy level. Bala, and Sharma, (2005) [1], advocated that agriculture diversification is one of the important strategies to enhance the employment and income. The main objectives of the study are – to assess changes in cropping pattern over the period, and to assess the changes in income and employment level as a result changes in cropping pattern. Three stages of Stratified Sampling technique has been used for the selection of the sample. The study reveals that there are very impressive changes in the cropping pattern and cropping intensity during the study period. Traditional crops were replaced by the vegetables crops. The vegetable crops being more labour intensive generate more employment and enhance the income. Consequently the standard of living has been improved. Joshi, Birthal, and Minot, (2006) [10], examine the sources of agriculture income growth in crops sector in India during the period of 1980"s and 1990"s with the help of a formula developed by the Minot. The analysis discusses the crop income growth due to yield increase, area expansion, price increase and diversification. The analysis confirms that during the 1980"s technology was the main source of crop income growth while during the 1990"s price rising and diversification emerges as a dominant source of growth. Kumar (2014) [11], explains the pattern of agriculture diversification in India. He observes that the agriculture production is shifting from the traditional subsistence agriculture to high value products. He concluded that the major force behind the shift in production is the change in consumption pattern. He suggested that there is a need of integration of production with the market to boost the agriculture diversification. (UP Studies review)

## Objectives of the study
Keeping the above dimensions an attempt has been extended to find out the concentration of crop diversification in Uttar Pradesh, the present study main objectives are as follows:

- To see the trends among the crop area and income during 2009- 12 in all the agro-climatic zones of Uttar Pradesh;
- To find out the variations in area and their production of crops grown in all the different Agro-Climatic Zones of UP during 2009-12; and
- Finally to confirm the diversification of the crop area in different agro-climatic zones of Uttar Pradesh during

2009-12.

## Data and Methodology
To achieve the above objectives, primary data has been utilized from the project entitled 'Income and Consumption Levels of Farmers in UP 'completed by GIDS (2013). To achieve the above objective, the present paper analyses the trends in crop diversification in Uttar Pradesh households of different agro-climatic zones during 2009-12. The above-mentioned issues are very important in Crop diversification. A multistage stratified random sample design was followed. The nine agro-climatic zones in the state are taken as the first stage of the sample. From each zone 5 percent of the CD blocks have been selected. Blocks are taken as the basis of the sample because different blocks are more homogenous in terms of area and population. The selected blocks are distributed over the districts within the zone. The districts have been selected purposely from each zone on the basis of twin criteria of productivity per hectare and geographical spread within the zone. In the third stage we have selected two development blocks from every selected district-one from blocks with higher agricultural productivity and one from blocks with lower agricultural productivity. In some districts only one block was selected so as to ensure 5% coverage of total development blocks in the agro region. In the fourth stage, two villages from the selected blocks have been randomly selected-one near the town and one from the interior. In the final stage we have selected about 15 percent of households for the survey from the total households in the village. The households were grouped into 7 categories, e.g. lower marginal farmers, middle marginal farmers, upper marginal farmers, marginal farmers, small farmers, medium farmers, and large farmers' households. From each category 15 percent of households have been selected randomly. On an average 35 households have been selected from each village. The total sample consisted of 24 districts, 42 blocks, 84 villages and 3474 households' data collected to see the diversification in Uttar Pradesh. However, in this paper the analysis confined to 9 Agro-climatic zones of Uttar Pradesh during 2009-12. Ayyar, (1969), in his study "Crop Regions of Madhya Pradesh: A Study in Methodology" has evolved a new technique for measuring crop diversification regions. He has taken all the crops which were having 1 percent or more than 1 percent of the total cropped area. Then he divided the sum of crops by the number of crops which are having 1 percent or more than 1 percent of the total cropped area. His method is an improvement over Bhatia's and Singh's methods for measuring crop diversification.

