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Economic Analysis of Inputs Use Pattern in Wheat Crop and Constraints Faced by Farmers in Irrigated Zone of Haryana, India

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A B S T R A C T

This study pertained to the irrigated zone of Haryana state The study based on the data collected under the comprehensive scheme to study the cost of cultivation of wheat crop. Under this scheme from each of the 30 centers the data from ten farmers representing 5 size holdings that were upto 1 ha, 1 to 2 ha, 2 to 4 ha, 4 to 6 ha and above 6 ha were collected by the Agriculture Inspectors in different zones. Thus, in all data from sample size of three hundred farmers were collected. The inputs included in this study are seed, irrigation, fertilizer, insecticide, pesticide and herbicide. Each size of holding represent a sample of 60 farmers. The present study was related to agricultural year 2013-14. Data related to actual use of inputs in the wheat crop on each size of holding and in irrigated zone has been tabulated and presented in absolute as well as percentage form in simple and cross tables. The quantity and value of different inputs used per ha in all five size of holding in irrigated zone are presented. The state average for all the inputs used are also calculated. The actual input use has been compared crop-wise with the recommended dose to find out gap. To estimate the response of the input in the wheat crops grown on the farms, the Cobb-Douglas production function was used. The marginal value productivities of all the inputs (at their mean levels) were estimated by taking partial derivative of the production of the concerned crop and multiplying with the price of its output.

Introduction

India is the second largest producer of wheat after China. India produces about 70 million tonnes of wheat per year or about 13.2 % of world production. The productivity of wheat in India is second highest with 3075 kg/ ha compared to 3830 kg/ha in China. India harvested record wheat of about 94.9 million tonnes in 2011-12 from an area of 29.9 million ha. But in year 2012-13, the production of wheat remains 3 % lower to 92.3 million tonnes with 4.31 million ha decline in area and slightly lower yield due to less availability of irrigation, comparing this year.

Being the second largest in population, it is also the second largest in wheat consumption after China, with a huge and growing wheat demand. Wheat, being the second most important staple food of the country after rice, deserves the due attention. About 60 % of wheat output is contributed by North West India comprising the states of Punjab,

Haryana, Rajasthan and western UP. In this part of the country, two cropping systems namely rice- wheat and cotton- wheat contribute maximum to the wheat production. Combinedly both these systems add up roughly to 12 million ha area but the major part falls under North-West India (Annual Progress Report, 2002-03, Resource Management, Vol - II, DWR, Karnal). Wheat is grown in all the states in India except Southern and north eastern states. Uttar Pradesh, Haryana, Punjab and Rajasthan are the major wheat producing states and accounts for almost 80 % of total production in India. Only 13 % area is rainfed. Major rainfed wheat areas are in Madhya Pradesh, Gujarat, Maharashtra, West Bengal and Karnataka. Central and Peninsular Zone accounts for total 1/3rd of wheat area in India. All India basis only 1/3rd irrigated wheat receives desired irrigations and remaining is grown in limited irrigation only. Haryana contributes 13.3 % towards national production of wheat from the 8.9 % of wheat growing area of the country, with an average productivity of 4 tonnes per hectare. The area, production and productivity over last five years are 2.3 million ha, 9.3 tonnes and 4 tonnes per hectare respectively. The trend during last five years has shown marginal decline in production and productivity from nearly stable area of cultivation. Wheat production in the state is constant due to reduced soil organic carbon status, nutrient mining, imbalanced fertilization, crop residue burning leading to nutrient and organic carbon loss and declining water table.

The use of inputs in wheat depends largely on the availability of irrigation facilities and working capital with the farmers for acquiring the purchased inputs. As the small and marginal farmers have inadequate capital base, the non-availability of adequate credit may be a problem in exploiting the production potentials by them. The farmers have different attitudes for different crops grown on the farm regarding to application of inputs. This may be influenced by the relative profitability of the crops, degree of yield and price risks involved and the personal likings and consumption needs of the farm family. Thus, institutional, financial and behavioral constraints condition the farmer's decisions concerning his farm practices in general and to different use of inputs in particular. These constraints must be evaluated for the level of their incidence and their impact of input use at farm level. Such a study is all the more important to keep up our farm production targets.

Materials and Methods

The present study covers the irrigated zone of Haryana state. The study is based on the data collected under the comprehensive scheme to study the cost of cultivation of wheat crop out of seven principal crops (cotton, paddy, bajra, sugarcane, wheat, mustard and gram) of Haryana state. The data of input use, costs and return for wheat crop was taken for the study. Under this scheme from each of the 11 centers, the data from 10 farmers representing five size holdings i.e. upto 1 ha, 1 to 2 ha, 2 to 4 ha, 4 to 6 ha and above 6 ha were collected by the Agriculture Inspectors in different zones. The input used in wheat crop from the irrigated zone on different categories of farms were taken for the study and the inputs were seed, irrigation, fertilizer, insecticide, pesticide and herbicide. Each size of holding represent a sample of 60 farmers. The present study was related to agricultural year 2013-14.

