ABSTRACT

Farming in India, in general and in Rohilkhand in particular, is the backbone of the livelihood for majority of population. Small and marginal farmers account for 84 per cent of the population engaged in farming. Fifty seven per cent of India’s total employment and 73 per cent of total rural employment come from agricultural sector. The average monthly per capita expenditure of the Indian farm household is Rs. 503 not far above the rural poverty line. About 60 per cent of that Rs. 503 is spent on food. Another 18 per cent on fuel, clothing and footwear. Of the pathetic sum left over, the household spends on health twice what it does on education that is Rs. 34 and Rs. 17 in India current productivity of all the crops except sugarcane is roughly equal to what China achieved in the mid-1980s, despite the fact that India is having largest number of agricultural scientists on the government payroll in the world (over 30,000).

The traditional excuses for India’s substandard performance in the farm sector are not only tired but inadequate. Because Indian agriculture is placed favourably when compared to China in terms of quantify of arable land (161 million ha. vs 130 million ha.), irrigated land (55.8 million ha. vs. 54 million ha.), average farm size (1.41 ha. vs. 0.40 ha.) and farm mechanization (15.7 tractors per 1,000 ha vs. 7 ha. per 1000 ha.). Thus, most of the usual excuses for India’s poor agricultural performance do not hold up when it is compared to China.

Study area

The Rohilkhand plain lies in the north-western part of the state of Uttar Pradesh between latitude 27°35’ to 29°58’ N and longitude 78° to 80°27’E. Rohilkhand region shares its boundary with a newly created state of Uttarakhand and Nepal in the north. Rohilkhand plain comprises the districts of Bareilly, Budaun, Shahjahanpur, Pilibhit, Bijnor, Moradabad, Rampur and J.P. Nagar. It covers an area of 30,544 sq.kms. of north-western Uttar Pradesh having a total population of about 23.6 millions with density of 642 persons per sq.km (in 2001). The whole Rohilkhand region forms a part of the Indo-Gangetic plain.
The paddy grains harvested under organic methods have been found to have better weight compared with chemical farming. The weight of one bag under organic farming has increased up to 60-62 kg, whereas it was 54 kg with chemical farming. Because of the weight increase per hectare land will generate Rs. 3,000 additional income. Therefore, government should formulate a policy on organic farming for farmers.

Government should allow the entry of large organized players like Reliance Retail, ITC, Food Bazar (owned by Hishone Biyani’s Pantaloons) Bharti, Subhiksha (from the Aditya Birla Group) and more for contract farming which will connect farmers with consumers, bypassing the traditional route controlled by multiple layers of middlemen. These companies will give seeds and other inputs to the farmers and will provide insurance facilities in case of crop failure. In return farmer will promise a particular quantity of land to the company. The company will transport the produce directly from the field to the markets. In this way farmer will be protected from the undue exploitation of middlemen and can save in transportation cost. Government should act as a facilitator and participator in the implementation of this policy by providing infrastructural facilities such as roads, canals and power in such a manner that commercial activities in rural areas got a boost.

In few areas public sector organizations must act somewhat like the private sector. Research staff should be hired on a contract basis with pay linked to the research performance. Moreover, salaries for those who performed well should be increased at regular basis.

India needs agricultural development that is measured not just in terms of percentage increase in crop contribution but which goes far beyond so that it can uplift poor farmers from the harassments due to poverty and misery. We need agricultural development that ensures access to basic education, healthcare and shelter to every farmer, so that he may enjoy his fundamental right to live with dignity.
Objectives

The main objectives of the study are:

(i) To ascertain the changes in cropping intensity and crop combinations in time and space.

(ii) To explain the landuse organization as a consequences of the spread of new agricultural technology with special reference to the changes in cultivated area, production and yield.

(iii) To delineate the productivity regions to establish causal relationship with variable factors of production in different productivity regions, and suggest remedial measures for the improvement in productivity.

(iv) To find out the causal relationship among different variables of agriculture and socio-economic development to know the regional disparities in Rohilkhand plain.

(v) To know the influence of new cropping practices on farmers.

(vi) To know the impact of agricultural changes on the socio-economic development of the people of Rohilkhand plain.

Hypotheses

The study is primarily concerned with agricultural changes and socio-economic development in which following hypotheses are to be tested.

(i) The use of new agricultural technology leads to positive changes in cropping intensity which leads to overall agricultural development.

(ii) The farmers of Rohilkhand plain are moving from subsistence farming to the market oriented farming and from multicropping to monocropping pattern.

(iii) Agricultural development leads to socio-economic development.

