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Resource Use Efficiency of Major Field Crops in Reasi District of Jammu Region of Jammu and Kashmir State

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ABSTRACT

The present investigation conducted in the Reasi district of J&K state during the year 2015 has observed that the sample holding under study area comprise maize-wheat cropping system. By using Cobb-Douglas production function it is predicted that resource used in maize and wheat production like human labour, farmyard manure + fertilizer are underutilized indicating that there is further scope to increase their quantity which in turn will boost the returns. On the basis of regression analysis the value of regression coefficient of wheat for human labour, seed, FYM, urea, DAP and plant protection measures was 0.859, -0.321, 0.002, 0.067, 0.009 and 0.004 and for maize it was 0.522, -0.046, 0.095, 0.046, 0.016 and -0.015, respectively, which were found to be statistically significant. The positive sign indicated that one percent increase in the use of these inputs could increase the returns from crop. The negative sign shows that one percent additional expenditure on these inputs would reduce the return of crops. The marginal value productivity of farmyard manure and human labour of dry land wheat was positive and it was 0.312 and 1.231, respectively. This indicates that there still existed a scope to invest more on farmyard manure and human labour. The negative marginal value productivity estimated for seed at ₹ -5.150 showed that use of seed was more than optimum leading to fall in returns with each additional unit of this input. As far as maize is concerned, positive marginal value productivity of FYM, human labour, urea, DAP and pesticide indicates that there still existed a scope to invest more on these inputs. The negative marginal value productivity estimated for seed at ₹ -1.192 showed that use of seed was more than optimum leading to fall in returns with each additional unit of this input. The crop production function for wheat and maize with R^2 value at 0.74 and 0.87, respectively was statistically significant meaning thereby that 74% of wheat and 87% of maize production of this area was being explained by the mentioned variables in the study.

Keywords: Maize, wheat, resource use efficiency

Exhaustive use of natural and man-made resources increases pressure on natural systems and also on production and consumption systems in agriculture. As the urbanization is on increasing trend throughout the world, the distribution of the flow of energy, materials and waste is shifting on a large scale, and the quality of soil and water is under pressure which will definitely lead to difficult situation in coming days. Research on resource use efficiency is the only way to find out how to keep control on excess use of resources. The term 'resource use efficiency in agriculture' may be broadly defined to include the concepts of technical efficiency,

allocative efficiency and environmental efficiency. An efficient farmer allocates his land, labour, water and other resources in an optimal manner, so as to maximize his income, at least cost, on sustainable basis. However, there are countless studies showing that farmers often use their resources sub-optimally. While some farmers may attain maximum physical yield per unit of land at a high cost, some others achieve maximum profit per unit of inputs used. Also in the process of achieving maximum yield and returns, some farmers may ignore the environmentally adverse consequences, if any, of their resource use intensity (Haque, 2006). India constitutes about 2.4% of total geographical area of the world and land use classification based on different type of uses indicate that a little more than half of total land mass of 328.73 million hectare in the country is used for agriculture. As per the land use statistics, the acreage under different crops and the cropping pattern during the last two decades has shown a change. While the net sown area has come down from 143 million hectares in 1990-91 to 140.02 million hectares in 2009-10, the gross cropped area has gone up by 6 million ha, from 186 to 192.2 million ha during the same period due to increase in the cropping intensity from 130 to 137.3% (State of Indian Agriculture, 2012-13).

Like other states of India, agriculture is also base activity of J&K state contributing nearly 33% of the states income. Despite the importance of agriculture for ensuring inclusive growth and providing food security, the contribution of Agriculture towards Gross State Domestic Product (GSDP), is gradually decreasing from 28.06% in 2004-05 to 19.96% in 2012-13 due to various factors. Roughly 94% of the holdings fall in the size class of less than 2 hectares and around 81.5%, in less than 1 hectare (Economic Survey J&K, 2013-14). Reasi district of J&K state constitutes about 426.41% thousand acres of total geographical area of the state, in which the total cultivable area is about 33.23% thousand acres (2.32% thousand acres is irrigated and 30.91% thousand acres is rainfed). As far as maize crop is concerned, it is the main crop cultivated in reasi district. Area sown under maize was found to be about 22.545 thousand hectares during the year 2012-13 with the production of 324.54 thousand quintals. Wheat crop occupies an area of about 14.290 thousand hectares and production of 172.76 thousand quintals (Digest of Statistics, J&K, 2012-2013).

