



Resource use efficiency and constraints in cultivation of maize in Haryana

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ABSTRACT

The study was carried out during 2019 to determine the resource use efficiency and constraints faced in *kharif* maize growers in Karnal and Yamunanagar districts of Haryana. The experiment was conducted by surveying 60 maize cultivators selecting 30 respondents from each i.e. Karnal and Yamunanagar districts. Maize growers were personally interacted to extract relevant information. Cobb- Douglas production function was used to determine the resource use efficiency of maize cultivation to find out the most significant factor which influences the respondent; Henry Garrett's (1969) ranking technique was used. For optimal allocation of resource, it was observed that all the inputs in both the districts were less than unity, which indicates that all these inputs were over utilized in the respective district. It reflects that all the inputs were over utilized and use of these inputs needs to be curtailed to attain higher returns. Major constraints were watch and ward required to protect the crop from stray animals, lack of availability of suitable machines for threshing of maize, lack of availability of maize dryers and lack of availability of quality seed of recommended maize hybrids as specified by the maize growers.

Keywords: Constraints, Maize, Optimum allocation, Resource

The Haryana state is at crossroad with respect to agriculture. Agricultural growth based on wheat and paddy has stagnated, leading to stability in incomes from agriculture. Environmental concerns have been escalating, particularly relating to high level and imbalance use of chemical fertilizers, decline in the water table, and loss of land to salinity and water logging especially in the eastern zone of Haryana. In wheat-paddy rotation, paddy is more resource depleting crop and inefficiencies in its production are larger in the case of the small farmers (Kataria and Melkani 2014). Maize is cultivated on an area of 9.72 million ha in India with production of 28.64 million tonnes in 2019-20 (4th Advance Estimate) making maize as the third most important food grain after wheat and rice.

Haryana unlike the rest of India had traditionally been a maize growing state until rice became popular. The maize production in Haryana in 2019–20 was 17 thousand tonnes, and the total area under the crop was 6.0 thousand ha with productivity of 2833 kg/ha. Kharif maize is sown normally during the end of May to end of June and is harvested in the months of September-October. A number of efforts had been made to bring about technological breakthrough

to improve the productivity of maize. In spite of this, the area under maize depicted a continuous decline during the Post-green revolution period. The decline in maize-acreage was mainly caused by the advent of HYVs of rice (Singh *et. al.* 2003). The favorable agricultural policies promote the cultivation of maize as replacement crop to paddy in Haryana. State Government in recent times identified areas to promote maize crop by providing production incentives as well as procurement at MSP to arrest the depletion of groundwater. However, maize cultivation in the state is facing certain constraints which have proved detrimental to the rise in its growth in Haryana. In the back drop of this, the present study is initiated to examine extent of resource use and constraints in cultivation of maize in the state.

MATERIALS AND METHODS

In order to achieve the stipulated objectives, present experiment was conducted in Haryana state. Multi-stage sampling technique was followed for the selection of the study sample. Two districts with highest concentration of area under maize crop for the year 2019 was selected, viz. Karnal and Yamunanagar. From each district two blocks were selected after that one village from each selected block. 15 farmers were randomly selected from cluster of villages from each of these four blocks. Hence, a total of 60 farmers constituted sample size. A comprehensive schedule was prepared for the collection of information from the respondents keeping in view the objectives of the study.

Analytical tools: Cobb-Douglas function was employed with five exogenous variables i.e. human labour (X_1),

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machine labour (X_2), seed (X_3), fertilizer (X_4) and plant protection (X_5) in monetary term. The model adopted was as follows;

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + \ln \mu$
 $Y = \text{Returns (ha}^{-1}\text{)}; a = \text{Intercept}; X_1 = \text{Human labour}; X_2 = \text{Machine labour}; X_3 = \text{Seed}; X_4 = \text{fertilizer}; X_5 = \text{Plant protection}; b_1 \text{ to } b_5 = \text{Respective elasticity co-efficients.}$

Returns to scale (RTS) was calculated by summing production elasticities of all the inputs ($\sum b_i$). If, $\sum b_i = 1$, $\sum b_i > 1$ and $\sum b_i < 1$ it indicates constant, increasing and decreasing returns to scale. Marginal value productivity (MVP) indicates the expected increase in gross returns forthcoming from the use of an additional unit of relevant input, while the level of other inputs remaining unchanged.