(iv) New cropping practices leads to positive changes in the agricultural incomes of the farmers but leading to many environmental and social problems.
Database and Methodology

The present study is based on primary as well as secondary sources of data. The secondary data for three different periods i.e. 1985-90, 1991-96 and 1997-02 were collected from the published records of the Directorate of Agricultural Statistics and Crop Insurance, Krishi Bhawan and the Institute of State Planning, Jawahar Bhawan, Lucknow, U.P.

The primary data were collected with the help of a questionnaire prepared covering various aspects of agriculture and socio-economic development in rural areas. A comprehensive household survey in thirty seven villages (1 village from each Tehsil) of eight districts of Rohilkhand plain was conducted during the months of Feb. and April 2007 based on simple random sampling. From every village 10 per cent households were taken as samples.

The study is divided into three periods i.e. 1985-90, 1991-96 and 1997-02. Districtwise cropping intensity is calculated by using the formula:

\[
\text{Cropping Intensity} = \frac{\sum \text{ai}_j}{\sum \text{ai}_0} \times 100
\]

where

\[
\begin{align*}
\text{ai}_j &= \text{area under the ith crop in the ith year} \\
\text{ai}_0 &= \text{area under the ith crop in the base year} \\
\text{N}_j &= \text{net area shown in the jth year} \\
\text{N}_0 &= \text{net area shown in the base year}
\end{align*}
\]

Crop combination regions were determined by applying Weaver’s minimum deviation method, which would be read as follows:

\[
\text{SD} = \sqrt{\frac{\sum d^2}{n}}
\]

where

\[
\begin{align*}
d &= \text{differences between the actual crop percentages in a given areal unit and the appropriate percentage in the theoretical curve}
\end{align*}
\]
Crop combination regions also calculated by applying Doi’s method which substitutes Weaver’s method of $\Sigma d^2/n$ with the sum of square differences $\Sigma d^2$. The combination having the smallest $\Sigma d^2$ will be the combination of primary crops. It is not required to calculate $\Sigma d^2$ for each combination but it can be discovered by constituting a one-sheet table which Doi himself provided.

Spatial patterns of growth in area, production and yield of major crops computed by applying linear regression technique. The crop-wise linear growth rates (in order of increase or decrease or static position) for each district in area, production and yield were computed for the corresponding periods viz. 1985-90, 1991-96 and 1997-02.

An assessment of agricultural productivity is made to find out high, medium and low productivity regions based on Bhatia’s formula as follows:

\[
(i) \quad I = \frac{Y_c}{Y_r} \times 100
\]

where

- $I_{ya} = \text{is the yield index of crop } a$,
- $Y_c = \text{is the average acre yield of crop } a \text{ in the component unit}$,
- $Y_r = \text{is the average acre yield of crop } a \text{ in the entire study area}$.

and,

\[
(ii) \quad E_i = \frac{I_{ya}C_a + I_{yb}C_b + \ldots + I_{yn}C_n}{C_a + C_b + \ldots + C_n}
\]

where

- $E_i = \text{is the agricultural efficiency index}$,
- $I_{hya}, I_{yib}, \text{etc.} = \text{are the indices of various crops}$,
- $C_a, C_b, \text{etc.} = \text{represent the proportion of cropland devoted to different crops}$.

Agricultural productivity regions also worked on the basis of Standard Nutrition Unit (SNU) technique which can be written in algebraic form as follows:

\[
1 = \frac{\Sigma P(1) \times \text{Calo}(1)}{N \times \Sigma A(1) \times 8,000,000}
\]
Where

\[ P(1) = \text{total production of the respective crops in the unit area}, \]
\[ PA(1) = \text{area under the crop in the unit} \]
\[ \text{Calo}(1) = \text{Caloric value of the crop concerned} \]
\[ N = \text{number of crops} \]

Correlation between the variables of agriculture and socio-economic development have been computed with the help of Karl Pearson’s coefficient of correlation which may be expressed in equation form as :

\[
r = \frac{\sum xy}{\sqrt{\frac{\sum x^2}{N}} \sqrt{\frac{\sum y^2}{N}}} - \frac{\sum x \sum y}{N}
\]

This measure is known as ‘Product Moment Correlation Coefficient’ or simply a ‘Correlation Coefficient’. By symmetry it is clear that \( r_{xy} = r_{yx} = r \)

where,

\[
r = \text{coefficient of correlation}, \]
\[
x, y = \text{two given variables, and} \]
\[
r = \text{number of observations} \]

Properties of correlation coefficient (\( r \))

1. If the sign of \( r \) is positive the variables \( x \) and \( y \) will positively be related and if the sign is negative, they will negatively be correlated.

2. The value of \( r \) varies between -1 and +1. The value +1 or -1 indicates a 100 per cent positive or negative correlation. As the extent of correlation decreases the value of \( r \) approaches zero.

