

RESEARCH ARTICLE :

An analysis mechanical Vs conventional method of sugarcane cultivation in Latur district

■ **T.B. MUNDE, V. P. WAVDHANE AND S.C. NADARGE**

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SUMMARY : Sugarcane (*Saccharum officinarum*) belongs to family gramineae and is one of the major commercial crops of India. Maharashtra having second position in area and production of sugarcane with 0.78 million hectares and 57.80 million tonnes, respectively. Maharashtra having fourth position with 74.10 tonnes per ha. Latur is among one of the major district of Maharashtra where sugarcane is cultivated on an area of 0.024 million hectares area sugarcane production is 1.84 million tonnes and productivity is 77.00 tonnes per hectare. The study was centered on the analysis economics mechanical vs conventional method of sugarcane. The study will be useful for the farmer in minimizing the cost and increasing the profit. Multistage sampling design was adopted in selection of district, villages and sugarcane growers. The analytical techniques liketabular analysis in which arithmetic mean with cost concept cost-A, cost-B, cost-C and percentage and cost-benefit ratio. Investment on commonly used assets and irrigation structure was Rs.4726.92 and Rs. 82834.76 on the mechanical method of sugarcane farm while it was Rs. 4288.67 and Rs. 80543.75 in conventional method of sugarcane farm observed. Gross return was found to be Rs. 283874.00, Cost-C was Rs. 149592.12 and net profit was Rs. 134281.88 in mechanical method of sugarcane farm, while in conventional method of sugarcane farm it was Rs. 254127, Rs. 151628.93 and Rs. 102498.57, respectively. Per tones cost of production of sugarcane was higher as Rs. 1448.50 in conventional method as compare to Rs. 1219.17 in mechanical method of sugarcane farm. The output-input ratios were 1.90 and 1.68 in mechanical method and conventional method of sugarcane production.

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Author for correspondence :

T.B. MUNDE

Department of
Agricultural Economics
and Statistics, PGI, Dr.
Panjabrao Deshmukh
Krishi Vidyapeeth,
AKOLA (M.S.) INDIA
Email: tukarammunde01@gmail.com

See end of the article for
authors' affiliations

BACKGROUND AND OBJECTIVES

Sugarcane (*Saccharum officinarum*) belongs to family gramineae and is one of the major commercial crops of India which is the homeland of sugarcane cultivation. India is occupying about 4.948 million hectares area with an annual sugarcane production of 338.88

million tonnes and productivity is 68.60 tonne/ha. Maharashtra having second position in area and production of sugarcane with 0.78 million hectares and 57.80 million tonnes, respectively. Maharashtra having fourth position with 74.10 tonnes per ha. Latur is among one of the major district of Maharashtra where sugarcane is cultivated

on an area of 0.024 million hectares area sugarcane production is 1.84 million tonnes and productivity is 77.00 tonnes per hectare.

Day by day labour wages are increasing and in the same way demand of agriculture products and also today's world need faster rate of production of agriculture products. Farm mechanization, a critical component for agricultural growth in India, remains in its nascent stages and during the last two decades has only been able to achieve a meager growth of less than five per cent. It is widely agreed that to push the farm mechanization. The study will be useful for the farmer in minimizing the cost and increasing the profit.

Objectives :

To analysis cost and returns of mechanical and conventional methods of sugarcane cultivation

RESOURCES AND METHODS

Methodology includes, sampling design, analytical techniques, as well as terms and concepts which have been described as follows.

Sampling design:

Multistage sampling design was adopted in selection of district, sugarcane factory area, villages and sugarcane growers.

Selection of district:

In first stage, Latur district was purposively selected on availability of sugarcane area for the study purpose.

Selection of sugarcane factory area:

In second stage, on the basis of area under sugarcane crop in the vicinity of Vikas co-operative sugar factory of Latur district was selected for the present study.

Selecion of villages :

In third stage, from selected co-operative sugar factory four villages selected on the basis of highest area under sugarcane crop. The selected villages in the vicinity of Vikas co-operative sugar factory were namely Niwali, Dhakani, Ekurga and Borgaon.

