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Economics of strip v/s conventional method of sugarcane planting in western Maharashtra

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ABSTRACT

The investigation was based on the farm level data collected from 60 sugarcane growers adopting strip method and 60 adopting conventional method from the 6 selected villages of 2 Tahsils from Satara district of western Maharashtra. The results of the study indicated that, due to adoption of strip method of sugarcane planting there existed a saving in, the use of important resources like labour, planting material and manure and fertilizers over the conventional method of planting. This saving was maximum in the use of manure 16.40 pre cent followed by planting material 12.43 per cent and bullock and human labour by 11.46 and 7.25 per cent, respectively. There was reduction in the per hectare total cost of cultivation of sugarcane by 3.37 per cent in strip method than the conventional one. This reduction was 9.61 per cent at the level of cost 'A', which is the actual cost to be paid by the growers. The same method of sugarcane planting was also resulted in the increase of cane yield to the extent of 12.96 per cent and gross produce and net profit by 27.07 and 45.58 per cent over a conventional method. The production function analysis indicated that, the human and bullock labour, nitrogen. and phosphorous fertilizers were use efficiently under both the methods of sugarcane cultivation. The study advocates a wide spread of strip method of sugarcane plantation technology which resulted in saving of important and costly inputs, low cost of production and high returns.

Key words : Sugarcane, Strip (Patta) method, Planting, Inputs

INTRODUCTION

Sugarcane is an important cash crop grown in Maharashtra. Maharashtra ranks first in recovery of sugar, second in area and fourth in productivity of sugarcane in the country. The sugar industry, which is based on the raw produce that is sugarcane, occupied a pivotal place on the economic map of Maharashtra. This is because the state alone produces more than 40 per cent of the total production of sugar in the country. Success of sugar industry depends upon various factors of which adequate supply of raw produce *i.e.* sugarcane to the factories is a crucial one. It is, therefore, necessary to have production plans, which will ensure an adequate and steady supply of sugarcane to the sugar industry in Maharashtra. Either through area expansion of the crop or enhancing the productivity, or both can increase the production of sugarcane. However, in view of the constraints on resource such as irrigation, for the crop in the state, it would be difficult to allocate more land and water resources to this crop, but resort to adopt such a technology which would result in increasing and maintaining the high productivity as well as low cost of production of the crop. A planting pattern a part of sugarcane cultivation technology becoming popular in Maharashtra. The conventional ridges and furrow method was generally used for cultivation of sugarcane. But nowadays a strip (Patta) method of sugarcane cultivation has been introduced and it is undertaken by the large number of the farmers.

Strip method of sugarcane planting:

In the strip method, the furrows are opened at 90 cm in clay soils, 75 cm in medium soils, and 60 cms in light soils. By opening the furrows the planting is done by following ways.

– One row strip - planting is done in the alternative rows by keeping middle row fallow.

– Paired row planting is done in paired row by keeping one row fallow between the two-paired rows. Some time paired row are opened by keeping the strip of recommended distance instead of opening of furrow in entire field.

– Four row planting or skipped row planting - in this case sugarcane is planted in the four rows by keeping one row follow between the two four rows

Advantages of strip planting:

– Crop get more sunlight and aeration due to this there is increase in dry matter and number of millable cane with professed growth

– Due to the more space between the two rows inter crop of 3 to 3½ month can be taken. It will provide additional income to the farmer by utilizing available resources.

– Avoid the competition between the plants for the nutrient, space and water.

– Interculturing operation like earthing up, weeding can be done with the help of machinery. Even harvesting of cane can be possible by machine.

– Saving of manpower and inputs like water, fertilizers

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and ultimately there is reduction in the cost of cultivation.