Analysis of Data

Existing input use pattern

Data related to actual use of inputs in the wheat crop on each size of holding and in irrigated zone has been tabulated by using simple tabular method of analysis and results

were presented in absolute as well as percentage form in simple and cross tables. The quantity and value of different inputs used per ha in all five size of holding were presented. The state average for all the inputs used were also calculated. The actual input use has been compared size of holding wise with the recommended dose of inputs to find out gap in input use.

One way to determine which inputs were crucial in the production of wheat output was to calculate elasticities of wheat output with respect to these inputs. These elasticities were estimated by using a production function with an appropriate functional form. For this purpose in the current study a Cobb-Douglas production function was used to estimate the elasticities. This specification has the advantage that it yields direct estimates of production elasticities with respect to various inputs.

$Y = ax_1^{b1}x_2^{b2} x_3^{b3} x_4^{b4} x_5^{b5}$

Where dependent variable Y = Total output
x_1 = seeds
x_2 = irrigation
x_3 = insecticide
x_4 = pesticide
x_5 = fertilizer
a = constant
b = elasticity coefficients (i = 1……5)

The marginal value productivities of all the inputs (at their mean levels) were estimated by taking partial derivative of the production of the concerned crop and multiplying with the price of its output.

Results and Discussion

Overall existing use pattern of inputs

The overall existing status of input use in wheat crop in irrigated zone of Haryana has been summarized in Table 1 to give a picture at a glance. The quantity as well as value of all the inputs used per hectare is summarized.

Overall gap in input use in wheat crop in Haryana

In case of overall gap of the state the maximum gap has been observed in insecticide and minimum in herbicides. The Table 2 shows the overall gap in input use in wheat crop in Haryana.

Wheat Output Per hectare

Wheat output per hectare for each category was found by dividing total wheat output in quintals by total acreage in hectares.

Main product per hectare

It is evident from the Table 3 quantity of main product produced in irrigated zone was 46.46 qtl/ha which was more than the state average. As regards the state average the main product was 45.61 qtl/ha.

The values of the output per hactare in rupees were also mentioned in each category and in each zone. The value depends upon the quantity of the main product produced in each zone and each category.

By-product per hectare

It was evident from the Table 4 quantity of by-product produced in irrigated zone (48.84 qtl/ha) was more than the state average. As regards the state average the by product was 47.61 qtl/ ha. The values of the output per ha in rupees are also mentioned in each category and in each zone. The value depends upon the quantity of the main product produced in each zone and each category. Similar findings were also reported by John (2009) and Asodiya *et al.,* (2014).

Table.1 Existing use of inputs in wheat crop on different size of holdings. (Value in rs.)

Inputs	Irrigated Zone		State average	
	Qty	Value	Qty	Value
Seed (kg/ha)	113.00	2034	113.47	2042
No. of Irrigation	4	2065	5	2987
Nitrogen (kg/ha)	165.33	1985	143.67	1716
Phosphorus (kg/ha)	57.11	2569	57.25	2576
Zn sulphate (kg/ha)	10.18	285	14.03	393
FYM (qtl/ha)	19.80	495	18.78	468
Herbicide for broadleaved weeds (kg/ha)	0.59	147	0.54	137
Herbicide for narrow leaved weeds (kg/ha)	1.59	923	1.55	897
Insecticide(gms/ha)	170.76	53	159.99	50
Pesticide(gms/ha)	281.08	281	281.2	281

Table.2 Overall gap in input use in wheat crop in Haryana

Inputs	Existing	Recommended	Gap
Seed (kg/ha)	113.47	115.15	- 1.68
Irrigation	5	5	0
Nitrogen (kg/ha)	143.67	150	- 6.33
Phosphorus (kg/ha)	57.25	60	- 2.75
Zn sulphate (kg/ha)	14.03	25	- 10.97
FYM (qtl/ha)	18.73	25	- 6.27
Herbicide for broad leaved weeds (kg/ha)	0.54	0.75	- 0.21
Herbicide for narrow leaved weeds (kg/ha)	1.55	2	- 0.45
Insecticide(gms/ha)	159.99	172.5	- 12.51
Pesticide (gms/ha)	281.00	282.50	- 1.50

Table.3 Main product of wheat crop in irrigated zone (Rs. ha^{-1})

Size of holding	Irrigated Zone		State average	
	Qty	Value	Qty	Value
Upto 1 ha	46.22	64708	44.86	62804
1-2 ha	45.34	63476	44.92	62916
2-4 ha	46.39	64946	44.88	62832
4-6 ha	47.25	66150	45.75	64050
Above 6 ha	47.11	65954	45.99	64854
Average	46.46	65044	45.61	63854

Qty in qtl/ha

Table.4 By-product produced in irrigated zone in wheat crop (Rs. ha^{-1})

Size of holding	Irrigated Zone		State average	
	Qty	value	Qty	Value
Upto 1 ha	44.50	20691	45.99	19177
1-2 ha	47.39	19809	47.21	19686
2-4 ha	48.46	20256	47.14	19657
4-6 ha	49.50	20691	47.65	19870
Above 6 ha	49.36	20632	48.41	20186
Average	48.84	20415	47.61	19489