Selection of sugarcane growers:

In forth stage from selected villages list of the

sugarcane was prepared and from this list eight sugarcane growers from mechanical and eight sugarcane growers from conventional method were selected from each village. It means total sixty four sugarcane growers were finally selected for the study purpose.

Collection of data :

The cross sectional data were collected from 32 mechanical and 32 conventional method adopting sugarcane growers by personal interview method.

Analytical techniques:

To study the mechanical method of sugarcane cultivation achieved by tabular analysis in which arithmetic mean with cost concept cost-A, cost-B, cost-C, percentage and cost-benefit ratio was emphasized.

Terms and concepts used:

Cost concepts :

Cost of cultivation was worked out by using the cost concepts viz., cost- A, cost-B and cost-C.

Cost-A:

Direct expanses or actual expenses incurred by producer farmer from his pocket for the production of particular crop.

Cost-A includes:

- Hired human labour
- Bullock labour
- Seed
- Fertilizer
- Manure
- Plant protection
- Irrigation
- Land revenue and taxes
- Incidental expenditure
- Interest on working capital

Cost-B:

Cost A + indirect expenses incurred by producer farmer for the production of a particular crop. *i.e.* Rental value of land, Interest on fixed capital. (Rental value of land = $1/6^{\text{th}}$ value of gross value minus land revenue).

Cost-B includes:

Cost-A :

- Rental value of land
- Depreciation on implements and farm building

- Interest on fixed capital.

Cost-C includes:

Cost-B :

- Imputed value of family labour.

Measurement and evolution of cost items:

Human labour:

It includes both hired and family labour. Most of the labour force engaged in crop production comes from cultivators own family. However, the cultivators have to engage hired labour from time to time for certain operation human labour cost comprises of :

- Wages actual paid to the hired labour.
- Imputed values of family labour.

Hired human labour was measured in man-days. One man- day consist of 8 hours. Labour cost evaluated at the rate of Rs. 200 per day for male and Rs. 100 per day for female.

Bullock labour:

Hired bullock labour charge was considered for 8 hours as a day, actually paid in the locality. Family bullock labour charges accounted equal to the charges paid to the hired bullock pair. For the present study, hired bullock charge was Rs. 300 per day for a bullock pair.

Machine labour:

Machine labour in case of owned machine was evaluated as per the hired charge prevailed in the village and in case of hired machine that was Rs. 500/ hour.

Seed sets:

The actual price with expenditure incurred on procurement was taken into account for purchase of sugarcane seed was Rs.2500/tonnes.

Fertilizers:

Fertilizers in the form of urea, diamonium phosphate (DAP), 10:26:26 were used and quantity of nitrogen, phosphorus and potash were calculated in order to determine the actual expenditure on nitrogen, phosphorus and potash. The rate prevailing in the market for nitrogen, phosphorus and potash was Rs.13.97/kg, Rs.52.62/kg and Rs.32.66/kg, respectively.

Manure:

Manure produced on the own farm was evaluated

at the rate of prevailed in the village. The cost of purchased manure was accounted according to the price paid by cultivator. One cartload (CL) of manure was considering as five quintals and its prevailing price was Rs. 100/qtl.

Plant protection:

This includes the actual cost incurred on purchase of insecticides, pesticides, fungicides and their procurement.

Land revenue:

The land revenue was considered actually paid by sugarcane growers for crop.

Incidental expenditure:

It includes minor repairs, refreshing charges and other expenditure in regard to sugarcane growers.

Interest on working capital:

Interest on working capital was charged @ 13 per cent on items of expenditure as hired human labour, bullock labour, fertilizer, manure, plant protection, irrigation charges, land revenue and incidental charges for crop duration.

Depreciation of assets:

Depreciation means the decrease in the value of asset through wear and tear. Straight-line method was used for calculating depreciation. The uniform rate of 10 per cent on the present value at the beginning of the year of the farm implements and machinery was taken and only the proportionate charge was taken for the crop on hectare basis.