Keeping in view the importance of major field crops of Reasi district such as maize and wheat and use of resources in these crops, it become very important to study resource use efficiency with the objective to examine the resource use efficiency of major field crops.

MATERIALS AND METHODS

The present investigation entitled, *"Resource Use Efficiency of Major Field Crops in Reasi district of Jammu Region of Jammu and Kashmir State"*, was carried out during the year 2015.

Sampling structure

For the purpose of collection of relevant information from the study area, three stage sampling design was adopted. Blocks, villages and farmers formed the first, second and third stage units, respectively. Keeping in view the area under cultivation, all the four blocks (Reasi, Pouni, Arnas and Mahore) were selected from Reasi district and then from each block, two villages were selected randomly as secondary stage units. Than 15 farmers were selected randomly from each village of four blocks so as to constitute a total sample of 120 farmers from the whole area under study.

Analysis

Resource use efficiency is mainly concerned with the examination of the role of factors affecting productivity and their use of efficiency for the production of different crops in dry land ecologies. Gross value product per crop had been taken as the dependent variable whereas the use of area, seed, fertilizer, manure, plant protection measures, farm machinery expenses and expenditure on human labour had been taken as the explanatory variables. The log linear function was fitted to the data collected for production of maize-wheat in dry land area. Various combinations of variables were tried. The choice of the best equation was made on the basis of the value of R^2 explained and relevance of the expected sign of coefficients.

In order to study the relationship between output and various inputs used, Cobb-Douglas production function was used. This function is used extensively in agricultural production function analysis. The functional form applied was given as under:

$$y_t = \beta_0 \left(\prod_{i=1}^{n} X_i^{\beta_i} \right) u_t \qquad (i = 1,2,3 \ldots n)$$

Where, Y and X_i (I = 1, 2, 3,...n) are the output and level of inputs. The constant β_0 and β_i,'s (I = 1, 2, 3...n) represent

the efficiency parameters and the production elasticities of the respective input variables for the given population at a particular period, t.

The fitted Cobb-Douglas production may be written for the present case with six input variables as:

$$y = a_0 x_1^{b_1} x_2^{b_2} x_3^{b_3} \ldots x_6^{b_6}$$

On log transformation, the above function can be transformed to a linear form as:

$$\text{Log } y = \log a_{0+} b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + \ldots + b_6 \log x_6$$

Or,

Where y = Gross return (₹/ha

X_1 = Human Labour
X_2 = seed (₹/ha)
X_3 = FYM (₹/ha)
X_4 = Urea (₹/ha)
X_5 = DAP (₹/ha)
X_6 = Plant protection chemical (₹/ha)
b_1 ....., b_6 are the parameters to be estimated

Marginal value productivities (MVP) of resource used was worked out with the help of regression coefficient obtained from these crops. MVP of a particular resource represents the expected addition to the gross returns caused by the additional one unit of the resource input while the other input are held constant.

To examine the productivity of different inputs used in production of studied crops, marginal value productivities of inputs were estimated at geometric mean levels of inputs. To calculate Marginal Value Productivity (MVP) of resource x_i, the following formula had been used:

$$\text{MVP} = \hat{b}_i \frac{GM(Y)}{GM(Xi)}$$

Where MVP (x_i) is the Marginal Value Productivity of i^{th} resource.

$\hat{b}_i$ is the regression coefficient (estimated)

GM (Y) is the Geometric Mean of Output.

GM (X_i) is the Geometric Mean of Inputs.

RESULTS AND DISCUSSION

Regression function result and marginal value productivity of wheat

Yield of wheat was regressed on various factors of production viz., seed, FYM, urea, DAP and plant protection chemical. These variables were taken as the explanatory variables. The regression result pertaining to this is given in Table 1.

