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**Jitendra Ojha**  
Baba Raghav Das Post  
Graduate College, Deoria, Deen  
Dayal University, Gorakhpur,  
Uttar Pradesh, India

**Vinay Kumar Rawat**  
Baba Raghav Das Post  
Graduate College, Deoria, Deen  
Dayal University, Gorakhpur,  
Uttar Pradesh, India

**Vijay Pal**  
Baba Raghav Das Post  
Graduate College, Deoria, Deen  
Dayal University, Gorakhpur,  
Uttar Pradesh, India

**Chandra Prakash Singh**  
Baba Raghav Das Post  
Graduate College, Deoria, Deen  
Dayal University, Gorakhpur,  
Uttar Pradesh, India

**Abhishek Yadav**  
Baba Raghav Das Post  
Graduate College, Deoria, Deen  
Dayal University, Gorakhpur,  
Uttar Pradesh, India

**Corresponding Author:**  
**Jitendra Ojha**  
Baba Raghav Das Post  
Graduate College, Deoria, Deen  
Dayal University, Gorakhpur,  
Uttar Pradesh, India

## Extent of crop diversification and its impact on farmers income in Ayodhya District of UP

**Jitendra Ojha, Vinay Kumar Rawat, Vijay Pal, Chandra Prakash Singh and Abhishek Yadav**

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### Abstract

Agriculture diversification is implemented as a tactic to reduce risk associated with crop failure, when the immediate objective is not to earn a profit but to stabilize farm income for survival. Crop diversification is a term that defines growing of diverse crops on the same piece of land at the same time. The study was conducted in Ayodhya district of Uttar Pradesh during 2020-21. Simpson Index of Diversification and regression analysis was used for analysis of diversification and impact of diversification on farmers' income. The study revealed that the high diversification (SID-0.98) in the region. A positive co-relation was analyzed between income to explanatory variables like number of crop grown, cropping intensity, Cattles, age education). The P value of number of crop grown is observed significant which has greater impact on farm income than other variables.

**Keywords:** Crop, diversification, Simpson index of diversification, income, impact

### Introduction

Agricultural businesses are subject to some risk and pricing and production uncertainty as well as input supply uncertainty. Profitability is the primary criterion for adopting an enterprise or technique in this circumstance in the decision-making process of farmers. Diversification is assisting smallholder farmers in bridging the gap between their farming and non-farm. Agriculture diversification is implemented as a tactic to reduce risk associated with crop failure. As per the Agricultural Census (2015-16), the total operational land in India is 1464.54 lakh, in which 1002.51 lakh (68.45%) holdings are marginal land (less than 1 ha) followed by small holding (1-2 hectare) is 258.09 lakh (17.62%) and other (more than 2 ha) is 203.92 (13.93%). The data revealed that maximum farmers of India are marginal in nature. Diversification is the strategy with which one can earn higher profit in compare to single enterprise in that particular area. Diversification refers to changes in the crop-mix, enterprise-mix, and activity-mix. It is regarded as a resource transition from monoculture a substantial variety of crops and livestock. It can be helpful to improve agricultural sustainability, increase resilience to environmental changes, enhance soil health, reduce pest and disease risks, and provide a more balanced and nutritious diet. Kujawska *et al.*, (2021) <sup>[5]</sup> revealed that crop diversification helps in increasing farmers' resilience to changing weather conditions caused by climate change and stabilize their incomes. In the similar lines, crop diversification becomes increasingly important to adapt to new conditions and reduce vulnerability to extreme weather conditions. Also revealed that crop diversification has enormous potential as a driver of economic growth in the agriculture sector and could prove to be crucial in overcoming issues aftermath of the green revolution. Kumar and Gupta (2015) <sup>[6]</sup> conducted the research to examine the state level pattern of Crop Diversification in India from the period 1990-91 to 2011-12 revealed that cropping pattern in state level transformed from food grains to high value cropped during the said period. The favorable policy support from the government side in form of MSP also promote the diversification of crop. Crop diversification helpful for soil by adding the nitrogen and organic matter. Singh and Mishra (2012) <sup>[13]</sup> revealed that availability of Organic matter, Nitrogen and Phosphorus is low in Indian soil.

