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Economic Study of Resource Use Efficiency for Cabbage Cultivation in Rewa District of Madhya Pradesh

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Abstract

The regression coefficient of family labor was found non-significant (X_1) and hired labor (X_2) was found significant and machinery power (X_3) was found negatively significant. This indicates that 5% increase in the family labor and machinery power will decrease the yield by 0.013% and -0.127%, respectively. This suggests that if additional quantity of fertilizer were available, it would lead to an increase in cabbage production/yield by 2.68 kg among the farmers. This implies that the farmers are more technically efficient in the use of fertilizer. Of all the resources used, labor had the least MPP (0.28 and 0.26). This shows more efficiency in the use of available labor. Given the level of technology and prices of both inputs and outputs, efficiency of resource use was further ascertained by equating the MVP to the productive MFC of resources. A resource is said to be optimally allocated if there is no significant difference between the MVP and MFC i.e. if the ratio of MVP to MFC = 1 (unit). The high price of seed was the main problem expressed by 91.66% of the sampled cabbage growing farmer in production followed by non-availability of fund from institutional sources 86.66%. Lack of packing materials of cabbage was reported by 46.66% of sample farmer, Problem of higher market charges was reported by 85.00% of total sample farmers.

Key words : Cabbage, Production function, Resource use efficiency, Economics.

Cabbage (*Brassica oleracea* L. var Capitata) is the most popular winter vegetables in India. It appears to have been introduced by Portuguese, though the crop became popular during the British rule. The cabbage has originated from wild cabbage. The head cabbage was referred too much late in about the 16th century. It is mostly employed as culinary and diet article. It is also used in curries pickles etc. It may be used for feeding stock and chicken. Cabbage is used as salad, boiled vegetables and dehydrated vegetables. The vegetable production of late has become specialized and commercial due to their increasing export potential, rising domestic demand, providing better employment and income opportunities in view of being labor intensive and remunerative. Production of most of the vegetables is seasonal and highly localized is favored agro-climatic situation. The seasonal gluts are, therefore, common phenomenon in the assembling markets during normal production seasons resulting in price fluctuation which has definite bearing upon the rationality of decisions by growers as well as traders. The losses were found to be more at production level in most of the vegetable. The reduction in post harvest losses is important to increase the availability of fruit and vegetable in the economy (1). From the nutrition point of view it ranks very high. Cabbage is rich in mineral waters and in vitamin A, B, B_2 and C. It is said to help indigestion. There is great variation in the cultivated type of cabbage. They differ in size, shape and color of leaves and texture of head. The main crop is grown in northern India where the winter temperature is relatively low. In the hills it is taken as spring and early summer crop. In some part even two crops of cabbage are taken. It is also one of the most important cole crops of Madhya Pradesh. The cultivated area of cabbage in Madhya Pradesh is 6,459 hectares' while production is 1, 29, 180 tonnes with average productivity of 20.00 tons/ha (2007-08). In India is 0.58 million hectares's while production 7.16 million tonnes with

Table 1. Result of the estimated Cobb-Douglas type of production function. **Significant at 5%.

Particulars	Regression coefficients	Standard error
1. Constant	6.425*	1.408
2. X_1 Family (days)	0.105*	0.090
3. X_2 Hired (days)	0.013**	0.015
4. X_3 Machinery (h)	-0.127*	0.048
5. X_4 Seed (kg)	0.891**	0.171
6. X_5 Fertilizer (kg)	0.103**	0.124
7. X_6 Chemical (kg)	-0.088*	0.065
8. X_7 Irrigation (no.)	0.029**	0.503
9. R^2	86.10*	0.048

average productivity 12,357 kg per hectare during 2007-08. It is mainly grown of Madhya Pradesh in Rewa, Raipur Karchuliyan, Sirmour, and Vindhya region of Madhya Pradesh. Rewa block is one of the important cabbage growing blocks in Rewa district of Madhya Pradesh. Cabbage, being fresh and perishable, needs to be transported overnight to urban markets and delivered, through retailers, to consumers fresh and green. Hence, efficient marketing assumes greater significance to minimize post harvest losses of cabbage. Besides, sustaining the interest of cabbage growers through ensuring reasonable price also assumes greater significance. Assured supply of cabbage to the market is possible through efficient transport system. Thus, efficient functioning of marketing channels, especially for cabbage depends to a larger extent on the cabbage growers, transporters, and commission agents at regulated vegetable markets and on their mutually beneficial linkages and effective transporting and marketing mechanisms.