## Results and Discussion
The Crop Diversification in Uttar Pradesh is one of the most important phenomena. The coverage of districts, blocks and villages differ from one region to another region. To avoid the discrepancy of variations, the present paper analyzed about the data related to all the Agro-Climatic Zones of Uttar Pradesh. The total cropped area of the sample farms was 20,557 acres in 2009-10 and 20178 acres in 2011-12. Wheat and Paddy are the two dominant crops on the sample farms accounting for about 30% and 25% of the GCA (Gross Cropped Area) respectively in 2011-12. Coarse grain accounted for about 10% GCA and Pulses for another 9%. Thus food grain crops account for over 70% of the cropped area. Out of the remaining 30% of Non-Food grain crops area, sugarcane is the most important crop accounting for about 8%

of GCA. Oilseed crops and Vegetable crops account for about 6% of the cropped area each. Rest of the 10% of the area is under various miscellaneous crops. Season-wise area under crops shows the following trends during the study period.

**Table 1:** Trends of the area under cultivation in the different crop season

| Zone | Crop season | Area (percent) | | |
|---|---|---|---|---|
| | | **2009-10** | **2010-11** | **2011-12** |
| Tarai and Bhabar | Kharif | 66.26 | 69.72 | 69.67 |
| | Rabi | 24.13 | 26.20 | 27.00 |
| | Zaid | 9.61 | 4.08 | 3.33 |
| Western Plain | Kharif | 54.13 | 52.32 | 56.20 |
| | Rabi | 36.03 | 42.71 | 38.53 |
| | Zaid | 9.82 | 4.97 | 5.27 |
| Mid -Western Plain | Kharif | 50.49 | 51.77 | 53.83 |
| | Rabi | 41.33 | 42.44 | 40.77 |
| | Zaid | 8.18 | 5.79 | 5.40 |
| South-Western Plain | Kharif | 43.90 | 13.45 | 44.75 |
| | Rabi | 46.72 | 73.68 | 46.95 |
| | Zaid | 9.37 | 12.87 | 8.29 |
| Central Zone | Kharif | 52.81 | 50.73 | 49.55 |
| | Rabi | 40.32 | 42.89 | 43.77 |
| | Zaid | 6.87 | 6.37 | 6.68 |
| Bundelkhand | Kharif | 51.96 | 56.42 | 51.90 |
| | Rabi | 47.69 | 43.46 | 47.70 |
| | Zaid | 0.35 | 0.12 | 0.39 |
| North East Zone | Kharif | 54.75 | 47.84 | 64.25 |
| | Rabi | 41.71 | 50.81 | 34.68 |
| | Zaid | 3.54 | 1.36 | 1.07 |
| Eastern Zone | Kharif | 50.27 | 48.32 | 50.95 |
| | Rabi | 47.43 | 50.67 | 47.95 |
| | Zaid | 2.31 | 1.01 | 1.11 |
| Vindhyan Zone | Kharif | 50.26 | 50.50 | 85.70 |
| | Rabi | 49.43 | 49.17 | 14.30 |
| | Zaid | 0.31 | 0.33 | 0.00 |
| U.P. | Kharif | 52.01 | 51.30 | 53.81 |
| | Rabi | 42.75 | 45.20 | 42.72 |
| | Zaid | 5.24 | 3.49 | 3.47 |

**Source:** Primary data.

**Trends are under cultivation in different crop seasons**
Season-wise area under different crops shown in the above table during 2009-12 has a lot of fluctuations. Percentage of cropped area under Kharif occupied a predominant place among all the zones, subsequently Rabi occupied second place, and Zaid occupied third place in all the zones during the study period.

**Trends related to Crop Diversification Area**
Does the further analysis indicate that how to measure these variations among the agro-climatic zones? We have computed the F test to find out whether the variations show among the cropped area, Production and Incomes are significant among the agro-climatic zones in Uttar Pradesh.