Rental value of land:

Rental value of owned land was estimated at $1/6^{\text{th}}$ of the value of produce *i.e.* $1/6^{\text{th}}$ value of gross return minus land revenue.

Rental value of land= $1/6$ (Gross return)-Land revenue.

Interest on fixed capital:

It was calculated by charging interest @ 11 per cent on investment on commonly used assets like wooden plough, iron implements, equipments and which distributed on cropped area. Commonly used assets include plough, harrow, seed drill, bullock cart, hand

sprayer and power sprayer.

Irrigation structure:

It includes capital investment on well, electric motor, pipe line and dripper. Annual expenditure on irrigation structure include electric charge, depreciation on well @ 2 per cent, interest on well @ 10 per cent, depreciation on electric motor @ 10 per cent, interest on electric motor @ 10 per cent, depreciation on pipe line @ 10 per cent, interest on pipe line @ 10 per cent depreciation on dripper @ 10 per cent, interest on dripper @ 10 per cent.

Positive correlation :

Positive correlation is relationship between two variables which are depends on each other in which as increase in one variable cause increase in ratio.

Negative correlation:

Negative correlation is inverse relationship between two variables which are depends on each other.

Measure of income:

Following production business analysis has been carried out by using different measures of income as under.

Gross income :

The value of produce (*i.e.* main produce and by produce) was calculated at prevailing price in the area.

Farm business income:

The difference between the gross income and cost-A represents farm business income of the producer (Gross returns – Cost 'A').

Family labour income:

The profit on cost- B, that is difference between the gross income and cost-B represents the income of the cultivator and accounts at his own and family labour used in particular crop (Gross returns – Cost 'B').

Net profit :

The profit on cost-C, which is the net profit from particular crop (Gross returns–Cost C).

Output-input ratio :

It is ratio of output (gross returns) to input (cost-C).

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Costs, returns and profitability of sugarcane farm:

Physical inputs can be transformed in monetary term for the production of sugarcane. The inputs can be converted into monetary term to determine the perfectare cost of cultivation. Similarly, main produce and by-

Table 1: Per hectare physical inputs and outputs of sugarcane production under mechanical and conventional method (unit/ha)

Sr. No.	Particular	Sugarcane farm	
		Mechanical	Conventional
Input			
1.	Hired human labour (man days)	172.94	197.43
2.	Bullock labour (pair days)	8.93	9.03
3.	Machine labour (hours)	8.13	7.83
4.	Seed sets (tonnes)	3.94	4
5.	Manure (qtl.)	34.64	32.72
6.	Nitrogen (kg)	238.54	232.48
7.	Phosphorus (kg)	108.73	105.83
8.	Potash (kg)	102.82	99.87
9.	Irrigation (m ³)	10266.41	11217.93
10.	Family human labour (man days)	14.85	17.96
Output			
11.	Main produce (tonnes)	122.7	104.68
12.	By produce (tonnes)	14.18	17.45

produce can be converted into monetary term to get the gross return. With the help of costs, returns and profitability of sugarcane production was determined as follows.

Physical inputs and outputs in sugarcane production:

Per hectare physical inputs and outputs of sugarcane production of mechanical and conventional methods of sugarcane cultivation were calculated and presented in Table 1. The use of hired human labour was more *i.e.* 197.43 man days and 172.94 man days in conventional method and mechanical method of sugarcane farm, respectively. Use of bullock labour was 9.03 and 8.93 pair days in conventional method and mechanical method of sugarcane farm, respectively. Similarly the use of machine labour 7.83 and 8.13 hours in conventional method and mechanical method of sugarcane farm, respectively.