Qty in qtl/ha

Table.5 Marginal value productivity of inputs used in wheat crop

Inputs	Marginal value productivity (`/ kg of inputs)
Seed	35
Irrigation	1500
Nitrogen	21
Phosphorus	56
Insecticide	370
Pesticide	1075

Table.6 Existing and optimum levels of input use in wheat crop

Inputs	Existing level	Optimum level
Seed (kg/ha)	113.47	117.15
Irrigation	5	6
Nitrogen (kg/ha)	143.67	151.66
Phosphorus (kg/ha)	57.25	59.45
Insecticide(gms/seed used)	159.99	175.50
Pesticide	281.00	286.86

Table.7 Constraints faced by farmers in input use in Haryana

Sr. no.	Constraints	Irrigated Zone	State Average
1	Non-availability of irrigation facilities	76(76)	202(77)
2	Non-availability of funds	67 (67)	196(75)
3	Unfavorable climatic condition	35 (35)	104(40)
4	Lack of technical knowledge	19 (19)	71(27)
5	Non-availability of fertilizers at right time	31 (31)	92(35)
6	Imperfect knowledge about fertilizers	41 (41)	106(40)
7	Non-availability of labour	29 (29)	88(34)
8	Non-availability of good quality weedicides	31 (31)	87(33)
9	Non-availability of good quality pesticides	33 (33)	85(32)
10	Non-availability of good quality insecticides	33 (33)	85(32)
11	Non-availability of adequate good quality seed	15 (15)	57(22)
12	High prices of fertilizers	16 (16)	53(20)

Figures in the parentheses indicate the percentage to total number of sample farmers

Marginal value of productivity of inputs in wheat crop

The marginal value productivities of all the inputs (at their mean levels) were estimated by taking partial derivative of the production of the concerned crop and multiplying with the price of its output and have been presented in the Table 5.

Optimum levels of inputs

For the maximizing profits**,** resources should be applied upto the level where marginal value product is equal to the cost of the resources. However, this criteria is valid only if the resources with the farmers are available in plenty. Only the financially sound farmers may opt for the profit maximizing situation. However due to various risks associated with the agricultural production and capital rationing, many farmers may like to keep the level of MVPs substantially higher than the marginal factor cost. The optimum and existing levels of input application in wheat crop are presented in Table 6. The existing level of seed use per hactare in wheat crop is 113.47 kg which has to be increased to 117.15 kg under optimum level. In case of irrigation the existing level was 4 and optimum level was 6. In case of nitrogen and phosphorus the existing levels are 143.67 and 57.25 which has to be increased to 151.66 and 59.66 kg respectively. The existing level of insecticide use is 159.99 g which has to be increased to 175.50 under optimum level. In case of pesticide the use, the existing level is 281.00 which increased to 286.86 under optimum level. Similar findings were also reported by John (2009) and Asodiya *et al.,* (2014).

Constraints faced by the farmers in input use in wheat crop

The study had showed that 77 % of the sample farmers did not used recommended doses of inputs due to lack of irrigation facilities in the state. Whereas about 75 % of the sample farmers did not used recommended dose of inputs due to non-availability of funds. About 40 % of the sample farmers expressed the view that they did not used recommended dose of inputs due to unfavorable climatic conditions. Due to lack of technical knowledge, 27 % of the sample farmers did not used recommended dose of inputs. About 35 % of the sample farmers in expressed that they don't got fertilizer at right time. About 40 % of the sample farmers have imperfect knowledge about fertilizers in the state. About 34 % of the sample farmers did not used recommended dose of inputs due to non-availability of labour. Whereas about 33 % of the sample farmers did not used recommended dose of inputs due to non-availability of good quality weedicides. Whereas about 32 % of the sample farmers did not used recommended dose of inputs due to non-availability of good quality of insecticides and pesticides. About 22 % of the sample farmers did not used recommended dose of inputs due to non-availability of good quality seed. Due to high prices of fertilizers 20 % of the sample farmers did not used recommended dose of inputs. Sasa *et al.,* (2010) found that Serbian agricultural producers were currently facing a large number of challenges which had a significant influence on their business activities. Continuous monitoring and evaluation of existing family farms business activities was the only way to improve their profitability and enhance competitiveness in such conditions. Bearing this in mind, the objective of their research was to emphasize an importance of the economic analysis of wheat production on family farms and to contribute successfully to the formulation of the answers to questions if and under which conditions the wheat production is profitable. In order to have a complete insight into investigated problem

subject, investigations were carried out on selected family farms. Collected data were processed using calculation procedure for the purpose of determination of main economical indicators of the success of wheat production. Based on realized financial results they concluded that with the selling price of 10,000.00 dinars per tonne, only family farms which have achieved yield of over 7.5 t/ha with adequate level of investments were profitable. Since realized average yield of wheat on family farms in the Republic of Kumar *et al.,* in 2009 was 3.58 t/ha and level of investment necessary for realisation of this yield, it was clear that the majority of family farms had loss in wheat production. The results of this study suggest that the economic status of the wheat production depends on the yield and achieved sales price, as well as on the amount of applied production factors and price level for their purchasing.

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