**Table 2:** Significance Level of crops Area by Agro-Climatic Zone Wise in Uttar Pradesh during 2009- 2010 to 2011-12

| Climatic Zone | 2009-10 | 2010-11 | 2011-12 |
|---|---|---|---|
| | F value and significance | F value and significance | F value and significance |
| Tarai and Bhabar | 32.239** | 31.527** | 26.560** |
| Western Plain | 10.327* | 25.212** | 29.980** |
| Mid - Western Plain | 17.959* | 16.932* | 2.929 |
| South Western Plain | 16.056 | 11.965* | 24.367** |
| Central Zone | 14.900* | 1.539 | 1.69 |
| Bundelkhand | 8.316 | 1.421 | 21.827** |
| North East Zone | 20.141** | 1.396 | 0.502 |
| Eastern Zone | 44.476** | 18.598* | 43.493** |
| Vindhyan Zone | 2.833 | 7.784 | 8.32 |

**Note:-** * shows 5% level of significance, ** shows 1% level of Significance
**Source:** Primary Data

**Crops:-** Paddy. Kharif Pulses, Kharif Coarse Grain, Kharif Groundnut, Kharif Oilseeds, Kharif cotton, sugarcane, Kharif Vegetables, Kharif Others, Wheat, Rabi Pulses. Rabi Oilseeds, Rabi Coarse Grain, Rabi Vegetables, Rabi Others, Zaid Food grains, Zaid Vegetables, Zaid Fodder, Zaid Others.

We have computed F test among the various crops area of 9 Agro Climatic Zones in Uttar Pradesh during 2009-12. Table 1, the results show that during 2009-10 there are significant variations in Tarai and Bhabhar, North-East Zone and Eastern Zone. It means area wise diversification of crops are

significant at 1% level in these zones. Western Plain, Mid-Western Plain, Central Zone are significant at 5% level. Though this level is universally accepted a level of significance, as compared with above less diversification recorded in these zones. 2011-12 data reveals that out of 9 zones, 5 zones are significant at 1 % level. It means when the time moves on the area under diversification has grown at a rapid rate.

## Crop Area Diversification Index

Nature and scope of agricultural diversification were quite dissimilar across different regions. Diversification was relatively more pronounced in the Western region in contrast to other regions. Central region followed it. The above-mentioned data related to area, production and income shows large variations among the regions. So, to confirm the variations, we have computed the HH Index. The results are as follows:

**Table 3:** Crop Diversification Index (HHI) in Agro-Climatic Zone of Uttar Pradesh during 2009-12

| Climatic Zone | Farmers Land Wise Category | 2009-10 | 2010-11 | 2011-12 |
|---|---|---|---|---|
| Tarai and Bhabar | Marginal Farmers | 0.315 | 0.326 | 0.328 |
| | Small Farmers | 0.310 | 0.305 | 0.299 |
| | Medium Farmers | 0.316 | 0.329 | 0.318 |
| | Large Farmers | 0.319 | 0.274 | 0.288 |
| Western Plain | Marginal Farmers | 0.326 | 0.324 | 0.320 |
| | Small Farmers | 0.275 | 0.264 | 0.261 |
| | Medium Farmers | 0.251 | 0.249 | 0.249 |
| | Large Farmers | 0.279 | 0.268 | 0.261 |
| Mid - Western Plain | Marginal Farmers | 0.300 | 0.349 | 0.350 |
| | Small Farmers | 0.230 | 0.263 | 0.266 |
| | Medium Farmers | 0.204 | 0.233 | 0.234 |
| | Large Farmers | 0.202 | 0.235 | 0.242 |
| South Western Plain | Marginal Farmers | 0.317 | 0.325 | 0.313 |
| | Small Farmers | 0.273 | 0.278 | 0.276 |
| | Medium Farmers | 0.272 | 0.302 | 0.275 |
| | Large Farmers | 0.267 | 0.262 | 0.258 |
| Central Zone | Marginal Farmers | 0.392 | 0.402 | 0.410 |
| | Small Farmers | 0.378 | 0.377 | 0.362 |
| | Medium Farmers | 0.372 | 0.345 | 0.366 |
| | Large Farmers | 0.329 | 0.319 | 0.313 |
| Bundelkhand | Marginal Farmers | 0.347 | 0.369 | 0.344 |
| | Small Farmers | 0.296 | 0.309 | 0.270 |
| | Medium Farmers | 0.250 | 0.260 | 0.239 |
| | Large Farmers | 0.225 | 0.254 | 0.220 |
| North East Zone | Marginal Farmers | 0.371 | 0.391 | 0.400 |
| | Small Farmers | 0.311 | 0.332 | 0.345 |
| | Medium Farmers | 0.326 | 0.369 | 0.359 |
| | Large Farmers | 0.294 | 0.314 | 0.324 |
| Eastern Zone | Marginal Farmers | 0.368 | 0.367 | 0.358 |
| | Small Farmers | 0.344 | 0.340 | 0.331 |
| | Medium Farmers | 0.309 | 0.318 | 0.311 |
| | Large Farmers | 0.337 | 0.340 | 0.325 |
| Vindhyan Zone | Marginal Farmers | 0.490 | 0.453 | 0.450 |
| | Small Farmers | 0.476 | 0.456 | 0.445 |
| | Medium Farmers | 0.469 | 0.442 | 0.430 |
| | Large Farmers | 0.464 | 0.400 | 0.420 |