The use of sets was 3.94 tonnes in mechanical method of sugarcane farm followed by that of 4.00 tonnes in conventional method of sugarcane farm. In regard to manure, the higher quantity of 34.64 quintals was used in mechanical method of sugarcane farm than that of 32.72 quintals in conventional method of sugarcane farm. Use of nitrogen, phosphorous and potash was slightly higher

as 238.54, 108.73 and 102.82 kg, respectively in mechanical method of sugarcane farm while use of nitrogen, phosphorous and potash was 232.48, 105.83 and 99.87, respectively in conventional method of sugarcane farm. Use of irrigation was 11217.93 cubic meters in conventional method of sugarcane farm and 10266.41 cubic meters in mechanical method of sugarcane farm. Use of family human labour was higher in conventional method of sugarcane farm as 17.96 man days while that was 14.85 man days in mechanical method of sugarcane farm, respectively. It implied that, there was need of skilled labour in mechanical method. It was also observed from the Table 2 that main produce of mechanical method of sugarcane farm was observed more 122.70 tonnes and conventional method was 104.68 tonnes per hectare. It was observed that, affect the mechanical method of sugarcane cultivation another factors important to increase the yield of mechanical method of sugarcane farm *i.e.* mechanization. By-produce was higher as 17.45 tonnes in conventional method of sugarcane farm, while that was 14.18 tonnes, in mechanical method of sugarcane. Mechanically harvest sugarcane field losses of by-produce (green part) of sugarcane due to the machine or harvester. But actually it is not loss, it was gain more than the value of

Table 2: Per hectare cost of cultivation of sugarcane production under mechanical and manual method (Rs./ha)

Sr. No.	Particular	Sugarcane farm			
		Mechanical	Per cent	Conventional	Per cent
1.	Hired human labour	30678.11	20.51	34905.54	23.02
2.	Bullock pair	2679.96	1.79	2709.95	1.79
3.	Machine hours	4063.08	2.72	3913.32	2.58
4.	Seed sets	9842.5	6.58	9992.18	6.59
5.	Fertilizers	12411.88	8.3	12078.27	7.97
6.	Manure	3463.99	2.32	3271.99	2.16
7.	Plant protection	1259.65	0.84	1332.64	0.88
8.	Irrigation	22586.1	15.1	24679.45	16.28
9.	Land revenue	2156	1.44	1279.8	0.84
10.	Incidental expenditure	418.38	0.28	368.22	0.24
11.	Interest on working capital @13%	11108.9	7.43	11705.75	7.72
12.	Cost-A (\sum item 1 to 11)	100668.55	67.3	106237.1	70.06
13.	Rental value of land	45156.33	30.19	41074.78	27.09
14.	Interest on fixed capital @ 11%	519.96	0.35	471.75	0.31
15.	Depreciation on capital asset @10%	472.69	0.32	428.87	0.28
16.	Cost-B (\sum item 12 to 15)	146817.54	98.15	148212.5	97.75
17.	Family human labour	2774.58	1.85	3416.42	2.25
18.	Cost-C (\sum item 16 to 17)	149592.12	100	151628.9	100

by-produce with production of organic manuring addition to the soil fertility.

Cost of cultivation of sugarcane production:

Per hectare cost of cultivation in sugarcane of mechanical method and conventional method were calculated and presented in Table 2. The results revealed that, cost A was higher as Rs. 106237.11 in conventional method of sugarcane farm while that was Rs. 100668.55 in mechanical method of sugarcane farm. It was due to adoption of new technology in mechanical method. Input utilization was very less as compare to conventional method *i.e.* hired labour, seed sets, fertilizers and irrigations etc. Among the various items of expenditure, the proportionate share of hired human labour was predominant as 20.51 per cent followed by irrigation 15.10 per cent, fertilizers 8.30 per cent, sets 6.58 per cent, machine labour 2.72 and bullock labour 1.79 per cent in mechanical method of sugarcane farm. In case of conventional method of sugarcane farm proportionate share of hired human labour 23.02 per cent, followed by irrigation was 16.28 per cent, fertilizers 7.97 per cent, sets 6.59 per cent, machine labour 2.58 and bullock labour 1.79 per cent. The cost B was higher as Rs. 148212.51 in conventional method of sugarcane farm while that was Rs. 146817.54 in mechanical method of sugarcane farm.

