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Subhash Chandra
Department of Agricultural Economics & Statistics, Chaudhary Charan Singh Snatkottar Mahavidyalaya, Padmapur, Pandavnagar, Basti, Uttar Pradesh, India

Vinay Kumar Rawat
Department of Agricultural Economics & Statistics, B.R.D.P.G. College, Deoria, Uttar Pradesh, India

Satish Chandra Verma
Department of Agricultural Economics & Statistics, B.R.D.P.G. College, Deoria, Uttar Pradesh, India

OP Singh
Department of Agricultural Economics & Statistics, T.D.P.G. College, Jaunpur, Uttar Pradesh, India

Corresponding Author
Subhash Chandra
Department of Agricultural Economics & Statistics, Chaudhary Charan Singh Snatkottar Mahavidyalaya, Padmapur, Pandavnagar, Basti, Uttar Pradesh, India

Cost and returns analysis of sugarcane production in Basti district of Eastern Uttar Pradesh, India

Subhash Chandra, Vinay Kumar Rawat, Satish Chandra Verma and OP Singh

Abstract
Sugarcane (*Saccharum officinarum*) is one of the most important crops in the world because of its strategic position and immense uses in the daily life of any nation as well as for industrial uses aimed at nutritional and economic sustenance. Sugarcane contributes about 60% of the total world sugar requirement while the remaining 40% came from sugar beet. Sugarcane cultivation in India dates back to pre-Vedic period and presently the country stands second largest producer of sugarcane (355.0 mt) and sugar (>32.0 mt) in the world after Brazil. Brazil has the highest area (5.34 million hectares) while Australia has the highest productivity (85.1 tonnes per hectare) India ranks second among the sugarcane growing countries of the world in the both area and production after Brazil with an area under sugarcane cultivation of 4.94 million hectares with an average yield is 68.6 tons per hectare. Among different states of the country, Uttar Pradesh occupies first place in area (22.34 lakhs hectare) and production 1623.38 lakhs million tons but in terms of productivity it ranks seventh. (Annual Report 2017-18). The cost of cultivation of sugarcane was more at the field of large farmers followed by medium farmers and small farmers. The cost of cultivation of sugarcane per hectare in the small, medium and large farmers categories were Rs. 53998.40, Rs. 54442.39 and Rs. 57649.61 respectively.

Keywords: sugarcane, farm income, grass income, profitability, sample farm, farmers, cost of cultivation, input output ratio

Introduction
Sugarcane (*Saccharum officinarum*) is one of the most important crops in the world because of its strategic position and immense uses in the daily life of any nation as well as for industrial uses aimed at nutritional and economic sustenance. Sugarcane contributes about 60% of the total world sugar requirement while the remaining 40% came from sugar beet. It is a tropical crop that usually takes between 8 and 12 months to reach its maturity. Matured cane may be green, yellow, purplish or reddish considered ripe when sugar content is at its maximum. Sugar production in India is concentrated in six states namely Maharashtra, Uttar Pradesh, Gujarat, Tamil Nadu, Karnataka and Andhra Pradesh with 85-90% sugar production of the country (Gawali S., 2003). The Indian sugar industry is highly fragmented with over 450 mills and no single player having market share more than 5 per cent. Out of it, 60% mills are in the cooperative sector, 35% in the private and rest are in public sector. The Indian Sugar Industry is a key driver of rural development because it supports more than 55 million sugarcane farmers and 7.5% rural population depends on sugarcane cultivation, harvesting, machine manufacturing etc. The average land holding of sugarcane producing farmers is very small and fragmented.

In Indian, sugarcane productivity ranges from 70 tonnes per hectare to 110 tonnes per hectare whereas global average production is 64 tonnes per hectare. Currently 69 per cent of the world's sugar is consumed in the country of region. Globally, sugarcane is cultivated over an area of 20.10 million hectares with a production of 1,318.10 million tones and productivity of 65.5 tonnes per hectare. Sugarcane area and productivity differ widely from country to country. Brazil has the highest area (5.34 million hectares) while Australia has the highest productivity (85.1 tonnes per hectare) India ranks second among the sugarcane growing countries of the world in the both area and production after Brazil with an area under sugarcane cultivation of 4.94 million hectares with an average yield is 68.6 tons per hectare. Among different states of the country, Uttar Pradesh occupies first place in area (22.34 lakhs hectare) and production 1623.38 lakhs million tons but in terms of productivity it ranks seventh (Annual Report 2017-18) [1].