**Source:** Authors calculation.

Table 3 data reveals that the above-mentioned variations among all the different crops, different agro-climatic zones, and different land size category of farmers crop diversification index during 2009-12 by HH Index.

• **HHI** = Herfindahl- Hirschman Index

HHI shows the values are close to zero will be highly specialized for diversification. If the values are showing above 0.50 onwards shows less diversification. SI is totally opposite of HHI.

## The significance of Crop Area Diversification: HH Index

The data shows that among all the agro-climatic zones, the value of HHI indicates very much significant among all the farmer's categories point of view. It means the values are below 0.50 to close to 0.20. As per the values, the HH Index reveals that the crop area diversification is significant at a moderate level among all the farmer's categories point of view in all the agro-climatic zones. It clearly indicates that diversification is a must for the growth of incomes among the farmers in all the agro-climatic zones. Every year data confirms the above-mentioned trend.

**Table 4:** Trends in Agricultural Productivity (Rs.)

| Zone | Per Acre value (Rs.) of the output | | |
|---|---|---|---|
| | 2009-10 | 2010-11 | 2011-12 |
| Tarai and Bhabar | 24296 | 29409 | 31997 |
| Western Plain | 22541 | 23392 | 26190 |
| Mid - Western Plain | 14683 | 26471 | 17172 |
| South Western Plain | 20281 | 19261 | 21157 |
| Central Zone | 19954 | 18512 | 19342 |
| Bundelkhand | 12530 | 12272 | 13711 |
| North East Zone | 17632 | 15958 | 16463 |
| Eastern Zone | 13254 | 13138 | 15690 |
| Vindhyan Zone | 8403 | 9426 | 9638 |
| Total UP | 17064 | 20846 | 20913 |

**Source:** Authors Calculation.

## Trends in agricultural productivity

Table 4 data shows the productivity trends with respect to per acre value of output in all agro-climatic zones during 2009 – 12 as per sample data collected from each zone. The above data reveals that crop diversification is significant among the agro-climatic zones. Table 2 data clearly indicates that there are large variations among agro-climatic zones, overall in UP, the average per acre value of output has grown from Rs.17064 to Rs.20913 during the study period. It means per acre value of output has grown in the majority of agro-climatic zones, but slight decline indicated in North East Zone and Central Zones only. Out of 9 agro-climatic zones, 4 zones have recorded lower value of output per acre as compared with the average of UP.in 2009-10, whereas in 2011-12 there are 6 zones have recorded lower value of output per acre as compared with the average of Uttar Pradesh. Gross value productivity per acres increased from Rs. 17,267 in 2009-10 to 17,820 in 2010-11 and further to Rs. 19,271 in 2011-12. However, sharp variations are found in the level of productivity across regions.