In that the proportionate share of rental value of land was 30.19 per cent in mechanical method of sugarcane farm and 27.09 per cent in conventional method of sugarcane farm. Cost-C was higher as Rs. 151628.93 in conventional method of sugarcane farm while that was Rs. 149592.12 in mechanical method of sugarcane farm.

It inferred that, due to higher yield and prices of sugarcane that proportionate share of rental value of land was higher in mechanical method as compared to conventional method of sugarcane farm.

Profitability of sugarcane production:

Per hectare profitability in sugarcane production of mechanical method and conventional method of sugarcane farm were calculated and presented in Table 3. The results revealed that, gross return was highest as Rs. 283874.00 in mechanical method of sugarcane farm followed by Rs.254127.50 in conventional method of sugarcane farm.

It was clear that, farm business income, family labour income and net profit was also more Rs.183205.45, Rs. 137056.46 and Rs. 134281.88, respectively in mechanical method of sugarcane farm. On the contrary, farm business income, family labour income and net profit was less Rs. 147890.39, Rs. 105914.99 and Rs.102498.57, respectively in conventional method of sugarcane farm. It shows that mechanical method of sugarcane production was more profitable than that of conventional method of sugarcane production. It was clear that, output-input ratio was higher as 1.90 in mechanical method of sugarcane farm than that of 1.68 in conventional method of sugarcane farm. It implied that, when 1 rupee spent on sugarcane production, it would lead to give the returns of Rs. 1.90 in mechanical method of sugarcane production and Rs. 1.68 in conventional method of sugarcane production. It revealed that capital investment of mechanical method of sugarcane production was most efficient than that of conventional

Table 3: Per hectare profitability of sugarcane production under mechanical and conventional method (Rs./ha)

Sr. No.	Particular	Sugarcane farm	
		Mechanical	Conventional
1.	Returns from main produce (cane)	276075	244530
2.	Returns from by produce	7799	9597.5
3.	Gross returns (item 1+2)	283874	254127.5
4.	Cost-A	100668.55	106237.11
5.	Cost-B	146817.54	148212.51
6.	Cost-C	149592.12	151628.93
7.	Farm business income (Gross return minus Cost-A)	183205.45	147890.39
8.	Family labour income (Gross return minus Cost-B)	137056.46	105914.99
9.	Net profit (Gross return minus Cost-C)	134281.88	102498.57
10.	Output-Input ratio (Gross return divided by Cost-C)	1.9	1.68
11.	Per tonne cost of production (Cost-C divided by main produce quantity)	1219.17	1448.5

method of sugarcane production. Per tonnes cost of production of sugarcane was higher as Rs. 1448.50 in conventional method of sugarcane farm, while that was less Rs. 1219.17 in mechanical method of sugarcane farm. It implied that, cost of production was reduced due to mechanical method of sugarcane.

Conclusion :

Sugarcane was main cash crop grown by both mechanical and conventional method of sugarcane growers. It was concluded that mechanical method farm was more efficient in production of sugarcane compared conventional method of sugarcane farm. The use of hired human labour and family human labour was in inverse position in both mechanical and conventional method of sugarcane farm.

The per hectare use of hired human labour and irrigation was relatively less in case of mechanical method of sugarcane farm than conventional method of sugarcane farm. It was concluded that, machine labour, manures, fertilizers and rental value of land was slightly dominant in cost-C on mechanical method of sugarcane farm. Whereas, hired human labour and irrigation was dominant in cost-C on conventional of sugarcane farm.

The highest per hectare return were obtained from mechanical method of sugarcane farm than conventional method of sugarcane farm. This has also depicted the higher input-output ratio in case of mechanical method

of sugarcane farm.

Authors' affiliations :

V.P. WAVDHANE, Department of Agricultural Economics and Statistics, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA

S.C. NADARGE, Department of Agricultural Economics and Statistics, Vasanttrao Naik Marathwada Krishi Vidyapeeth, PARBHANI (M.S.) INDIA

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