Beside a cash crop, it occupies an important place in the national economy and also provides fodder for animals, food for human being and casual employment to more than 5 lakh persons in sugar factories. A part from a large number of agricultural labour nearly 35 million farmers and their families are involved in Sugar cane cultivation. Uttar Pradesh, Maharashtra, Tamilnadu, Karnataka, Andhra Pradesh, Gujarat, Haryana and Uttaranchal are major sugar cane cultivating states in India

Materials and Methods

The present study pertains to Basti district of Eastern Uttar Pradesh. Out of 14 community developmental blocks in the district Basti, only one block, namely Basti was selected purposively, where two sugar factories are situated in the block. They are already functioning. Therefore, the Basti block was taken as the sample block.

A list of all villages of Basti block was prepared, having more than five percent of the net cultivated under sugarcane cultivation were prepared with the help of record available with revenue officials. Out of which five villages namely Katahapur, Badhaya, Dayalpur, Bakhashai and Rajaya were selected randomly.

A list of all cultivators along with their cultivated area for each of the selected village was prepared. Farmers having ten percent of the net cultivated area under sugarcane were considered as sugarcane cultivators. These cultivators were stratified under the marginal, small, medium and large size group of operational holdings for selected villages. The equal number of 15 sugarcane farmers from each stratum in each selected villages were taken randomly in the sample. Thus in totality there were 75 farmers in each stratum comprising 225 cultivators in the total sample.

Statistical Tools

For comparison and interpretation of the data following statistical tools were used:

1. Tabular Analysis

The tabular analysis was used to compare the production and productivity, loss and returns, income and employment level and other differential input level and their impact on farm economy.

2. Function Analysis

The production function analysis was carried out to examine the resource use efficiency of sugarcane on the sample farm. To study the effect of various independent variable on the dependent variable (yield) multiple regression analysis was used with a view to determine the simultaneous relationship between total farm return from sugarcane production and their various input variable on the basis of lavd per ha.

However, Cobb-Douglas type production function for resource use efficiency have been found with the functional analysis applying the model as under:

$$y = a + \sum_{i=1}^{n} B_i X_i$$

Where,

Y= The dependent Variable (yield)

X_i = Independent variable (Casual factors)

B_i= Elasticities of production with respect of X_i (Regression coefficient)

a = Intercept (constant)

The value of intercept (constant) and coefficient (B_1) in respect of independent variable (casual factor) in the function have been estimated by using the least square method.

To measuring the return of farm size as a institutional variable, all the variable except land are transferred into per hectare basis. After standardizing it this will take the functional formulae-

$$Y = a.e^{bx}$$

When expressed in logarithmic terms into linear function of the following type;

log y = log a + b (log e.x.)

suppose b log e = B

So, log y = log a + B.x

Where

$$B = \frac{\sum \log y}{\sum x^2}$$

Then

$$B = \frac{B}{2.71828}$$

where,

y = Area/Production/Yield

x = Number of years/time variable in years

e = napionion base i.e. 2.71828

a = Intercept

b = Regression co-efficient

The compound growth rate (r) was worked out as follows:

$$r = (e^b - 1) \times 100$$

where

r = Compound growth rate

e = napionion base

b = Regression coefficient

Cost concepts

For policy matter, the Estimation Committee on Cost of Cultivation, 1981, Directorate of Economics and Statistics, Govt. of India, has recommended the following classification of costs to be adopted:

Cost. A1 all actual expenses and kind incurred in production by owner

Cost A2 = Cost A1 + Rent paid for leased-in land, if any

Cost B1 = Cost A1 + Interest on value of owned fixed capital (excluding land)

Cost B2 = Cost B1 + Rental value of owned land (net of the land revenue) and rent paid for leased in-land.

Cost C1 = Cost B1 +Imputed value of family labour

Cost C2 = Cost B2 +Imputed value of family labour

Cost C3 = Cost C2 + 10 per cent of Cost C2 to account for managerial input of the farmers

Gross Income

It includes:

Cash received on account of the sale of farm produce.

Value of the produce, main or by-product used for home consumption and for cattle feed are given over as wages in

kind.
Value of the seed for sowing purposes.

Net Income
Gross income - Gross expenses

Family labour income
Net income + Family labour wages

Farm business income
Family labour income + Interest on working capital + Rental Value of own land.