Methods

Sampling Procedure

The primary and secondary data were used to accomplish the objectives. The secondary data were collected from the ADH and Statistics data were collected from published record of Statistics Department, Rewa, whereas, the primary data were collected from the sample cabbage growers selected randomly using multi-stage random sampling technique. At the first stage of sampling major cabbage grower, Rewa block out of nine block namely Rewa, Raipur karchuliyan, Gurh, Sirmour, Teothar, Mauganj, Hanumana, jawa, Naigarhi. On the basis of highest area under cabbage crop. At the second stage of sampling, five important major cabbage grower villages namely, Judmania, Vidva, Ataria, Karahiya, Madi were selected. Further, at the third stage of sampling, 60 cabbage growers were selected. Post-harvest losses of vegetable in both physical and economic terms at different stage during 99-00 and 2000-01. The multistage stratified random sampling has been employed to estimate losses at wholesaler, retailer and farm level. The estimates are developed for losses at transportation storage and shorting level. It is evident from the losses that the overall loss varies up to 20% in vegetable viz., tomato, cabbage, cauliflower and chilli (2). Thus five villages were selected for present investigation. Finally 60 sample cabbage growers were selected randomly at the rate of 12 growers from each village. The growers were selected in proportion to their size group. The cross-sectional data were collected from the sample cabbage growers through personal interview with the help of specific pre-tested schedules and questionnaires.

Production Function Analysis

Production function analysis was carried out to examine the productivity and efficiency of different resources of the sample farms. Multiple regression analysis was done to examine the cost-benefit relationship and productivity of farm inputs on cabbage.

Cobb-Douglas type of production function was finally fitted which gave the best fit to data. Because of the higher R^2 value obtained in the Cobb-Douglas function, this form was finally retained for economic analysis (Table 1). Cobb-Douglas production also provided an addition information regarding returns to scale in farming operation. The Cobb-Douglas type of production took the form of :

$$Y=ax_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7}$$

Where, Y = Yield of cabbage in quintal, A - Constant, X_1 = Family labor use in days, X_2 = Hired labor use in pair days, X_3 = Machinery power (h), X_4 = Seed (kg), X_5 = Fertilizer (kg), X_6 = Irrigation (no.), X_7 = Chemical (kg).

The value of the constant (a) and regression co-

Table 2. Resource use efficiency of the sample farms.

	Variable	APP	MPP	MVP	MFC	*r*
1	Family labor (hectare) (X_1)	100	0.26	26	100.00	0.26
2	Hired labor	102.77	0.28	27.54	100.00	0.28
3	Machinery power (h) (X_3)	9.77	0.93	186.16	200.00	0.93
4	Seed (kg) (X_4)	0.45	1.00	3000.00	3000.00	1.00
5	Fertilizer (kg) (X_5)	237.00	2.68	21.43	8.00	2.68
6	Irrigation (no.) (X_7)	4.00	1.03	1028.34	1000.00	1.03
7	Chemical (kg) (X_8)	1.90	0.99	493.27	500.00	0.99

efficient (bi) in respect of independent variables in the function have been estimated by using the method of least squares.

Marginal Value Product (MVP)

The marginal value product of inputs was estimated by taking partial derivatives of return with respect to the input concerned, at the geometric mean level of the inputs. The marginal value product (MVP) of each resource was worked out by using the following formula :

MVP with reference to resource Xi = bi

Where, Y = Geometric mean of gross return of the crop, Xi = Geometric mean of ith independent variable, bi = The regression coefficient of ith independent variable,

After estimating the marginal value of each input, it was compared with its marginal cost.