Table 1: Estimated regression coefficient of various factors, their standard error and MVP of wheat production

Variable	Regression coefficient	Standard error	MVP
Constant	-2.182	0.203	
Human Labour	0.859*	0.069	1.231
Seed	-0.321	0.135	-5.150
FYM	0.002	0.021	0.312
Urea	0.067*	0.018	0.021
DAP	0.009	0.013	0.525
Pesticide	0.004	0.100	0.314
Coefficient of Determination (R^2)	0.74**		
F-Value	54.56		

** Significant at 1% level of probability*
*** Significant at 5% level of probability*

The crop production function for wheat with R^2 value at 0.74 was statistically significant meaning thereby that 74% of wheat production of this area was being explained by the above-mentioned variables. Further, it is clear from the table that for wheat, urea and human labour were found to be significant at 1% level of probability. The value of regression coefficient for these variable were 0.067 and 0.859, respectively. The results further explained that regression coefficient of human labour, farmyard manure, urea, DAP and plant protection chemical with positive sign indicated that one percent increase in use of these inputs after keeping the use of all other inputs constant, the return of crop could increase by 0.859%, 0.002%, 0.067%, 0.009% and 0.004%, respectively. The negative sign of the regression coefficient of seed in the function showed that one percent additional expenditure on the use of seed would reduce the return of wheat by 0.321%. Similar finding were observed by Kumar and Kumar

(2004). This showed that this input was being excessively used at present and thus the additional use of this input should be checked immediately so as to avoid any further fall in the return of wheat.

Table 2: Estimated regression coefficient of various factors, their standard error and MVP of maize production

Variable	Regression coefficient	Standard error	MVP
Constant	-1.114	0.226	
Human Labour	0.522	0.070	1.156
Seed	-0.046*	0.065	-1.192
FYM	0.095*	0.045	0.032
Urea	0.046*	0.018	0.025
DAP	0.016*	0.016	0.014
Pesticide	-0.015	0.014	0.212
Coefficient of Determination (R^2)	0.87		
F- Value	20.87		

** Significant at 1% level of probability*

*** Significant at 5% level of probability*

Further, it could be seen that the positive marginal value productivity of human labour (1.231), FYM (0.312), urea (0.021), DAP (0.525) and plant protection chemical (0.314) of wheat crop indicated that an additional rupee one spent on area. Thus there was a scope to invest more on human labour, farmyard manure, urea, DAP and plant protection chemical. But, in maize production, use of farmyard manure depends on rainfall. Thus there seemed to very little scope to increase more farmyard manure and fertilizer application in maize production. Similar finding were observed by Kumar and Kumar (2004). The negative marginal value productivity estimated for seed at ₹ -5.150 showed that use of seed was more than optimum leading to fall in returns with each additional unit of this input.

Regression function result and marginal value productivity of maize

The yield of maize was regressed on various factors of production viz human labour, seed, FYM, urea, DAP and plant protection chemical taken as the explanatory variables. The perusal of data depicted in table 2 depicted R^2 value 0.87 as statistically significant meaning thereby that 87% of variation in maize production was due to above mentioned variables. Table further indicated that the regression coefficient of seed, FYM, urea, DAP of maize was found to be significant at 5% level of probability. Human labour and plant protection chemical were found to be non-significant and their values were 0.522, and -0.015, respectively.

Further human labour, farmyard manure, urea, DAP were with positive regression coefficient whereas plant protection chemical has negative. The regression coefficient of the labour was, however, positive (0.522) but non-significant, where for plant protection chemical variable it was negatively non significant. The negative sign of the regression coefficient of seed in the function showed that one percent additional expenditure on the use of seed would reduce the return of maize by 0.046%. This showed that seed was being excessively used at present and thus the additional use of this input should be checked immediately so as to avoid any further fall in the yield maize.

Similar findings were observed by Singh (2011) and Kumar and Kumar (2004). The marginal value productivity of human labour, farmyard manure, urea, DAP and plant protection chemical was positive with its value at 1.156, 0.032, 0.025, 0.014 and 0.212, respectively. This indication that there still existed a scope to invest more on these inputs. The negative marginal value productivity estimated for seed ₹ -1.192 showed that use of seed and more than optimal leading to fall in return with each additional unit of this input by the marginal value productivity of the respective input. Similar finding were observed by Kumar and Kumar (2004).

CONCLUSION

It is concluded that the sample holding under dryland ecosystem comprise maize – wheat cropping system, respectively. By using Cobb-Douglas production function, it was found that the resources used in maize and wheat production like seed, FYM, urea and DAP are underutilized indicating that there is further scope to increase their quantity which in turn will boost the returns.

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