## Trends related to Agriculture Income

Diversification of agriculture refers to a larger crop-mix to increase farm income and enhance resource productivity. In a subsistence agriculture system, diversification was considered as a strategy to minimize farm risks, which arise as a result of fluctuations in output prices, weather uncertainties, and incidence of insect pests, among others.

**Table 5:** Total Farmers Household Income in Rs. by Agro-Climatic Zone wise in Uttar Pradesh during 2009-10 to 2011-12

| Agro-climatic Zone | Category of Farmers | 2009-10 | | 2010-11 | | 2011-12 | |
|---|---|---|---|---|---|---|---|
| | | Farm Business Income | Total Income | Farm Business Income | Total Income | Farm Business Income | Total Income |
| Tarai and Bhabar | Marginal farmers | 50658 | 78294 | 54020 | 76748 | 59732 | 83667 |
| | Small Farmers | 114254 | 135902 | 118602 | 141200 | 129256 | 151765 |
| | Medium Farmers | 204820 | 242630 | 199381 | 226902 | 212518 | 238610 |
| | Large Farmers | 302892 | 417801 | 334382 | 399109 | 342161 | 398043 |
| | Total | 112877 | 147212 | 115955 | 142420 | 125141 | 151580 |
| Western Plain | Marginal farmers | 61189 | 97749 | 65077 | 114956 | 71723 | 123037 |
| | Small Farmers | 117312 | 164107 | 120856 | 198447 | 123219 | 191845 |
| | Medium Farmers | 212992 | 240108 | 208201 | 251143 | 212749 | 252405 |
| | Large Farmers | 356560 | 381830 | 356345 | 379495 | 373225 | 409390 |
| | Total | 130924 | 167110 | 132169 | 185505 | 138427 | 190425 |
| Mid -Western Plain | Marginal farmers | 35172 | 63409 | 42150 | 72053 | 42865 | 75974 |
| | Small Farmers | 83670 | 103168 | 80103 | 99687 | 83158 | 106977 |
| | Medium Farmers | 129656 | 177007 | 113679 | 137123 | 130447 | 137709 |
| | Large Farmers | 204504 | 309338 | 212436 | 292603 | 241423 | 324923 |
| | Total | 63010 | 92849 | 64554 | 92189 | 68588 | 97659 |
| South Western Plain | Marginal farmers | 61350 | 101103 | 67427 | 94240 | 72544 | 98471 |
| | Small Farmers | 140064 | 162220 | 157395 | 180989 | 154779 | 178847 |
| | Medium Farmers | 194927 | 228959 | 188998 | 218991 | 219144 | 281551 |
| | Large Farmers | 421630 | 467335 | 381537 | 416245 | 411144 | 456732 |
| | Total | 121671 | 156379 | 127744 | 154643 | 134519 | 167324 |
| Central Zone | Marginal farmers | 38355 | 64164 | 49654 | 82116 | 44110 | 78666 |
| | Small Farmers | 85394 | 117743 | 103549 | 141131 | 97987 | 135108 |
| | Medium Farmers | 144961 | 167282 | 158835 | 189072 | 183022 | 217476 |
| | Large Farmers | 333010 | 436534 | 347494 | 463004 | 370132 | 473395 |
| | Total | 70528 | 100344 | 83909 | 120336 | 81796 | 120525 |
| Bundelkhand | Marginal farmers | 38262 | 59133 | 44978 | 71729 | 46720 | 75178 |
| | Small Farmers | 69661 | 83563 | 79192 | 94103 | 84738 | 106192 |
| | Medium Farmers | 127435 | 141171 | 131540 | 145582 | 146444 | 166815 |
| | Large Farmers | 274694 | 329624 | 288950 | 333726 | 311467 | 369283 |
| | Total | 95053 | 115820 | 103909 | 126009 | 111457 | 139090 |
| North East Zone | Marginal farmers | 39421 | 69516 | 39273 | 81120 | 40980 | 84291 |
| | Small Farmers | 75954 | 115292 | 82814 | 137874 | 85919 | 139591 |
| | Medium Farmers | 133505 | 172710 | 141232 | 217569 | 168995 | 234518 |
| | Large Farmers | 289120 | 556998 | 302838 | 639603 | 312939 | 607074 |
| | Total | 63898 | 102850 | 66390 | 121870 | 71263 | 126181 |
| Eastern Zone | Marginal farmers | 35594 | 84913 | 39637 | 98052 | 44181 | 102937 |
| | Small Farmers | 65774 | 122668 | 68033 | 131630 | 81265 | 145684 |
| | Medium Farmers | 100310 | 221601 | 116436 | 239003 | 132060 | 247777 |
| | Large Farmers | 219700 | 329403 | 214024 | 383678 | 247178 | 321995 |
| | Total | 57363 | 118712 | 61700 | 132349 | 70316 | 138083 |
| Vindhyan Zone | Marginal farmers | 22012 | 72327 | 26486 | 81677 | 28076 | 89195 |
| | Small Farmers | 48540 | 70458 | 59807 | 96174 | 50888 | 75702 |
| | Medium Farmers | 62735 | 124415 | 70500 | 140129 | 75760 | 124435 |
| | Large Farmers | 132888 | 262488 | 161197 | 316597 | 171877 | 317077 |
| | Total | 46444 | 96396 | 60257 | 120031 | 55100 | 107351 |
| UP | Marginal farmers | 41467 | 75672 | 46927 | 86900 | 48237 | 89600 |
| | Small Farmers | 84877 | 119856 | 93737 | 136571 | 96542 | 139256 |
| | Medium Farmers | 146217 | 192523 | 150579 | 202076 | 169221 | 220548 |
| | Large Farmers | 298459 | 391394 | 302753 | 405316 | 324434 | 412337 |
| | Total | 79082 | 117888 | 85390 | 130634 | 89968 | 135897 |