Significance Test of Correlation Coefficient or the students ‘t’ distribution with \( (n-2) \) degree of freedom may be written in equation form as follows :

\[
t = r \sqrt{\frac{n-2}{1-r^2}}
\]

Where,

\[
n \text{ is the number of observations used} \]
\[
r \text{ is the coefficient of correlation, and} \]
\[
t \text{ is the calculated value} \]
In the last simple percentage and average methods are used to calculate the data collected through field survey with the help of a questionnaire. Levels of agricultural and socio-economic development have been computed by using Z-score technique which can be written as follows:

\[ Z = \frac{X_i - \bar{X}}{S.D.} \]

Where,
- \( Z \) = score of variables
- \( X_i \) = original value of individual variable x of ith component areal unit
- \( \bar{X} \) = Mean of individual variable of x
- \( S.D. \) = Standard deviation of variable

Composite mean Z-score is calculated as follows:

\[ CS = \frac{\sum z_{ij}}{N} \]

Where,
- \( CS \) = Composite mean z-score
- \( \sum z_{ij} \) = Z-score of a variable j in observation i,
- \( N \) = Number of variables.

**Organization of Work**

The entire work has been divided into six chapters. In the first chapter an assessment of physical and cultural settings with a brief account of historical background of Rohikhand plain have been made. Second chapter deals with general landuse pattern, crop concentration and crop combination regions of Rohilkhand plain. In the third chapter an attempt has been made to findout the spatial pattern of growth in area, production and yield for all the districts of Rohilkhand.

In the fourth chapter an assessment of agricultural productivity is made to know the high, medium and low productivity regions in Rohilkhand plain. In the fifth chapter correlation between the variables of agriculture and socio-economic development have been computed to know the regional imbalances in the districts of Rohilkhand plain.

Sixth and the last chapter is based on a comprehensive field survey of 37 villages from 37 tehsils belonging to eight districts of Rohilkhand plain. Total 440
households have been surveyed with the help of a questionnaire. This chapter deals with agriculture and socio-economic development in Rohilkhand plain. An attempt also made to know the levels of agriculture and socio-economic development.

The present study attempt to examines the existing levels of agricultural and socio-economic development in Rohilkhand region which spreads over the north-western part of the state of Uttar Pradesh. Administratively the region includes thirty seven tehsils of the districts of Bareilly, Budaun, Shahjahanpur, Pilibhit, Bijnor, Rampur, Moradabad and J.P. Nagar. The main findings of the research are based on computation of data collected through extensively field survey and empirical observations.

The landuse classification of Rohilkhand plain has been made with a view to derive maximum benefits from each type of land whether agricultural or non-agricultural.

Crop combination regions were worked out keeping in view the importance of integrated assemblage of various crops grown for planning purposes. It has been observed during the study periods i.e. 1985-90, 1991-96 and 1997-02 that crop combination ranges from two to three crops in the entire Rohilkhand plain.

The crop-wise growth computed on the basis of linear regression for each district in area, production and yield for the corresponding periods i.e. (1985-90, 1991-96 and 1997-02). It was evident that in all the districts of Rohilkhand plain, the crops of rice, wheat, sugarcane and potato showed a positive trend (in area, production and yield) with few exceptions. Pulses and oilseed crops, which occupy only about 10 per cent area, observed fluctuating trends in area, production and yield.

Agricultural productivity regions were worked out to delineate the general pattern of productivity in the districts of the region. A causal relationship between the variables of agriculture and socio-economic development shows, that of interdependence of different variables has decreased during the periods of 1985-90 to 1991-96 and again in 1997-02. The levels of agriculture and socio-economic development were worked out by using the data collected through extensive field surveys in thirty seven tehsils belonging to eight districts of Rohilkhand plain.
During the survey, it was observed, that the farmers of Rohilkhand plain are mostly illiterate and are easily exploited by government officials on matters related to land consolidation, land revenue and irrigation charges.

Land revenue is collected through a person designated as *Amin*. He issues receipts that do not follow the Gregorian and *Hizrior Vikrami* calendars, but merely a *Fasli* years. This calendar and the measurement units were started several hundred years back.

For example, according to the *Fasli* calendar, the year written is 1414, but how may farmers or others know this? As a result, many farmers do not even know for which year the revenue dues are being collected. The receipts issued are also not of standard size and are without stamp. Since *Amins* are unfamiliar faces to the villagers, in many cases there is no way to distinguish genuine person and fake person who issue the revenue receipts.