Conducted a research on effects of integrated farming system on residue recycling and soil quality in rice-based integrated farming systems revealed that about 10 tonnes of organic matter was recycled, and the major share was from the dairy unit (~52%) in the form of dung and cow urine. The current research was conducted to study to measure the extent of diversification and impact of diversification to stabilize and increase farm income, increase employment opportunities, conserve and enhance natural resources in Ayodhya district of Uttar Pradesh.

**Research Methodology**

The current study has conducted in Uttar Pradesh state of India. Out of the 75 district of Uttar Pradesh, the present investigation was carried out in Ayodhya district. There are 11 blocks in the district Ayodhya. Milkipur block was selected purposely. Two villages namely (Bawan and Akma) was selected randomly through chit method following Simple Random Sampling without Replacement. Out of the two villages 100 farmers were selected through PPS (probability proportionate size). Sampling and selection of respondent was done using systematic random sampling method.

The Simpson Index of Diversification was used to calculate the diversification index (Modified Simpson index of diversification (SID, 1949))

$$SID = 1 - \sum Pi^2$$

Where,

P<sub>i</sub> = Proportion of income coming from source i

The value of SID lies between, 0 to 1.

**Impact of farm diversification on farm income was used from given formula**

This analysis was also done using primary data. Impact of farm diversification on farm income was analyzed using primary data by estimating equation

$$Y = A + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + \dots + b_{12} X_{12} + b_{13} X_{13} \dots$$

Y is Gross returns/ ha whereas A is the intercept

Explanatory variables used in the equation were 1-HI(X1), 1-HI(X1), farming experience(X2), education(X3), total land in ha (X4), fertilizer consumption/ha (X5), share of irrigated area (X6)

**Results and Discussion**

The data in table1 revealed that the average farm size (ha) was 1.11 which may be the result of occupation of higher cultivated area per farm. The region is highly diversified as indicated by the cropping efficiency, average number of the crop grown and share of ancillary & horticultural enterprise in the region.

The per family income is also calculated higher, which may be the result of higher cropping land occupancy, higher number of cattle per farm and higher cropping intensity in the district. Infrastructure facilities like family labour per farm and distance from market is revealed the developed facilities in the region.

**Table 1:** Summary of statistics of the sample farmers of the village in the district

S. No.	Variable	Mean	Standard Deviation
<b>Cropping scheme</b>			
1.	Average farm size (ha)	1.11	1.74
2.	Cropping intensity (%)	183.50	55.53
3.	Average No. of crops cultivated	3.67	1.11
4.	Share of ancillary & horticultural enterprise (%)	47.8	0.281
<b>Economic scheme</b>			
5.	Average No of cattle per farm household	2.5	2.24
6.	Farm income per family (Rs.)	148717.118	81792.42919
<b>Infrastructure facility</b>			
7.	Family labour per farm	2.09	1.13
8.	Market distance (km)	4.46	0.50

**Status of share of crops/livestock in the study area**

The study in the district revealed that a steady but declining trend of share of area of cereals was observed in the region. Pulses are the second important crop in the study area showing steady increasing trend in area. In the similar lines, the steady growth in share of area under oilseed was also

observed in the region. A steady growth in the share of area under vegetables and sugarcane was observed. Growth in share of area for pond construction in case of fisheries was observed in decade in the region as well the data revealed a steady growth in number of livestock in the region.

**Table 2:** Share of area of crops and livestock in the selected block of the region

Year	Cereal	Pulses	Oilseeds	Vegetables	Sugarcane	Fisheries
2011-12	85.77	5.23	1.55	3.23	4.20	0.02
2012-13	85.49	5.52	1.57	3.22	4.19	0.02
2013-14	84.99	5.65	1.59	3.47	4.29	0.02
2014-15	85.08	5.39	1.56	3.49	4.47	0.02
2015-16	84.94	5.27	1.64	3.53	4.61	0.02
2016-17	85.01	5.28	1.64	3.44	4.61	0.03
2017-18	84.93	5.27	1.64	3.53	4.61	0.03
2018-19	84.93	5.27	1.64	3.53	4.61	0.04
2019-20	84.92	5.27	1.64	3.53	4.61	0.04
2020-21	84.92	5.27	1.64	3.53	4.61	0.04