A resource or input factor is considered to be used most efficiently if its marginal value product (MVP) is just sufficient to offset its input marginal cost (IMC). Equality of MVP to factor cost is the basic condition that must be satisfied for resource use efficiently. If the ratio of MVP to IMC is less than one, it indicates that excess use of the particular resource is being used under the existing price conditions and vice versa. A list of all the important constraints in maize was prepared with various studies, interaction with scientists, development officials, progressive farmers etc. Thus, opinions of 60 respondents were recorded to elicit the major constraints in the cultivation of maize. The collected data were tabulated and analysed using Garrett ranking technique to interpret the obtained result.

Garrett's Ranking Technique: To find out the most significant factor which influences the respondent, Henry Garrett's (1969) ranking technique was used. As per this method, respondents have been asked to assign the rank for each constraints and the outcome of such ranking has been converted into score value as;

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

where R_{ij} = Rank given for the i^{th} variable by j^{th} respondents;
 N_j = Number of variable ranked by j^{th} respondents.

With the help of Garrett's table, the per cent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor. The final ranking of the factor in order to fix their relative priority was done on the basis of their mean score.

RESULTS AND DISCUSSION

Resource Use Efficiency of kharif maize: The wisdom of cultivator lies on level of use of resources, procurement purchase at reasonable price, timely application and trail up recommended agronomic practices for realizing higher returns from cultivation of farm enterprise. The resource use analysis give an idea about usage of scarceresources and needs to improve the use of particular resource for increasing returns from farm business.

Therefore, based on data collected from *kharif* maize growers Cobb Douglas production function was employed to determine the efficiency level of individual resource used. The resources like human labour, machine hour, seed, fertilizer and plant protection were identified as major contributing exogenous variables in cultivation of maize. The production function analysis fitted for resource use in study area reveals that the regression co-efficient of machine hour, seed and fertilizer resources in Karnal, machine hour and fertilizer cost in Yamunanagar and human labour and seed cost in overall were positive. Human labour and plant protection in Karnal, human labour, seed and plant protection in Yamunanagar and machine hour, fertilizer and plant protection in overall were found negative (Table 1). In Karnal, Yamunanagar and overall machine hour, seed, fertilizers, human labour, were found to be statistically significant at 5% level. This implied that every five per cent increase in these inputs would increase return from maize cultivation by 0.05, 0.04 and 0.11% for Karnal, 0.002, and 0.034% for Yamunanagar and 0.003 and 0.63 for overall, respectively. Whereas all other resource coefficients were non-significant indicating that expenditure on these inputs were of not much effect on total returns attained from cultivation of maize. The summation of regression coefficients worked out for Karnal, Yamunanagar districts and overall to be 0.11, -0.13 and 0.51, respectively indicates decreasing returns to scale. The estimated co-efficient of multiple determinations (R^2) revealed that selected inputs (human labour, machine labour, seed, fertilizers and plant protection) were capable of explaining 58.42, 18.60 and 76.12% variation in production of maize in Karnal, Yanunanagar districts and overall, respectively. This is in line with Hasan, 2008 and Shehu *et al.* 2017.

The ratio of MVP to MFC for inputs like human labour (-0.33), machine hour (0.06), seed (0.09), fertilizer (0.11) and plant protection (-0.10) for Karnal district and human labour (-0.14), machine hours (0.02), seed cost (-2.31), fertilizer cost (0.77) and plant protection (-2.09) for Yamunanagar district and human labour (0.03), machine hour (-0.04), fertilizer (-2.51) and plant protection (-0.62) for overall were less than unity. It indicates that all these inputs were over utilized in the respective districts and overall. It reflects that all the inputs were over utilized and use of these inputs needs to be curtailed to higher returns. There was ample scope for exploitation the use of these resources to maximize the production and to increase the gross returns. It is imperative from the study that optimum use of over utilized inputs caused in reduction of expenses incurred which is in line with Dahal and Rijal 2019.

Constraints faced by maize growers in Haryana: The analysis reveals that watch and ward required to protecting the crop from stray animals ranked first in Karnal, Yamunanagar, and overall basis with an average score 77.90, 77.50, and 77.70 followed by lack of availability of suitable machines for threshing of maize in Karnal and overall basis and third rank in Yamunanagar district with an average score of 75.20, 74.00 and 72.80, respectively.

