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Resource use efficiency and economic potential of barley cultivation in Haryana

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Abstract

The present study was conducted during 2023-24 in two districts namely, Rewari and Mahindergarh from south west Haryana with the objective to analyze the profitability, resource use efficiency and constraints faced by barley farmers. Budgeting technique was employed to draw practical implications, production function technique was used for measure the extent of resource use in barley cultivation for taking policy decisions to encourage its cultivation in Haryana. The result of the study revealed that overall average per hectare total cost of cultivation was Rs. 69940. The overall average gross return was Rs. 83638 per hectare. The return over variable cost and net return were Rs. 45808 and RS 13698 per hectare, respectively. Moreover, the value of overall B: C ratio over variable and total cost was 2.21 & 1.20 respectively which indicated the economic viability of barley crop in the study area. The value of the coefficient of multiple determination indicated that 46.69 percent of variation in the total gross income of barley cultivation was explained by explanatory variables included in the model. The efficiency ratio of the input, machine, chemical fertilizers, plant protection and irrigation were greater than one indication that the user of these were under-utilized, while human labour and seed cost but were less than one which indicated over utilization of these resources. Major constraints were less profitable as compared to completing crops (92%) low consumption of barley as staple food (88%), poor fodder quality (84%), Low processing units in local area (82%) and less availability of improved varieties without husk (72%).

Keywords: Resource use efficiency, barley, production function, B: C ratio, constraints

Introduction

Barley (*Hordeum Vulgare* L.) is one of the oldest cultivated crop, holds considerable importance in global agriculture due to its adaptability to diverse climatic conditions and its versatile applications. The crop is considered as poor man's crop because of its low input requirement and better adaptability to drought, salinity, alkalinity and marginal lands. It is not only useful for malting, feed and food purposes but also its B- glucans is helpful in lowering the cardio- vascular diseases. Globally barley was grown on nearly 463 Lacks ha area with a production of around 145876 Lacks tons and productivity of 3151 Kg/ha. Barley is cultivated on about 5.51 Lacks ha & 0.1287 Lacks ha with production of 16.99 Lacks tonnstons 0.4599 Lacks tons and productivity of 3082 Kg/ha and 3573 Kg/ha (Anonymous, 2023) in India and Haryana, respectively. Among the major barley growing states in India, Rajasthan occupied the highest area and production but maximum productivity (3573 kg/ha) is recorded in the Haryana.

Resource use efficiency in agriculture plays an important role in determining the form production and income, manure and fertilizer, irrigation facilities, plant protection, seed cost, machine labour and human labour are major crucial input in agriculture. The efficiency in the use of scarce resources, farmers can arrangement their income and saving. This study is aimed at exploring the profit ability as well as efficiency of various resources and constraints in the cultivation of barley crop.

Materials and Methods

The present study was based on information collated from 50 barley cultivators of two districts namely, Rewari and Mahendergarh districts of Haryana state during 2023-2024. The information was extracted from identified cultivators using well-structured interview schedule through survey method. Cobb-Douglas function was employed with six exogenous variables *i.e.* human labour (X_1), machine (X_2), seed (X_3), chemical fertilizers (X_4), plant protection (X_5) and irrigation (X_6) 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 = Returns (Rs./ha)

a = Intercept

X_1 = Human labour

X_2 = Machine

X_3 = Seed

X_4= chemical fertilizers

X_5 = Plant protection X_6 = Irrigation

b_1 to b_6 = Respective elasticity co-efficients

Returns to scale (RTS) was calculated by summing production elasticities of all the inputs (bi). If, Σbi: = 1, Σbi: > 1 and Σbi: < 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 pertinent 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 efficient use of farm resource. If the ratio of MVP to MFC is less than one, it indicates that excess use of the particular resource is being used under the existing price conditions and vice versa. Resource-use efficiency is worked out by computing the difference of MVP to opportunity cost.