Results and Discussion

Cost of cultivation of sugarcane

Table 1 shows cost of cultivation of sugarcane per hectare, it reveals that irrespective to the farm size of holdings, the total cost of cultivation of sugarcane of sample farms was Rs 87491.30 per hectare in which the share of total variable cost was 85.11 per cent followed by total fixed cost which was found to be 14.82 per cent. In total variable cost the shares was found to be maximum in human labour cost 40.20 per cent followed by total material cost 33.01 per cent, cost of total power used was observed to be 7.59 per cent and interest on working capital was 4.31 per cent, respectively. In materials cost, the share of seed was 17.11 per cent and fertilizer 11.36 per cent was noticed to be the major cost. While in human labour cost, the share of hired labour cost being 21.02 per cent was comparatively more than that of family labour cost 19.18 per cent. The share of machine power 5.60 per cent was more than that of bullock power 1.99 per cent. In total fixed cost, the rental value of land in Basti district was Rs 12000 per hectare and Rs 25.00 was paid as land revenue. The total fixed cost was comparatively more than the interest on working capital. The total cost of cultivation of sugarcane was increasing with respect to farm size of holdings and was found to be maximum under large farms Rs 92899.07 per hectare and minimum in marginal farm Rs 73661.04 per hectare. It is important to note that total variable cost was increasing with respect to the farm size. Thus, it could be concluded that total cost of cultivation was increasing with respect to farm size holding due to bigger farmers could incurred more expenditure on the material inputs.

Measures of farm profit in sugarcane

Table 2 shows the measures of farm profit in sugarcane has been understand by considering the economic parameters viz; yield of sugarcane, cost of cultivation, gross return, net return, cost of production, and input-output ratio, which is presented in Table 2. It has been observed from empirical findings that net return over total cost of cultivation of sugarcane was Rs 136941.07 per hectare, irrespective to the farm size holding and it varying from Rs 109007.50 to Rs 147873.43 per hectare for marginal to large farms size.

Table 1: Costs of cultivation of sugarcane under different farm size (Rs/ha)

Particular	Marginal	Small	Medium	Large	Overall
a. Material cost					
I. Seed	14520.42 (19.71)	14880.30 (18.46)	14950.30 (17.09)	15125.20 (16.28)	14977.57 (17.11)
II. Fertilizer	6545.32 (8.81)	8270.77 (10.20)	9617.50 (10.96)	11450.30 (12.33)	9943.35 (11.36)
III. Plant protection	1575.39 (2.12)	1752.31 (2.26)	2065.72 (2.35)	2362.70 (2.54)	2103.46 (2.39)
IV. Irrigation charges	1236.45 (1.66)	1552.05 (1.91)	1898.85 (2.16)	2145.35 (2.30)	1890.90 (2.15)
Total material cost	23877.58 (32.30)	26455.43 (32.83)	28532.37 (32.56)	31083.55 (33.45)	28915.28 (33.01)
b. Human labour cost					
I. Family labour	21750.34 (29.28)	22650.80 (27.95)	15750.20 (17.94)	14250.40 (15.37)	16783.23 (19.18)
II. Hired labour	7500.21 (10.10)	9750.11 (12.03)	19800.30 (22.56)	22950.10 (24.67)	18392.92 (21.02)
Total human labour cost	29250.55 (39.38)	32400.91 (39.98)	35550.50 (40.50)	37200.50 (40.04)	35176.15 (40.20)
c. Power use cost					
I. Bullock labour	1176.85 (1.59)	1494.89 (1.85)	1698.15 (1.95)	1984.35 (2.13)	1746.09 (1.99)
II. Machine power	4165.58 (5.60)	4486.75 (5.57)	4897.10 (5.60)	5213.70 (5.61)	4904.29 (5.60)
Total power use cost	5342.43 (7.19)	5981.64 (7.42)	6595.25 (7.55)	7198.05 (7.78)	6650.38 (7.59)
d. Interest on working capital	2570.33 (3.48)	2953.10 (3.70)	3844.95 (4.60)	4286.21 (4.59)	3777.06 (4.31)
Total variable cost (A)	61040.89 (82.86)	67791.08 (84.14)	74523.07 (85.22)	79768.31 (85.86)	74518.87 (85.11)

Note: Interest on working capital is computed at 7% interest rate per annum for the crop period. Figure in parentheses indicate percentage of total cost of cultivation

Table 2: Measures of farm profit in sugarcane

S. No	Particulars	Farm Size				
		Marginal	**Small**	**Medium**	**Large**	**Overall**
1	Yield (q/ha)	676.55	754.95	830.25	891.75	831.23
2	Cost of cultivation (Rs/ha)	73661.04	80581.58	87463.32	92899.07	87491.30
3	Gross return (Rs/ha)	182668.50	203836.50	224167.50	240772.50	224432.37
4	Net return (Rs/ha)	109007.50	123254.92	136704.18	147873.43	136941.07
5	Cost of production (Rs/q)	108.87	106.73	105.34	104.17	105.38
6	Input -Output ratio	1:2.47	1:2.52	1:2.56	1:2.59	1:2.56

Note: - Procurement price of sugarcane was Rs. 325/qt. provided by Govt. of U.P.

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