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Research Article

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Identification of Factors Influencing Yield Gap of Rapeseed and Mustard in Bihar (India) - A Micro Level Analysis

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ABSTRACT

Food insecurity is linked to low yields in the production, low investment in technology, and high transaction costs for local markets, as well as low wages and a high percentage of uneducated low-skilled workers in rural areas. The present investigation was carried out to estimate the yield gap and attempt has been made to know the factors affecting the yield gap in rapeseeds & mustard crop in the state of Bihar. Plot level data of Cost of Cultivation Scheme, GoI was used in the study for the year 2015-16. Simple regression analysis was applied to identify the factors influencing yield gaps. The result of the investigation revealed that variety of seed, irrigation and education level of the cultivators were the important and significant factors for the present yield gap, and addressing them about 54% variation in yield may be bridged.

Keywords: *Food insecurity, Yield gap, Rapeseed & Mustard, Regression*

INTRODUCTION

Oilseed crops are the second most important determinant of agricultural economy, next only to cereals within the segment of field crops. The self-sufficiency in oilseeds attained through "Yellow Revolution" during early 1990's, could not be sustained beyond a short period. Despite being the fifth largest oilseed crop producing country in the world, India is also one of the largest importers of vegetable oils today. There is a spurt in the vegetable oil consumption in recent years in respect of both edible as well as industrial usages.

The demand-supply gap in the edible oils has necessitated huge imports accounting for 60 per cent of the country's requirement (2016-17: import 14.01 million tonnes; cost Rs. 73,048 crore**)**. Despite commendable performance of domestic oilseeds production of the nine annual crops (Compound Annual Growth Rate of 3.89%), it could not match with the galloping rate of per capita demand (about 6%) due to enhanced per capita consumption (18 kg oil per annum) driven by increase in population and enhanced per capita income.

Total oilseeds production in the country during 2017-18 is estimated at 31.31 million tonnes which is marginally higher than the production of 31.28 million tonnes during 2016-17.

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However, the production of oilseeds during 2017-18 is higher by 1.76 million tonnes than the average oilseeds production.

Oilseeds occupy only 1.46% of gross cropped area (GCA) in Bihar during 2017-18. Marginal decline in productivity of total oilseeds was recorded during the period of 2013- 14 to 2017-18 by 0.6 percent. However, some selected oilseeds registered an increase castor (0.9 percent), safflower (0.4 percent), sunflower (0.3 percent), and sesame (0.1 percent). But the production and productivity of rapeseeds and mustard recorded decline of 2.92% and 1.30% per annum during the same period (Anonymous, 2018). Food insecurity is linked to low yields in the production, low investment in technology, and high transaction costs for local markets, as well as low wages and a high percentage of uneducated and low-skilled workers in rural areas.

Vegetable oil is the main source of fatty acids, which are vital for human nutrition. Oilseed sector plays an important role in agriculture and economy of India (DOR 2013). Oilseed crops are cultivated on poor and marginal soils primarily under rainfed conditions (Singh et al., 2013; Singh et al., 2014). This has resulted in poor realization of potential of improved varieties.

Yield gap is always a matter of prime concern for researcher and developmental stakeholders to ensure that real potential of any crop variety is harvested at the cultivator's field. In reality, a gap always prevails between potential yield and demonstration yield and further what is harvested at farmer's field. According to International Rice Research Institute, there are two components of yield gap i.e. yield gap-I which is defined as gap between potential yield and demonstration yield and yield gap-II which is defined as gap between demonstration yield and actual farm yield (Alam, 2006). The yield gap between demonstration and actual farm yield has failed to show appreciable reduction over the past two decades (Jha et al., 2011). There are number of empirical evidences of yield gap analysis in crops like rice, wheat cotton etc. (Aggrawal et al., 2008). A study was conducted by Kiresur et al., (2001) to analyze profitability and sustainability of improved oilseeds production technologies for eight annual oilseed crops. This study also estimated the yield gaps in all the crops. The facts emanating from those works were the reason of genesis of the present study. Bridging the yield gap aims not only helps to improve the efficiency capital and resources use but reduce production cost and increase food security.

MATERIALS AND METHODS

Data and its sources

The present study was mainly based on plot level data of Comprehensive Cost of Cultivation Scheme running in the state of Bihar for the year, 2015-16. Most of the required secondary data were obtained from official websites and different publications of government of Bihar and India.

Yield gap analysis

The nature and extent of the yield gaps in pulse crops in the state were analyzed using the following Gap-I and Gap-II equation in the percentage form.

Gap-I: It is the gap between potential yield (Y_P) of a variety and the yield in the demonstration field (Y_{df}) i.e.

Yield Gap-I (YG- I %)=$(Y_p - Y_{df})/Y_p \times 100$

Gap-II: Similarly, Yield gap-II is the difference between the yield of variety in the demonstration field (Y_{df}) and at farmers' field (Y_{ff}), i.e.