Results and Discussion

Compound annual growth rate of area production and productivity in Haryana

Barley is cultivated in *rabi* season in Haryana. The sharp decline in its area was noticed from 30.32 to 9.40 thousand hectare from 2001-05 to 2021-24 quinquennial ending periods. The main reasons for decline in area was low productivity & less profit as compare to competing crops (wheat & mustard). The quinquennial growth rates of area and production of barley were negative *i.e.* -26.35 and -21.48 percent, respectively. The CAGR of barley yield was 6.80 percent as yield increased in initial years due to cultivation on fertile land, adoption of quality seeds and better production technologies. The production of barley decreased over the year owing to sharp decline in area due to less profitability even with higher productivity (Table 1).

Table 1: Compound annual growth rate of barley in Haryana

S. No.	Quinquennial ending year	Area (000, ha.)	Production (000, ton)	Productivity (Kg/ha.)
1	2001-05	30.32	83.2	2720.4
2	2006-10	40.1	127.2	3120
3	2011-15	40.02	140.4	3532.8
4	2016-20	19.48	69.2	3646.2
5	2021-24	9.40	33.7	3496.5
	CAGR (%)	-26.35	-21.48	6.80

Cost and returns of barley cultivation in Haryana

The item wise break-up of cost of cultivation of barley in Rewari & Mahendergarh districts and overall average are presented in table 2. Total cost of barley cultivation per hectare in Rewari and Mahendergarh were Rs. 71008 and Rs. 68871, respectively. While total variable cost was Rs. 38215 and Rs. 37444 in Rewari & Mahendergarh, respectively. Expenditure on field preparation, seed & sowing, manure & fertilizers, plant protection, irrigation and harvesting & threshing were important component of total variable cost. The expenditure incurred on harvesting & threshing was the highest and workout to be (23.91 & 23.63%) followed by field preparation (8.38 & 7.77%), irrigation (6.77 & 8.42%), manure & fertilizers (6.02 & 5.74%), seed & sowing (5.42 & 5.55%) and plant protection (1.50 & 1.43%) in Rewari & Mahendergarh districts, respectively. Similarly, rental value of land and management & risk factor were the major components of fixed cost, which accounted for Rs. 23875 & Rs. 7643 and Rs. 22625 & Rs. 7489 per hectare in Rewari & Mahendergarh, respectively. The gross return of barley cultivation in Rewari & Mahendergarh was Rs. 86271 and Rs. 81004 per hectare, respectively. The return over variable cost and net return in Rewari & Mahendergarh were Rs. 48056 & Rs. 15263 and Rs. 43560 & Rs. 12133 per hectare, respectively. The B: C ratio over variable & total cost was 2.26 & 1.21 and 2.16 & 1.18 in Rewari & Mahendergarh, respectively. Similar findings were also observed by Chaturvedi, *et al.* (2019) [1] and Singh and Singh (2019) [4]. Similarly, overall average per hectare total cost of cultivation and variable cost of barley was Rs. 69940 and Rs. 37830, respectively. The expenditure incurred on harvesting & threshing was the highest and workout to be (23.77%) followed by field preparation (8.08%), irrigation (7.59%), manure & fertilizers (5.88%), seed & sowing (5.48%) and plant protection (1.46%). Similarly, average rental value of land and management & risk factor were the major components of fixed cost, which accounted for Rs. 23250 & Rs. 7566 per hectare, respectively. The overall average gross return of barley cultivation was Rs. 83638 per hectare. The return over variable cost and net return were Rs. 45808 and Rs. 13698 per hectare, respectively. Moreover, overall B-C ratio over variable & total cost was 2.21 & 1.20 indicating economic viability of barley cultivation in study area. The findings are in accordance with that of Verma *et al.* (2022) [6] and Kaur *et al.* (2019) [2].

Table 2: Cost and returns of barley cultivation, (Rs./ha.)