MATERIALS AND METHODS

The sampling technique adopted for this investigation was two stages stratified random sampling with the villages as a primary unit and the cultivators as an ultimate unit of sampling. Satara being a major sugarcane growing district, two tahsils *viz*, Karad and Satara having maximum area under sugarcane were selected purposively for the study. Three villages each from the selected tahsils were selected randomly on the basis of probability proportion to the area under sugarcane. Ten cultivators adopting strip (Patta) method and 10 cultivators adopting conventional method from each of the villages were selected randomly. Thus the total sample for the study consists of 120 sugarcane growers comprised of 60 adopting patta method and 60 adopting conventional method of sugarcane planting. The data on the various aspects such as input use, productivity, costs and returns according to plantation types was collected from the selected sugarcane cultivators for the crop year 2001-2002. A simple method of tabular analysis was used to analyse the data on physical resource use costs and returns for each method under study. The analysis was further extended to know the resource productivities and their use efficiency with the help of Cobb-Douglas type of production function.

RESULTS AND DISCUSSION

Saving in the use of resources:

The profitability of the farm business can be decided from the relationship between costs incurred and returns obtained from it. The cost structure depends upon the type of resource employed, the resource mix and the extent of their application. The information on utilization of different resources on per hectare basis and proportionate saving in their use under strip method of planting is presented in Table 1.

It could be revealed from the Table 1 that for strip method, the total human labour required for cultivation of one hectare of sugarcane was 249.60 days. This use level was less as compared to the conventional method, under which the human labour use was 269.12 days. The per hectare bullock labour use was maximum in conventional method than the strip method of planting of sugarcane. As machine power is concerned, the machine power required for cultivation of one-hectart? area for strip method was 10.29 hrs which was less as compared to machine power required for the conventional method. The use of planting material was more in conventional method and less in strip method. Nowadays manure became a scare commodity. Therefore, there was a large gap between the recommended and used level of manure. The used level of manure was less in strip method than the conventional method. The per hectare application of plant nutrients like nitrogen phosphorous and potassium through chemical fertilizer for strip method was 288.70, 124.10 and 122.30 kg., respectively which was less than the nitrogen, phosphorous, potassium used for conventional method of planting.

Table 1 : Per hectare use levels and saving in the use of important resources

Resource	Units	Strip method	Conventional method	Saving under Strip method (%)
Human labour	Days	249.60	269.12	7.25
Bullock labour	Pair-Days	9.11	10.29	11.46
Machine power	Hrs	10.29	12.31	16.40
Planting material	Qtls	65.50	74.80	12.43
Manure	Qtls	62.35	66.34	6.01
Fertilizers N	Kg.	288.70	298.59	3.31
P	Kg.	124.10	130.61	4.98
K	Kg.	122.30	129.50	5.55

The last column of Table 1 revealed that, due to adoption of strip method of sugarcane planting the saving in resource use was maximum to the extent of 16.40 per cent in case of machine labour. It was 12.43, 11.46 and 7.25 per cent in the use of planting material, bullock labour and human labour, respectively. Even though the use of manure and fertilizers were less than the recommendations under both the methods of planting till there was saving in the use of these important inputs. It was 6.01, 3.31, 4.98 and 5.55 per cent in case of manure, nitrogen, phosphorous and potassium, respectively.

Reduction in the cost of cultivation:

The per hectare cost of cultivation in strip method and conventional method have been worked out at different cost levels (*i.e.* cost A, Cost B and Cost C) and presented in Table 2. From the Table 2 it was observed that, under conventional method, the per hectare total cost of cultivation of sugarcane that is cost 'c' was Rs. 60659.23 which comprised of Rs. 37198.96 and Rs.52895.03 at cost 'A' and cost 'B', respectively. The proportion of cost 'A' and cost 'B' in the total cost was 61.32 and 87.20 per cent, respectively. Whereas, the per

Table 2 : Per hectare cost and reduction in the cost of cultivation of sugarcane

Costs	Strip method	Conventional method	Reduction in cost under strip (%)
Cost 'A'	33621.25 (57.36)	37198.96 (61.32)	9.61
Cost 'B'	51445.41 (87.77)	52895.03 (87.20)	2.74
Cost 'C'	58612.77 (100.00)	60659.23 (100.00)	3.37

hectare total cost of cultivation of sugarcane under strip method of planting was Rs. 58612.77. The proportion of cost 'A' and cost 'B' in the total cost 'C' was 57.36 and 87.77 per cent, respectively. The unit cost of cultivation of sugarcane was comparatively low in the case of strip method of sugarcane planting than the conventional one at all the levels of costs.

