

Original Research Article

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A Study on Resource Use Efficiency and Cost and Return of Sugarcane Cultivation in Sultanpur District of Eastern Uttar Pradesh

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ABSTRACT

Keywords

Cost, Cropping Intensity, Gross Income, Net Income, Input Output Ratio, Returns to Scale

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Hundred sample farmers (Marginal- 60, Small- 25, and Medium- 15) were interview from five villages of Kurebhar block of Sultanpur district. Data hence gathered was analyzed and it was found that average holding size was 1.71 hectares and cropping intensity was 182.46 per cent. On an average cost of cultivation was ₹ 92691.29 per hectare. The gross and net incomes on overall farms were found to be ₹ 191544.53 and ₹ 105083.49 per hectare, respectively. The input and output ratio was found to be 1:2.06 on cost C. sugarcane cultivation in the study was characterized by decreasing return to scale.

Introduction

Sugarcane (*Saccharum officinarum* L.) belongs to family gramineae and originated to tropical south Asia and south east- Asia. Sugarcane is a renewable, natural agriculture resource because it provides sugar besides biofuel, fibre, fertilizer and myriad of by-products with ecological sustainability. Sugarcane juice is used for making white sugar, brown sugar (Khandhasari), jaggery (Gur) and ethanol.

Sugarcane is an important cash crop grown in

India. Sugarcane cultivation and development of sugar industry runs parallel to the growth of human civilization and is as old as agriculture. The importance and use of sugarcane and sugar in the country's socio-economic milieu is deep rooted and immense. In the current day rural economy set up sugarcane cultivation and sugar industry has been focal point for socio-economic development in rural areas by mobilizing rural resources generating employment and higher income, transport and communication facilities. About 7 million sugarcane farmers and large number of agricultural labourers are

involved in sugarcane cultivation and ancillary activities. Apart from this the sugar industry provides employment to 5 Lakh skilled and semiskilled workers in rural area. “*Statistical yearbook*”; *Food and Agricultural Organization, 2015*.

Nearly 1877.10 million tonnes of sugarcane was produced in the harvesting year 2017-18 worldwide. With the production of over 739.27 million tonnes in 2017-18, Brazil was the leader in Sugarcane production followed by India (341.20 million tonnes) and China (125.54 million tonnes). (Food and Agriculture Organization Corporate Statistical Database, 2018)

The information regarding the area, production and productivity of Sugarcane cultivation in Uttar Pradesh shows that the highest area under sugarcane cultivation in Uttar Pradesh was 23.40 lakh hectares in the year 2018-19 and the lowest area under cultivation was 19.77 lakh hectares in the year 2009-10. The highest production of sugarcane was in the year 2018-19 i.e. 1753.5 lakh tonnes and the lowest production was in the year 2009-10 i.e. 1171.4 lakh tonnes. The maximum yield was obtained in the year 2018-19 which was 74.93 tonnes/ha and the minimum yield was in the year 2010-11 which was 56.73 tonnes/ha. (Department of Agricultural and Farmers Welfare. 3rd Advance Estimates for Sugar Season 2017-18. March 2018, Vol.49, No.7.)

Materials and Methods

Selection of sample farmers

A separate list of sugarcane growers of five selected villages were prepared along with their size holding and classified into three categories i.e. (1) Marginal farmer (below 1 hectare), (2) Small farmer (1-2 hectare) and (3) Medium farmer (2-4 hectare). Multistage

stratified cum random sampling technique was used to select the district, block, village and farmers. Sultanpur district was selected purposely. A list of all the blocks was prepared and Kurebharblock was selected purposively.

Method of enquiry

The primary data were collected by survey method through personal interview on well-structured schedule, while secondary data were collected from books, journals, report and records of the district and block headquarters (Land acreage in Sultanpur district is four *bigha* per hectare).

Analytical tools

Both the tabular and functional analysis were used. Weighted average was worked out for interpretation of data with the help of following formula.

$$WA = \frac{\sum W_i X_i}{\sum W_i}$$

Where,

- WA = Weighted Average
- Xi = Variable
- Wi = Weights of variable

Production function

To study the resource use efficiency in sugarcane production, Cobb-Douglas production function was used. The mathematical form of Cobb Douglas production function is:

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5} \dots \dots \dots X_n^{bn}e^u$$

Where,

Y = per hectare output (□ /ha)

X_1 = seed (□ /ha)
 X_2 = Irrigation charge (□/ha)
 X_3 = Plant protection charges (□ /ha)
 X_4 = Manure and fertilizers (□ /ha)
 X_5 = Labour Cost (□ /ha)
 b_i = Elasticity coefficient of the respective input variables
 e = Error term or disturbance term
 μ = Random variables

Results and Discussion

Cost and Returns

The different cost concepts viz. Cost A_1/A_2 , B_1 , B_2 , C_1 , C_2 and C_3 were considered for analysis of the data. On an average cost A_1/A_2 , cost B_1 , cost B_2 , cost C_1 , cost C_2 and cost C_3 came to □ 64288.31, □ 68601.86, □ 78619.86, □ 52531.47, □ 84262.80, □ 92691.29, respectively.