**Source:** Authors calculation

Table 5 shows that agricultural and non-agricultural income during 2009-12 among various farmers categories in different agro-climatic zones. Agricultural income is most important in all the agro-climatic zones. In total the agricultural income varies from 50% to 80% among all the zones. Except for Central and Vindhyan Zones, agricultural incomes trends are continuously growing at a higher rate among all the other agro-climatic zones point of view during 2009-12. The income variations within each zone between and among the different size category of farmers are recorded at a higher rate

during 2009-12. Total Household Income for the sample farm households for Uttar Pradesh came to Rs. 1,35,897. It varied from Rs. 97,659 in Mid-Western Plain to Rs. 1,90,425 in Western Plain region. In terms of annual household income farmers of Western Plains, South Western Plain and Tarai & Bhabhar region are the richest followed by farmers of Bundelkh and and Eastern Zones. The remaining four zones have relatively lower household income as compared to the UP average total Income. Household Income from agriculture is estimated at Rs. 89,968 for the sample farmers. Large

variations are found across agro-climatic zones in terms of income from agriculture. A farmer in Vindhyan Zone has an annual agricultural income of only Rs. 55,100 as compared to an income of Rs. 1,38,427 earned by a farmer in Western Plain. Agricultural income is relatively higher in Western Plain, Tarai & Bhabhar Zone and South Western plain region. Lowest Household Income from agriculture has been reported in North East, Eastern Zone and Vindhyan Zone, all falling in the Eastern Uttar Pradesh. The above data reveals that variations exist in area, output and agricultural income point of view.

## Conclusion
As mentioned in the above tables, the data reveals that crop diversification is a must for the growth of incomes of the farmers among all size categories in all the agro-climatic zones. The trends are significant from the crop area, production and agricultural income point of view. In the coming future, if we want to double the farmer's income in Uttar Pradesh, we have to suggest the crop diversification among all types of farmers in all the agro-climatic zones.

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