**Extent of crop diversification in the study area**

Diversification in agriculture commonly means growing different crops instead of concentrating under a single crop. However, Pingali and Rosengrant (1995) [10] defined diversification as “change in product (or enterprise) choice and input use decisions based on market forces and the principles of profit maximization”. Conversely, Joshi *et al.* (2004) [4] have defined “agricultural diversification as movement of production-portfolio from a low-value commodity mix (crop and livestock) to high-value commodity-mix (crops and livestock)” making a shift from traditional definition. However, to encompass all the agricultural and allied sector, diversification should be considered as a strategy of changing crop or enterprise-mix with more equivalent distributive share for each sector. Diversification indicates growing of various crops as well as raising livestock in the region. An attempt was also made to explore the extent of diversification in the region. The data on crop grown in the region, number of livestock and allied activities practiced by the farmers is collected for the purpose. The Simpson Diversification Index was used to evaluate the diversification in the. It was found that cereal based cropping system as Paddy-wheat is dominated in the region. Along with this farmers diversify his land to cropping of pulses like chickpea, mung bean, urd bean, pigeon pea oilseeds like mustard and other horticultural crops like mango, guava, orange and vegetable crops like chilly, cabbage, cauliflower, lady finger, pumpkin etc. The study also revealed that farmers practiced the rearing the livestock’s as buffalos, cattle, sheep and goat for meeting the need of milk requirement in the region. Poultry and goat were the major enterprise established in the region. The Simpson Diversification Index (SID) calculated to know the extent of diversification in the region. The study revealed the high diversification in the region. The SID value

calculated for the region was 0.98 in the region. Kumar, *et al.* (2018) [7] supported the result by revealing that state agriculture is diversified from traditional crops to high value crop. He also revealed that irrigation, fertilizers and mechanization were found to be the major drivers of shift in the area towards high value crops.

**To estimate the impact of diversification on selected farmers of the region**

Crop diversification is considered as an important strategy to enhance income generation in farm. Diversification though increase the number of the crops including fruits and vegetables, in different seasons as well as raising livestock and practicing allied agricultural activities is an effective strategy in raising incomes, generating employment opportunities and alleviating poverty among small and marginal households (Vyas, 1996; Joshi *et al.*, 2007) [14, 3]. Many studies (Sharma and Singh, 2013; Mandal and Bezbaruah, 2013) [11, 8] reported positive impact of farm diversification on farmers income. It was also revealed that diversification especially with high value crops (HVC) as well as allied agricultural activities not only mitigate risk but may also be conducive to enhance the income of the farmers. The study made an attempt to investigate the impact of diversification on farmers income. In order to examine the impact of diversification on farm income generated per hectare (in thousand rupees) has been taken as dependent variable. A multiple linear regression model has been applied to assess the impact of diversification on farm income. In the explanatory variables, like number of crop grown, number of livestock, cropping intensity, age and education which may have influenced farm income were added. A positive co-relation was also analyzed between income to other explanatory variables (number of crop grown, cropping intensity, Cattles, age education).

**Table 3:** Correlation analysis between income and other explanatory variable

	Income	No of crops grown	Cropping intensity	Cattle’s	Age	Education
Income	1					
No of crops grown in 2022-23	0.341	1				
Cropping intensity	0.341	1	1			
Cattels	-0.00	-0.010	-0.010	1		
Age	0.113	0.169	0.169	0.189	1	
Education	-0.045	0.025	0.025	-0.126	-0.130	1

The regression analysis is perform to study the impact of the income over no of crop grown, cattles, age and education of the participants. To perform the study data on number of crop grown by the farmers in the year, no of cattles rearing for him, age and education collected. R square is explained

that proportion of variance in the dependent variable that explained by dependent variable on significance level less the 0.05%. The P value of number of crop grown is observed significant which has greater impact on farm income than other variables.

**Table 4:** Regression analysis to analyze the impact of income on explanatory variables

Heads	Value	Heads	P-Value
R Square	0.121	No of crops grown	0.001
Significance level	0.014	Cattels	0.891
Observations recorded	100	Age	0.597
		Education	0.618

**Conclusion**

The study revealed the high diversification in the region. The SID value calculated for the region was 0.98 in the region. A positive co-relation was also analyzed between income to other explanatory variables (number of crop grown, cropping intensity, Cattles, age education). R square

is explained that proportion of variance in the dependent variable that explained by dependent variable on significance level less the 0.05%. The P value of number of crop grown is observed significant which has greater impact on farm income than other variables.

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