S. No.	Particulars	Rewari		Mahendergarh		Overall	
		Qty.	Value	Qty.	Value	Qty.	Value
1	Field Preparation	3.4	5950 (8.38)	3.1	5348 (7.77)	3.3	5649 (8.08)
2	Seed & sowing	91.3	3850 (5.42)	95.3	3820 (5.55)	93.3	3835 (5.48)
3	Manure & fertilizer		4275 (6.02)		3950 (5.74)		4113 (5.88)
4	Irrigation	3.8	4810 (6.77)	4.7	5800 (8.42)	4.25	5305 (7.59)
5	Plant protection (Weeds, insect pests and disease control)		1063 (1.50)		985 (1.43)		1024 (1.46)
6	Harvesting & Threshing		16975 (23.91)		16275 (23.63)		16625 (23.77)
	Total (1 to 6)		36923 (52.00)		36178 (52.53)		36550.5 (52.26)
7	Interest on working Capital		1292 (1.82)		1266 (1.84)		1279 (1.83)
8	Variable cost		38215 (53.82)		37444 (54.37)		37830 (54.09)
9	Management & risk factor		7643 (10.76)		7489 (10.87)		7566 (10.82)
10	Transportation		1275 (1.80)		1313 (1.91)		1294 (1.85)
11	Rental value of land		23875 (33.62)		22625 (32.85)		23250 (32.24)
12	Total Cost		71008 (100.00)		68871 (100.00)		69940 (100.00)
13	(a) Main production (qt)	43.2	76896	40.7	72039	42.0	74467.5
14	(b)By Product		9375		8965		9170

15	Gross return		86271		81004		83638
16	Return over variable cost		48056		43560		45808
17	Net return		15263		12133		13698
18	B: C (Over variable cost)		2.26		2.16		2.21
19	B: C (Over total cost)		1.21		1.18		1.20

Resource use efficiency of barley cultivation in Haryana

The value of the coefficient of multiple determinations, R square (R^2 estimated 0.4669) indicated that 46.69 percent of variation in the total gross income of barley cultivation was explained by explanatory variables included in the model. Out of five independent variables included in the model, three variables had statistically significant effect on the income attained from barley cultivation. The variables like machine, chemical fertilizers and plant protection (10% level of significance) were reported. The estimated marginal value product (MVP) and efficiency ratios of different inputs used in barley production were presented in table 3. The efficiency ratio of the inputs: machine labour (1.88), chemical fertilizers (2.56), plant protection (1.57) and irrigation (1.66) were greater than one indicating that these inputs were underuse. While, human labour (0.12) and seed cost (0.31) were over utilized. Similar findings were also observed by Tijani and Tijani (2019) [5] and Wollie *et al.* (2018) [7].

Table 3: Resource use efficiency of barley cultivation

Particulars	GM	Coefficients	MVP	MFC	R = efficiency ratio	Efficiency
Human labour	9.71	0.08	0.12	1.00	0.12	Over utilized
Machine labour	8.08	1.05*	1.88	1.00	1.88	Under utilized
Seed cost	6.70	0.15	0.31	1.00	0.31	Over utilized
Chemical fertilizers	7.26	1.29*	2.56	1.00	2.56	Under utilized
Plant Protection	5.91	0.64*	1.57	1.00	1.57	Under utilized
Irrigation	7.49	0.86	1.66	1.00	1.66	Under utilized
R^2	0.4669					

* Significant at 10% level

Constraints faced by barley growers in Haryana

The production and marketing constraints faced by growers in cultivation of barley are presented in table 4. Major production problems were less profitable as compared to competing crops (92.00%) followed by low consumption of barley as staple food (88.00%), poor fodder quality (84.00%), less processing units in production region/local area (82.00%) and less availability of improved varieties (without husk) (72.00%). Similar observations were also reported by Sendhil *et al.* (2018) [3].

Table 4: Production and marketing constraints faced by barley farmers in study area (n = 50)

Sr. No.	Particulars	No of respondents	Percentage
1.	Less profitable as compared to competing crops	46	92.00
2.	Low consumption of barley as staple food	44	88.00
3.	Poor fodder quality	42	84.00
4.	Less processing units in production region/local area	41	82.00
5.	Less availability of improved varieties without husk	36	72.00

Conclusion

The study concluded that the major components of variable cost in barley cultivation were expenditure incurred on harvesting & threshing followed by field preparation, irrigation, manure & fertilizers, seed & sowing and plant protection in both the districts and overall average. Similarly, rental value of land and management & risk factor were the major components of fixed cost in both the districts and overall. The cost benefit ratio was more than one which indicated that cultivation of barley in the study area was profitable. Major production problems were less profit as compared to competing crops followed by low consumption of barley as staple food, poor fodder quality, less processing units in production region/local area and less availability of improved varieties without husk.

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