The method of collection of water charges for irrigation from canals, is also realized by the *Amin*. A person known as *Patrawal* issues a bill for inflicted amount. If the farmer pays some extra amount, he may even reduce the amount of bill. In the Shahbad tehsil, it was observed that, sometimes, the *patrawal* issues a general dues bill, calling it *sailab* (flood irrigation). It is most unfair, since farmers should be exempted from floods and not penalized to pay irrigation charges. Also, the pricing of water for irrigation is made on the basis total area irrigated, and not on the basis of total water consumed.

In fact, there may be a justification to decentralize all such functions, related to land revenue, irrigation charges etc. All such collections should be made by village *panchayats* to make the procedure safe and simple. Million of rupees are provided by the government to individual *panchayat* in the villages for various developmental works. The money is deposited by the government into the *panchayat*’s account. Likewise, the amount of revenue collected from the farmers can be deposited in the bank account which may be used for development works. This step is needed to protect many of the farmers from undue exploitation.

During the survey it was observed that in the implementation of National Rural Employment Guarantee Act (NREGH) and *Nirmal Gram Yojna* the corruption
is rampant. It was reported in many villages that not a single family member and relative of the Pradhan had worked on any site, yet, they all received wages for over 100 days (the minimum guarantee provided by the law) of work. Large amounts of money were being siphoned off in the name of material procurement.

Most persons are unaware of the legal entitlement of the Act. For instance, the Act mandates that any individual holding a job card can apply for work and will be provided an employment within 15 days with the submission of submitting application. If the applicant does not get work, he or she is entitled to unemployment allowance. It was noticed that in most of the villages not a single job application was received.

*Nirmal Gram Yojna* was launched mainly to improve the sanitation conditions, particularly for the construction of toilets in the houses. All the households of the village will get a sum of Rs. 900 from government for this purpose. All the amount is deposited in the joint account of pradhan (headman) and Gram Panchayat Adhikari. It is obvious that a sum of Rs. 900 are not sufficient for the construction of a toilet. Therefore, the owner of the house has to pay Rs. 400 to 500 to construct a toilet. Most of the villagers particularly belonging to OBC and S.C. were not really in position to pay this amount. Thus, pradhan and gram panchayat adhikari give them a sum ranging in between Rs. 500 and 600 for toilet construction just on papers.

Public vigilance and monitoring is the only way to sort out these problems. Social auditing involving activists, academics and policy makers is mandatory requirement. A social audit is a process through which citizens compare state’s reported expenditures of development works with the actual amount spent. Evidences are gathered through interactions with participants in development projects, verification of schemes and interviews with panchayat members and local officials. Findings are than shared with government officials. Social audits are mandatory under the NREGA.

Direct investigations of accounts by social audit can go a long way in identifying the misuse of funds. Moreover, the very act of interacting with labourers and organizing gram sabhas (village councils) on the NREGA and Nirmal Gram Yojna can strengthen awareness about the scheme. Social auditing has a potential to transform governance in Rohilkhand region of Uttar Pradesh.
During the survey it was observed that most of the residences of villages were electrified and on an average in between 60 and 70 per cent households were using electricity. But households were not have electric metres even in a single village. Though supply of electricity was less than 6 hours in 90 per cent villages. Government should develop a mechanism of electric revenue collection at least from farmers having medium and large holdings, and should ensure better electric supply in the villages.

Development block level extensive field surveys are needed in the districts of Rohilkhand plain to identify the potential areas. For instance, the Kaleen and zari work and some other small scale industries can be developed in the villages of Shahjahanpur district with the help of micro-financing to the natives of the villages. The Rohilkhand plain has achieved revolution in farming with the use of HYV of seeds. Now this region needs a soil revolution concurrent attention is needed to soil health care. Soil testing laboratories should be established in all the districts of Rohilkhand plain. Water harvesting technique should be developed particularly in those tehsils where crop of mentha is cultivated. Investment in rural infrastructure, particularly the layering of roads as well as storage and other marketing facilities. Funds are to be generated by abolishing schemes like Kanya Vidhya Dhan Yojuna and reducing subsidies to the farmers. The giving of subsidies are against the market reforms as they distort the market and reduce resource efficiency.

The Rohilkhand region needs building of new organizations like landuse advisory system based on integration of data from meteorological departments marketing advisory boards. In addition to this a market intelligence system is required in every district, which will help to safeguard the interests of farmers.

The use of organic manure can help achieving bumper yield and reducing the input cost. As it has been proved from the study conducted in Kothavasal village of Tiruvarur district in Tamil Nadu that by adopting organic farming cultivation cost of one hectare of rice can be reduced from Rs. 4,000 to 1,500. About 200 kg of farmyard manure and 40 kg of sea algae in one hectare of paddy are applied as manures both in the nursery and in the main field and about 500 ml. of liquid algae diluted in 400 litres of water is given as a foliar spray once in 15 days to the crop.