The reduction in per hectare cost of cultivation of sugarcane at the level of cost 'A' was to the extent of9.61 per cent due to adoption of strip method over the conventional one. This saving in cost was 2.74 per cent and 3.37 per cent at level of cost 'B' and cost 'C', respectively.

Increase in returns and profitability:

An attempt has been made here to compare the per hectare output, returns and profitability in strip method and conventional method of sugarcane cultivation. The details in this respect are given in Table 3. It is found from the data exhibited in Table 3 that, under strip method the yield of sugarcane obtained was to the tune of 120.58 tons per hectare. The value of the gross produce was Rs. 102404.38. The profit at cost 'c' that is net returns was Rs. 45196.96 and the benefit cost ratio was 1.83. This was comparatively higher than the conventional method of sugarcane cultivation. The per ton cost of production of sugarcane was Rs. 436.85 under strip method which is less than the per ton cost of production (Rs. 516.23) under conventional method. This is due to the higher yield and less cost of cultivation under the strip method.

The increase in yield of main produce and by produce was to the extend of 12.96 and 27.07 per cent due to adoption of strip method of sugarcane cultivation. This increase in the case of gross return and net return was to the tune of 13.69 and 45.58 per cent.

Resource productivity and resource use efficiency:

The resource productivity and resource use efficiency in sugarcane production have been analysed with the Cobb-Douglas type of production function framework. Cobb Douglas type of production function was fitted to the sample data separately for strip and conventional method of sugarcane cultivation.

Resource productivity:

The data on regression coefficients, standard errors and coefficient of multiple determination are given in Table 4. The significant F ratio obtained from the analysis of variance in respect of production function of strip and conventional method of sugarcane cultivation indicated the overall significance of the estimated production function.

The coefficient of multiple determination (R^2) indicates the proportion of total variation in the dependent variable (*i.e.* crop output) explained by the independent variable jointly. The eight resource variables included in the production function analysis have explained variation in output *i.e.* 78.97 per cent in case of conventional method and 76.07 per cent in strip method of sugarcane cultivation. The regression coefficient of the resource variable namely human labour (X_2), bullock labour (X_3), manure (X_4), nitrogen (X_5) and phosphorous (X_6) were positive and significant. Where as, the regression coefficient of area

Table 3 : Per hectare returns and profitability of sugarcane cultivation

Particulars	Strip method	Conventional method	Increase in returns under strip (%)
Main produce (tons)	120.58	106.74	12.96
Value of main produce (Rs.)	96467.09	85394.76	--
By-produce (tons)	18.26	14.37	27.07
Value of by-produce (Rs.)	5937.28	5557.11	--
Gross value of production (Rs.)	102404.38	90066.24	13.69
Cost of cultivation	58617.77	60659.23	--
Per tonne cost of production	436.85	516.23	--
Net profit (Rs.)	45196.96	31044.16	45.58
Benefit cost ratio	1.83	1.52	--

Table 4 : Regression coefficients, standard error and coefficient of multiple determination for strip and conventional method

Particulars	Strip method	Conventional method
Number	44.00	46.00
Constant (log 10^a)	1.85	1.45
Cropped area (hectares)	0.05N	0.01
X_1	(0.97)	(0.16)
Human labour (Man days)	1.30*	0.79***
X_2	(0.69)	(0.28)
Bullock labour (Pair days)	1.33*	0.65**
X_3	(0.73)	(0.32)
Manure (Quintals)	1.13**	0.04 N
X_4	(0.49)	(0.17)
Nitrogen (Kgs)	0.93***	0.41 *
X_5	(0.34)	(0.30)
Phosphorous (Kgs)	0.67**	0.65*
X_6	(0.33)	(0.40)
Potassium (Kgs)	-0.18 N	0.76N:)
X_7	(1.12)	(0.80)
Other working capital	-0.11 N	0.01 N
(Rs.) X_8	(0.34)	(0.14)
R^2	0.7607	0.7897
'F' value	5.59**	17.31**