On an average gross income was recorded □ 191544.33 and net income came to □ 105083.49. On medium farms, gross income was highest, which was recorded □ 192000.00, followed by marginal farms □ 191804.33 and lowest on small farms □ 190829.27, respectively. The net income was highest on marginal farms □ 105886.69 followed by medium farms □ 105604.43 and small farms □ 103759.37.

On an average family labour income, farm business income and farm investment income were observed to □ 112942.673, □ 8922.89 and □ 84926.61, respectively. Family labour income was highest on marginal farms followed by medium and small farms, farm investment income was highest on medium farms followed by small farms and marginal farms and farm business income was highest on marginal farms followed by medium farms and small farms. On an average, yield per hectare was estimated 598.57 quintal. The benefit cost ratio for marginal, small and

medium farms were observed to be 1:1.10, 1:1.13 and 1:1.17, respectively. On an average benefit cost ratio were observed to be 1:1.13.

On an average input output ratio regarding costs C_3 , C_2 , C_1 , B_2 , B_1 , and A_2/A_1 were recorded 1:2.06, 1:2.27, 1:2.57, 1:2.43, 1:2.78 and 1:2.97, respectively. On the basis of cost C_3 input output ratio was highest on medium farms (1:2.11) followed by small farms (1:2.08) and marginal farms (1:2.01), respectively. It may be concluded the cost of cultivation on different size group of farm increases with an increase in farm size. But net return per hectare was found of negative trend with farm size. It was because of less increase in yield against the increased input factors at increasing size of farm. Per hectare cost of return from the cultivation of sugarcane crop on different categories of farms have been presented in Table 1.

Resource use efficiency

The Cobb - Douglas production function was applied to find out the efficiency of various resources use in production of sugarcane. It indicated that five variables viz. seed, irrigation, plant protection chemicals, fertilizer and labour.

In marginal household the production elasticity's of seed, irrigation, plant protection chemicals, fertilizer and labour were 0.01, 0.06, 0.44, 0.24 and 0.63, respectively. The return to scale in marginal farm was 0.97 which shows decreasing return to scale i.e. marginal farmers were gaining less than what they were spending. The R^2 value of marginal household was 0.90 i.e. the considered variable explains 90.00 percent of the variation in depending variable i.e. return from sugarcane. It can be concluded that cost of fertilizer at 5 percent level of significance had significant influence on the returns.

In small household the production elasticity's of seed, irrigation, plant protection chemicals, fertilizer and labour were 0.10, 0.20, 0.25, 0.07 and 0.47, respectively. The return to scale in small farm was 1.09 which shows increasing return to scale i.e. small farmers were gaining more than what they were spending. The R² value of small household was 0.93 i.e. the considered variable explains 93.00 percent of the variation in depending variable i.e. return from sugarcane. The cost of seed at 5 percent level of significance and cost of irrigation at 1 percent level of significance had significant influence at the returns from sugarcane

In medium household the production elasticity's of seed, irrigation, plant protection chemicals, fertilizer and labour were 0.30, 0.44, 0.11, 0.23 and 0.02, respectively. The return to scale in medium farm was 1.10 which shows increasing return to scale i.e. medium farmers were gaining more than what they were spending. The R² value of medium household was 0.95 i.e. the considered variable explains 95.00 percent of the variation in depending variable i.e. return from sugarcane. It was found that the cost of seed at 5 percent level of significance and cost of irrigation at 1 percent level of significance had significant influence at the returns from sugarcane.

Table.1 Measures of Per Hectare Cost and Return of Sugarcane (Rs.)