Results and Discussion

Production Function Analysis

Investigated the cropping pattern and cropping intensity of selected vegetable growers and also determined and compared the relative profitability of selected winter vegetables. The selected winter vegetables constituted about 15% of total gross cropped area and the average cropping intensity of land was 195.52%. Production of selected vegetables (cauliflower, cabbage, tomato, radish, bean and bottle gourd) was found to be profitable (3). To have the adequate comparison between small, medium and large size group of holdings it is felt necessary to establish the relationship between the total yield and the eight independent variables. Viz. family labor, hired labor, Machinery power, seed, fertilizer, irrigation and chemical. So the Cobb-Douglas type of production function of the following type is fitted for a small, medium and large size group of holding (Table 2). Table 3 shows that 86.10% variation in the yield was jointly explained by the independent variables. The regression coefficients for the variable representing the area were significant at 1% but having negative sign. It indicates that the yield decreased with the increase in the area. It may be because of inefficient maintenance of land. Showed that the results of production function analysis indicated that the variables included in the function explained 97% of the variations in yield. The results of the resource used efficiency analysis for small farmers indicated that there is scope for increasing the use of land, fertilizer and staking materials which had statistically significant production elasticities. Similar analysis for the large farmers found the regression coefficient of the fertilizers, human labor and animals labor statistically significant and positive. The regression coefficient of land indicated that there was scope to increases tomato production by increasing the area under the crop in the case of small farmers and need for better management of land use by the large farmers (4).

The regression coefficient of family labor was found non-significant (X_1) and hired labor (X_2) was found significant and machinery power (X_3) was found negatively significant. This indicates that 5% increase in the family labor and machinery power will decrease the yield by 0.013% and -0.127%, respectively. It indicates that the yield decreased with the increase in the both labor. It may be because of in efficient management of labor in crop cultivation.

Table 3. Constraints in production and marketing of cabbage.

	Constraints relating	No. of sample farmers	Percent to total (N=60)	Rank
	Production			
1.	Non-availability of good quality of seed	50	83.33	IV
2.	High price of seed	55	91.66	I
3.	High price of fertilizers, pesticides and fungicides and wage rate of labor	51	85.00	III
4.	Ignorance of severs infestation of insect-pest, disease control	40	66.66	IX
5.	Non-availability of fund from institutional sources	52	86.66	II
	Marketing			
6.	Lack of transportation	38	63.33	X
7.	High charges of transportation	48	80.00	VI
8.	Lack of link road	25	41.66	XIII
9.	Lack of market yard	33	55.00	VIII
10.	Traders collusion	30	50.00	X
11.	Mall practices by traders	49	81.66	V
12.	Higher market charges	47	78.33	VII
13.	No correct weighing	26	43.33	XII
14.	Late payment	31	51.66	IX
15.	Lack of credit facilities	25	41.66	XIII
16.	Lack of packing material	28	46.66	XI
17.	Price fluctuation and crasher	52	86.66	II
18.	Lack of price information	48	80.00	VI
19.	Lack of storage in market yard	5	83.33	IV
20.	Non-availability of adequate storage facilities	55	91.66	I

The regression coefficient of seed (X_4) was found non-significant. This indicates that 1% increase in the seed will increase the yield by 0.891%. It indicates that the yield increased with the increase in the seed quantity. It may be because there was minimum use of seed quantity in field and them no maintenance of plant population in field.

The regression coefficient of fertilizer (X_5) was found positively significant. This indicates that 1% increase in the fertilizer will increase the yield by 0.103%. It indicates that the yield increased with the increase in the fertilizer quantity. It may be because there was minimum use of fertilizer quantity in field and more requirement of fertilizer dose in crop production.

The regression coefficient of irrigation (X_6) was found positively significant. This indicates that 1% increase in the irrigation will increase the yield by 0.029%. It indicates that the yield increased with the increase in the irrigation quantity. It may be because there was minimum use of number of irrigation in field and them no sufficient water available in field. The regression coefficient of chemical (X_7) was found negatively significant. This indicates that 1% increase in the chemical will increase the yield by -0.088%. It indicates that the yield decreased with the increase in the chemical quantity. It may be because there was excess use of chemical quantity in field. In nutshell, it is to say that the factors, viz. hired labor, machinery power, fertilizer, irrigation and chemical have significant influence on the yield.

Determining the Economic Efficiency of Resource Use

The following ratio was used to estimate the relative efficiency of resource use

$$r = MVP/MFC$$

Where, MFC = Cost of one unit of a particular resource, MVP = Value added to cabbage output due to the use of an additional unit of input, calculated by multiplying the MPP by the price of output. i.e. $MPP_{xi} \times Po$.