(Figures in the parentheses are the standard errors of the respective regression coefficient)
*, ** and *** indicates significance of values at P=0.1, 0.05 and 0.01, respectively

(x_1), was positive but non significant. However, the negative and non-significant regression coefficients were noticed in case of potassium (X_7) and other working capital (X_8) under strip method of sugarcane cultivation. In Cobb-Douglas production function frame work the regression coefficients of the individual resource variable are the production elasticities of the respective resource variable indicate the percentage change in crop output associated with a percentage change in the concerning input at its geometric mean level. The highly significant regression coefficient observed in case of nitrogen in strip method indicated that one per cent change in its use level would increase the output of sugarcane by 0.93 per cent keeping the use levels of the other variable constant. In the same manner the other variables having positive regression coefficient can change the output of sugarcane in proportion to the value of their regression coefficient. The negative and non-significant coefficient of potassium and other working capital *i.e.* expenses on seed, irrigation, plant protection etc. indicated the excess use of the said variable. The resource variables like human labour, bullock labour and manure have the production elasticity exceeding unity showing increasing in marginal productivity of the factor inputs. In the conventional method, the production function estimate indicated that the resource variable namely human labour, bullock labour, nitrogen and phosphorous were positive and significant. Where as, the variables namely area, potassium and other working capital were positive but non significant. The variables having positive and significant regression coefficient were the important to which the crop output is responsive.

Resource use efficiency:

The production function analysis has been generally used to determine the economic efficiency of resource use, which required estimation of marginal value product

Table 5 : Comparison of marginal value product of resources with their per unit

Particulars	Strip	Conventional
Cropped area		
MVP at G.M.	5415.16	637.34
price (per unit)	17803.03	15618.73
Difference	-12387.86	-14981.39
Human labour		
MVP. at G.M.	1037.90	531.81
Price (per unit)	60.00	60.00
Difference	977.90	471.815
Bullock labour		
MVP. at G.M.	13438.07	4406.68
Price (per unit)	150.00	150.00
Difference	13288.07	4256.68
Manure		
MVP. at G.M.	3204.73	45.7392
Price (per unit)	55.00	55.00
Difference	3149.73	-9.2608
Nitrogen		
MVP. at G.M.	290.11	108.7202
Price (per unit)	10.86	10.86
Difference	279.25	97.8602
Phosphorous		
MVP. at G.M.	486.3 7	409.40
Price (per unit)	18.75	18.75
Difference	467.62	390.65
Potassium		
MVP. at G.M.	-134.49	462.34
Price (per unit)	7.50	7.50
Difference	-141. 99	454.84
Other working capital		
MVP. at G.M.	-0.8825	0.11
Price (per unit)	1.00	1.00
Difference	-1.8807	-0.8877

of resources. The resource or input is considered to be used most efficiently if its marginal value product just offsets its cost. Equality of MVP to factor cost is, therefore, the basic condition that must be satisfied to obtain efficient resource use. The marginal value product of resources so obtained at the geometric mean level from the estimated production function along with the per unit cost of the respective resources are presented in Table 5.

Table 5 revealed that positive difference between the marginal value product and the per unit acquisition cost of human labour, bullock labour, manure. Nitrogenous, phosphatic fertilizers showed the efficient effect of these inputs in the production of sugarcane under the strip method of sugarcane cultivation. Whereas, the negative difference between the marginal value product and the unit price *o*f resource namely land, potasic fertilizer and other working capital showed inefficient effect on sugarcane output in the same method of cultivation. While in the case of conventional method human labour, bullock labour, nitrogenous, phosphatic and potasic fertilizers were used efficiently. In efficient use in case of the land manure and other working capital was observed in the same method of sugarcane planting.

Conclusion :

The adoption of strip method of sugarcane planting resulted in saving in important and costly inputs, low cost of production and high returns. Efforts are, therefore, needed to activate extension education programme for the spread of strip method of sugarcane cultivation technology among the sugarcane growers.

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