Yield Gap- II (YG- II %)=$(Y_{df} - Y_{ff})/Y_p \times 100$

In this investigation an attempt has been made to assess the exploitable yield reservoir in case of rapeseed & mustard using frontline demonstration data. But, the availability of the official record regarding frontline demonstration data for different districts threw limitation for the analysis. Thus, with the recent data available for rapeseed & mustard from different KVKs were collected and yield gap-I and yield gap II were computed.

The potential yield data of different varieties of the respective crops were collected from *Kisan Dairy published by Dr. Rajendra Prasad Central Agricultural University, Pusa*

(Samastipur), Bihar. The values used in this paper are the averages of all such data, which include different seasons, varieties and locations within a state

Simple linear regression model was used to estimate the factors affecting yield gaps in rapeseeds & mustard crop. The factors considered in the regression model were as follow:

Y_i = Yield gap-II (q/ha)

X_1= Amount of capital used in production excluding labour and seed

X_2 = Seed rate (kg/ha)

X3 = Human labour (Man-days/ha)

X_4= Mechanization Index (%)

X_5 = Family size (number)

X_6 = Ratio of area under crop to the gross cropped area

X_7= Age of the farmer (years)

X_8= If educated 1, otherwise 0

X_9 = If irrigated 1, otherwise 0

X_{10}= Variety (improved 1, otherwise 0)

RESULTS AND DISCUSSION

Table 1: Summary statistics of rapeseed & mustard

Crops	Mean Yield gap-II(%)	Min Yield. Gap-II(%)	Max. Yield Gap-II (%)	Standard Deviation	CV (%)
Rapeseeds & mustard	28.96	19.17	47.00	5.7	19.83

It was revealed from the analysis that there was mean yield gap of 28.96% in case of rapeseeds and mustard in the state during the study period. The coefficient of variation in yield gap was recorded to be 19.83%. The result of the investigation recorded a wide variation in yield of rapeseed and mustard due to varied agro-climatic situation and socio-economic constraints prevailing in the state.

Table 2: Determinants of yield gap in rapeseeds & mustard in Bihar

Variables	Coefficients	Standard Error	t-value
Intercept	4.635*	0.879	5.275
Amount of capital used in production excluding labour and seed (X_1)	0.000	0.000	-0.096
Seed rate (kg/ha) (X_2)	-0.048	0.171	-0.280
Human labour (Man-days/ha) (X_3)	0.001	0.004	0.128
Mechanization Index (%) (X_4)	-0.004	0.009	-0.419
Family size (number) (X_5)	0.015	0.015	0.964
Ratio of area under crop to the gross cropped area (X_6)	0.063	0.284	0.223
Age of the farmer (years) (X_7)	0.000	0.004	-0.107
If educated 1, otherwise 0 (X_8)	-0.307**	0.151	-2.035
If irrigated 1, otherwise 0 (X_9)	-0.271***	0.161	-1.683
Variety (improved 1, otherwise 0) (X_{10})	-0.880*	0.157	-5.594
R^2	0.534		

*, ** and *** denote level of significance at 1%, 5% and 10% level of probability

Simple regression analysis was carried out taking yield gap-II as dependent variable and amount of capital used in production excluding labour and seed (Rs/ha), Seed rate (kg/ha), Human labour (Man-days/ha), Mechanization Index (%), Family size (number), ratio of area under crop to the gross cropped area, Age of the farmer (years), education, irrigation and variety as independent variables. The result of the analysis is presented in Table 1. The table revealed the variety of seed, educational level of farmers and irrigation were the most important and significant factors which caused the yield gap in rapeseeds and mustard in the

state. Other variables like seed rate, mechanization, have negative impact of yield gap indicating that proper seed quantity, mechanization may be helpful in bridging the yield gap of rapeseed in mustard in the state. R^2 value indicated that about 54% variations in yield can be narrowed by taking into account of the above independent variables in the consideration. Other factors may be biotic and abiotic condition of the different agro-climatic zones of the state as well as resource poor conditions of the farming community as about 91% of the cultivators of the state are marginal and small.

CONCLUSION

It was revealed from the investigation that there was mean yield gap of 28.96% in case of rapeseeds and mustard in the state during the study period. The coefficient of variation in yield gap was recorded to be 19.83%. The result of the investigation recorded a wide variation in yield of rapeseed and mustard due to varied agro-climatic situation and socio-economic constraints prevailing in the state.

Simple regression analysis was carried out to identify the factors causing yield gap in rapeseed and mustard and it was found that the variety of seed, educational level of farmers and irrigation were the most important and significant factors which caused the yield gap in rapeseeds and mustard in the state. Other variables like seed rate, mechanization, have negative impact of yield gap indicating that proper seed quantity, mechanization may be helpful in bridging the yield gap of rapeseed in mustard in the state. R^2 value indicated that about 54% variations in yield can be narrowed by taking into account of the above independent variables in the consideration. Other factors may be biotic and abiotic condition of the different agro-climatic zones of the state as well as resource poor conditions of the farming community as about 91% of the cultivators of the state are marginal and small.

Note: The article is an outcome of Ph.D. research work carried out by first author

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