Decision Rule

If r = 1, resource is efficiently utilized, if r > 1, resource is underutilized while, if r < 1, resource is over utilized.

Economic optimum takes place where MVP = MFC. If r is not equal to 1, it suggests that resources are not efficiently utilized. Adjustments could be therefore, be made in the quantity of inputs used and costs in the production process to restore r = 1. Observed that the elasticity coefficients with respects to human labor were positive and significant. The marginal value productivity of working capital was higher than that of human labor in all the crops. Increasing returns to scale were observed in potato, peas, cauliflower and brinjal indicating that it is rational to use more of inputs in these crops to get higher returns (5).

An efficiency of resource use on the sample farms was judged with the help of r (MVP/MFC) ratio and results of the resource use efficiency are presented in Table 2. Measure of technical efficiency of resource use such as Average Physical Product (APP), Marginal Physical Product (MPP), and Marginal Value Product (MVP) and Marginal Factor Cost (MFC) were derived. This suggests that if additional quantity of fertilizer were available, it would lead to an increase in cabbage production/yield by 2.68 kg among the farmers. This implies that the farmers are more technically efficient in the use of fertilizer. Of all the resources used, labor had the least MPP (0.28 and 0.26). This shows more efficiency in the use of available labor. Given the level of technology and prices of both inputs and outputs, efficiency of resource use was further ascertained by equating the MVP to the productive MFC of resources. A resource is said to be optimally allocated if there is no significant difference between the MVP and MFC i.e. if the ratio of MVP to MFC = 1 (unit).

Table 2 further reveals that the ratios of the MVP to the MFC were seed efficient utilized equal to (1) and greater than unity (1) for fertilizer and irrigation input but human and machinery power, chemical. This implies that irrigation and fertilizer were under-utilized, while human and machinery power and chemical were over utilized (less than one). This means that cabbage yield was likely to increase and hence revenue if more of such inputs (irrigation and fertilizer) had been utilized. Examined the resource used efficiency and productivity of tomato, Brinjal, cauliflower and gourds production using data collected from ninety farmers in Guntur district Andhra Pradesh. Results indicates vegetable production is profitable despite major constrains such as the non-availability of quality seed, inadequate credit and marketing facilities, shortage of water and in efficient post harvest handling (6).

Constraints

Table 3 reveals that the high price of seed was the main problem expressed by 91.66% of the sampled cabbage growing farmer in production followed by non-availability of fund from institutional sources 86.66%, high price of fertilizers, pesticides and fungicides and wage rate of labor 85.00%, non-availability of good. Non-availability of adequate storages facilities of cabbage was the main problem expressed by 91.66% of sample farmers did not store cabbage on their farm due to lack of storage structure followed by price fluctuation and crashes 86.66%. Various types of malpractices such as deducting certain amount of quantity extra (Karda) were common in almost all markets. Since Rewa vegetable Mandi is regulated market no charges are payable by the seller (farmers) in the market. But still traders (agents) deducted from sale proceeds to farmers various charges, such as market fee the problem of collusion (secret agreement) between commission agent and buyers (outside traders) during the auction was also reported 50.00% of total sample farmers. Problem of higher market charges was reported by 85.00% of total sample farmers. The problem of cheating in weighing by the traders was 43.33 of samples farmers under delay in receiving payment after the sale of their produce was reported by 51.66% of sample farmers. Problem of getting credit to meet the marketing cost was also reported by 41.66% of sample farmers. About 83.33% of farmers felt that there is need for temporary storage facilities in the market because sometimes farm produces could not be sold on the same day due to low price or lack of adequate number of buyers in the market. About 80% of the total sample cabbage growers fell that there should be some system where by in addition to all India radio information about the price prevailing in other market could reach the farmers. The main source of price information for farmers was through neighbors/fallow farmers or by personal visit. Lack of packing materials of cabbage was reported by 46.66% of sample farmer. Cabbage growers reported unremunarative price during the peak season and lake of storage facilities to the important constraints. Besides high price of seed, fertilizers and pesticides, costly transportation and market charges, inadequate skilled labor and lack of information about arrivals and prices in the consuming market were main problem reported by various cabbage producers.

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