Table 1 Resource use efficiency of *kharif* maize

Item	Coefficients	Karnal district				R
		Geometric mean	MVP	MFC	MVP/MFC	
Human labour	-0.04	11521.65	-0.33	1	-0.33	Over utilized
Machine hours	0.05	10054.24	0.06	1	0.06	Over utilized
Seed	0.04	4421.06	0.09	1	0.09	Over utilized
Fertilizer	0.11	4049.39	0.11	1	0.11	Over utilized
Plant protection	-0.05	1892.77	-0.10	1	-0.10	Over utilized
R-square value	0.5842					
RTS = $\sum bi$		0.11 Increasing return to scale, (under-utilization of resources)				
		<i>Yamunanagar district</i>				
Human labour	-0.017	11258.61	-0.14	1	-0.14	Over utilized
Machine hour	0.002	11568.73	0.02	1	0.02	Over utilized
Seed	-0.103	4143.31	-2.31	1	-2.31	Over utilized
Fertilizer	0.034	4108.25	0.77	1	0.77	Over utilized
Plant protection	-0.041	1829.76	-2.09	1	-2.09	Over utilized
R-square value	0.186					
RTS = $\sum bi$		-13 Increasing return to scale, (under-utilization of resources)				
		<i>Overall</i>				
Human labour	0.003	11389.37	0.025	1	0.03	Over utilized
Machine hour	-0.004	10784.93	-0.036	1	-0.04	Over utilized
Seed	0.633	4279.93	14.171	1	14.17	Under utilized
Fertilizer	-0.107	4078.71	-2.514	1	-2.51	Over utilized
Plant protection	-0.012	1861.00	-0.618	1	-0.62	Over utilized
R-square value	0.7612					
RTS = $\sum bi$		0.51				

Table 2 Constraints faced by the maize growers in Haryana

Item	Karnal		Y/Nagar		Overall	
	Average score	Rank	Average score	Rank	Average score	Rank
Non- availability of quality seed of recommended maize hybrids	61.37	4	61.27	4	61.32	4
Higher expenses incurred on maize hybrid seed	51.40	7	52.87	7	52.13	7
Watch and ward to protect the crop from stray animals	77.90	1	77.50	1	77.70	1
Lack of availability of suitable machines for threshing of maize	75.20	2	72.80	3	74.00	2
Non- availability of dryers for maize produce (Cob)	72.60	3	74.20	2	73.40	3
Scarcity of labour for harvesting of maize harvesting is done by machines	56.27	6	54.00	6	55.13	6
Less number of buyers in market for maize produce	57.73	5	57.60	5	57.67	5
Absence of govt. agencies in market for procurement	49.70	8	50.87	8	50.28	8
Higher returns from paddy	45.37	9	46.70	9	46.03	9
Higher nutrients uptake by maize than paddy from soil	36.17	10	35.50	11	35.83	10
Prevalence of less harvest price than MSP	26.93	13	30.90	12	28.92	13
Problem in spraying of pesticides	20.93	14	19.40	14	20.17	14

Lack of availability of dryers for maize produce (Cob) ranked third in Karnal and overall basis and second rank in Yamunanagar district with an average score of 72.60, 73.40 and 74.20, respectively. Lack of availability of quality seed of recommended maize hybrids ranked fourth in both the districts and overall basis which is in line with study conducted by Chahal and Kataria 2010.

On overall basis lack of buyers in market for maize produce ranked 5th with an average score of 57.67 followed by scarcity of labour for harvesting of maize, higher expenses incurred on maize hybrid seed, lack of presence of govt. agencies in market for procurement and higher returns from paddy paddy ranked 6th, 7th, 8th and 9th with an average score of 55.13, 52.13, 50.28 and 46.03, respectively. In addition to this there were higher nutrients uptake in maize cultivation from soil ranked 10th with an average score of 35.83 followed by less harvest price than MSP and problem in spraying of pesticides in maize ranked 11th and 12th position with an average score of 28.92 and 20.17, respectively (Table 2) which is in line with study conducted by Krishna *et al.* 2018.

From the above discussion it may be concluded that the resource use efficiency in production of maize was observed to be over utilized in respect to all the inputs in both the districts. It is concluded that these inputs needs to be curtailed to higher returns. Though the farmers were facing a number of constraints the major ones were watch and ward, lack of availability of suitable machines for threshing of maize, lack of availability of dryers for maize produce, lack of availability of quality seed of recommended maize hybrids. Most of the constraints perceived by the farmers were administrative in nature, which require government intervention. The procurement arrangement at MSP, production incentives in term of inputs and farm machinery are required to promote maize for replacement of paddy particularly in water starving areas and to avoid

depletion of ground water. Arrangement of essential inputs like quality seed and timely dissemination of agronomic practices for cultivation of maize is of utmost prominence for increasing acreage under maize in the state.

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