Sl. No.	Particulars	Size group of farms			All farm average
		Marginal	Small	Medium	
1.	Cost A ₁ /A ₂	63849.38	64793.99	64221.56	64288.31
2.	Cost B ₁	68106.94	69154.48	68544.16	68601.86
3.	Cost B ₂	78106.94	79154.48	78544.16	78619.86
4.	Cost C ₁	77102.61	73247.65	72444.16	52531.47
5.	Cost C ₂	87102.61	83247.65	82444.16	84264.80
6.	Cost C ₃	95812.87	91572.42	90688.58	92691.29
7.	Gross income	191804.33	190829.27	192000.00	191544.53
8.	Net income	105886.69	103759.37	105604.43	105083.49
9.	Family labour income	113697.39	111,674.79	113455.84	112942.673
10.	Farm business income	127954.95	126035.28	127778.44	88922.89
11.	Farm investment income	118959.28	121942.11	123878.44	84926.61
12.	Yield (q/ha)	599.39	596.34	600.00	598.57
13.	Benefit-Cost ratio	1:1.10	1:1.13	1:1.17	1:1.13
14.	Input- output ratio				
(i)	On the basis of C ₃	1:2.01	1:2.08	1:2.11	1:2.06
(ii)	On the basis of C ₂	1:2.20	1:2.29	1:2.32	1:2.27
(iii)	On the basis of C ₁	1:2.48	1:2.60	1:2.65	1:2.57
(iv)	On the basis of B ₂	1:2.45	1:2.41	1:2.44	1:2.43
(v)	On the basis of B ₁	1:2.81	1:2.75	1:2.80	1:2.78
(vi)	On the basis of A ₁ /A ₂	1:3.00	1:2.94	1:2.98	1:2.97

Table.2 Resource use Efficiency in Sugarcane on Different Size of Sample Farms

Size group of sample farms (ha)	Production elasticities					Returns to Scale	R ²
	X ₁	X ₂	X ₃	X ₄	X ₅		
Marginal	0.01 (0.01)	0.06 (0.05)	0.44 (0.25)	0.24** (0.10)	0.63 (0.33)	0.97	0.90
Small	0.10** (0.01)	0.20* (0.06)	0.25 (0.20)	0.07 (0.05)	0.47 (0.28)	1.09	0.93
Medium	0.30** (0.11)	0.44* (0.11)	0.11 (0.08)	0.23 (1.3)	0.02 (0.02)	1.10	0.95

****significant at 5% significance level**

*** significance at 1% significance level**

Where,

X₁, X₂, X₃, X₄ and X₅ stand for seed, irrigation, plant protection chemicals, fertilizers and labour cost (□) respectively

Cost estimation revealed that indicate that cost of cultivation, was highest on small farms (□ 87069.00), followed by medium farms (□ 86395.57) and small farms (□ 85917.64), respectively. The overall average costs of cultivation was observed (□ 86476.72) on sample farms.

The major component of the cost were human labour (15.61 percent), machinery charges (7.09 percent), manure and fertilizer (9.22 percent), recent value of owned land (11.57 percent), seed cost (23.29 percent), plant protection (7.11 percent) and irrigation charge (9.19 percent), respectively of the total cost of cultivation. Per hectare cost of cultivation was found of positive trend with farm size.

Estimates of different cost showed that on an average cost A₁/A₂, cost B₁, cost C₁, cost C₂ and cost C₃ came to □ 64288.31, □ 68601.86, □ 78619.86, □ 52531.47, □ 84262.80, □ 92691.29, respectively.

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The input output ratio regarding costs C₃, C₂, C₁, B₂, B₁, and A₂/A₁ were recorded 1:2.06, 1:2.27, 1:2.57, 1:2.43, 1:2.78 and 1:2.97, respectively. On the basis of cost C₃ input output ratio was highest on medium farms (1:2.11) followed by small farms (1:2.08) and marginal farms (1:2.01), respectively. It may be concluded the cost of cultivation on different size group of farm increases with an increase in farm size. But net return per hectare was found of negative trend with farm size. It was because of less increase in yield against the increased input factors at increasing size of farm.

The production function analysis showed In marginal household the production elasticities of seed, irrigation, plant protection chemicals, fertilizer and labour were 0.01, 0.06, 0.44, 0.24 and 0.63, respectively. The return to scale in marginal farm was 0.97 which shows decreasing return to scale i.e. marginal farmers were gaining less than what they were spending. The R^2 value of marginal household was 0.90 i.e. the considered variable explains 90.00 percent of the variation in depending variable i.e. return from sugarcane. It can be concluded that cost of fertilizer at 5 percent level of significance had significant influence on the returns.

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seed at 5 percent level of significance and cost of irrigation at 1 percent level of significance had significant influence at the returns from sugarcane.

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