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DETERMINING COMPARATIVE ECONOMICS OF SOME PLANTING PATTERNS OFSUGARCANE

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The findings of this paper are based on experimental data collected from the Postgraduate Agricultural Research Station. University of Agriculture. Faisalabad. The data were used to evaluate comparative returns from different sugarcane planting techniques. Partial budgeting technique was used for data analysis.The results showed that the most appropriate method of planting sugarcane was 90 cm (90*90 cm) spread pits.

Key words: comparative economics. planting patterns, sugarcane

INTRODUCTION

Sugarcane is an important cash crop of Pakistan .It is mainly grown for sugar and jaggery production .It is an important source of income and employment for the farming community. It also forms basis for many important industries like sugar, beverages. chipboard. paper.animal feed, confectionery, etc. and provides raw materials to many other industries such as chemicals, plastics, paints, synthetics, fibre, insecticides and detergents,

Sugarcane production in Pakistan has increased over time, however, this increase has mainly resulted from an expansion in area, whereas yields have shown a nominal increase. Area, production and yield over the period of 1947-88 grew at an average annual rate of 3.79, 4.53 and 0.74% respectively (M ahmood and Waiters, 1990). In 1988-89, the area under sugarcane was 877 thousand hectares which increased to 1009 thousand hectares in 1994-95 and sugarcane production inc reased from 36976 thousand tons in 1988-89 to 47168 thousand tons in 1994-95. Thus during the same period cane yield only increased from 42.2 to 46.7 tons per hectare (Anonymous, 1994-95). It shows that despite expansion in production over the years, increase in the productivity per unit of area has been very low in Pakistan.

Average sugarcane yields in Pakistan have remained between 40 to 45 tons per hectare, which are considerably less than those obtained in many other countries. Average yield of sugarcane in the world is around 60 metric tons per hectare, while India and Egypt are obtaining 65 and 103 tons per hectare respectively (Anonymous, 1994). Thus Egypt with the highest cane yield in the world is getting about 140% higher yield than Pakistan. India with almost similar soil and elimatic conditions is obtaining about 5I % higher cane yield than Pakistan.

Even within Pakistan, there exists a large gap between yield obtained by the progressive farmers and that of national average. Moreover, much higher production potential has been exhibited at the research stations.It has been observed that conventional planting methods and low plant population are responsible for low yields (Ghaffar, 1990).

Recently some new patterns of planting sugarcane have been developed at the research stations which not only facilitate some essential operations freely and conveniently, but also help establish appropriate plant population per unit area and thus increase production. A lot of data were available with these research stations which could be put to economic analysis to assess the benefits and costs of alternative planting methods. The present study is directed to assess and compare gross and net benefits of the use of various sugarcane planting methods and to suggest the most appropriate planting pattern. It can help sugarcane growers to increase their cane yields at the lowest possible cost.

MATERIALS AND METHODS

TIle present study was based on experimental data of different planting patterns of sugarcane , collected from experiments conducted at the Postgraduate Agricultural Research Station (PARS), University of Agriculture, Faisalabad.

The following sugarcane planting techniques were compared:

PT! =90 cm spaced double row strips,
PT2= 100 cm spaced 100*100 cm pits,
PT3 = 75 cm spaced 100* 100 cm pits,
PT4=90 cm spaced 90*90 cm pits, and
PT5 =75 cm spaced 90*90 cm pits.

The data were analysed by using partial budgeting technique described by CIMMYT (l988).Partial budgeting technique is mostly used to compare new technologies with current farmer practices, to judge the possibility of adoption by the farmers. It is simply a part of an enterprise budget or crop rotation or farming systems budget. Basically, it involves selecting out only those costs that vary with the particular planting technique being analysed. In this study different types of planting techniques of sugarcane crop were compared with each other and only those costs were included in analysis that varied with the use of an alternative planting technique. For partial

hudgeting analysis the following procedure was employed:

a. Average yield of sugarcane crop was calculated for each planting technique.
b. The farmers often obtain less yield than researchers, even when they apply the same technology. It is mainly due to difference in management. It has been estimated that on average. tanners get 10-20 % less yield as compared to the experimental yield. To reach the farmer level, the average yields need to be adjusted down by 15 % (CIMMYT.1988).
c. Field price of a product is defined as the value to the farmer of an additional unit of production in the field prior to harvest. It is calculated by subtracting from the sale price of the product those costs which are roughly proportional to the yield. These costs usually include cleaning, transport from field to the point of sale, farmer's storage costs and octroi charges . Field price of output comes to about 10-15 % less as compared to the sale price of the product in the market. Field price of sugarcane was calculated by discounting the sale price of sugarcane in the market by 15%.
d. By multiplying the field price and adjusted yields, gross field benefits for each treatment were calculated.
e. The next step used in partial budgeting technique was to calculate costs that vary. Costs that vary are those of purchased inputs (like weedicide , fertilizer, farm yard manure. etc.), labour (family or hired) and machinery (owned or rented) that vary between experimental treatments. In this study cash costs included costs of farm yard manure, while the opportunity costs included all the costs of labour from preparatory tillage to digging pits. Then the net field benefits were calculated by subtracting the total costs that vary from gross field benefits. The calculation of net field benefits for each planting technique was only an intermediate step. The planting technique which gave the highest net field benefits could not be recommended as the best technique because of some crucial aspects of farmer's conditions, namely capital scarcity, yield uncertainty and risk aversion had yet to be included in the analysis.
f. Dominance analysis was undertaken next in which clearly unprofitable sugarcane planting techniques (treatments) were discarded. Such techniques (treatments) are called as dominated treatments. These treatments were eliminated from further analysis. This elimination signifies the fact that the value of increase in yield is not enough to compensate for the increase in costs in a dominated treatment. For im.:reasing farmer's income and welfare, it is important to pay more attention to net benefits rather than yields.
g. After discarding the dominated treatments, marginal analysis was done. Marginal analysis included the calculation of marginal returns for each treatment which is an expression in percentage terms of relationship between the marginal net benefits(i.e. the change in net benefits) and the marginal cost(i.e. the change in total costs that vary). Finally, the treatment giving higher marginal rate of return was recommended.
h. Farmers confront risk due to price variation. To avert the element of risk, the effects of price variation were analysed. Here the analysis was carried out twice. Firstly, the marginal analysis was tarried out assuming cost-overrun of 20 % while keeping the benefits the same. Secondly, the analysis was rerun assuming benefits reduction of 20 % while keeping the cost constant. Finally, the results of cost-overrun and benefits reduction options were compared with the original analysis.

RESULTS AND DISCUSSION

The alternative choices of different planting techniques of sugarcane have been shown in Table I. In the first step of partial budget.average yield of each planting technique (treatment) was calculated. Then the yield was adjusted 15 % downwards to cover the difference in management practices between a research station and a common farmer. The second step was to calculate gross field benefits of each planting technique.In the third step, total costs that vary were calculated (Table I). Then net field benefits were calculated by subtracting total costs that vary from gross field benefits. Maximum net field benefits were obtained from PT4(treatment 4).

However. net field benefits is not the final criterion for recommendation to a common farmer because it does not tell about returns on investment. Before calculating returns on investment. dominance analysis was done in which dominated planting techniques were eliminated as shown in Table 2.

Table 2 shows that PT3 and PT5 are dominated planting techniques and were thus excluded from further analysis.

For the calculation of returns on investment, marginal analysis was done of the remaining undominated treatments .The results of marginal analysis showed that PT4 (90 cm spaced 90*90 cm pits) gave the highest (82 %) marginal rate of return (Table 3).The same planting technique was also chosen as the recommended planting pattern in the partial budget analysis (Table 1) by having the highest net benefits among all the five planting techniques.Therefore . PT4 (90 cm spaced 90*90 cm pit) was acceptable as the best sugarcane planting technique and was recommended for farmer's adoption.

Finally, to check risks due to price variability for both inputs and outputs,sensivity analysis was done by assuming cost-overrun as shown in Table 4 .

The significance of marginal analysis results, in case of "cost-overrun". however. remained the same. The best alternative here also was planting technique 4 (90 cm spaced 90*90 cm pits). The second option for sensitivity analysis pertained to "benefits reduction" (Table 5). Here also PT4 proved to be the best alternative as compared to other alternatives considered in this analysis.

Table I. Partial budget of average data obained from trials of various sugarcane planting techniques

Planting patterns	PT1 *	PT2	PT3	PT4	PT5
I. Gross Field Benefits					
I) Averageyicld (kg/ha)	114030.00	123100.00	125650.00	131050.00	131430.00
2) Adjusted yield (kg/ha)	96925.50	104635.00	106802.50	111392.50	111715.50
Gross Field Benefits	32955.00	35576.00	36313.00	37873.00	37983.00
11. Total Costs That Vary					
A. Cash costs (Rs./hal					
I) Cost Of FY M.	394.00	391.00	510.00	482.00	574.00
Subtotal A	394.00	391.00	510.00	482.00	574.00
B. Opportunity cost (Rs./ha)					
I) Cost of labour for preparatory tillage	1000.00				
2) Cost 01 labour for seedbed preparation	375.00				
3) Cost of labour for sowing operations	645.00	800.00	800.00	800.00	800.00
4) Cost of interculture	1760.00				
5) Cost of digging pits		5000.00	6530.00	6In.OO	7346.00
Subtotal B	3780.00	5800.00	7330.00	*69n.00*	8146.00
Total Costs That Vary(A+B)	4174.00	6191.00	7840.00	7454.00	8nO.OO
Net Field Benefits	28781.00	29385.00	28473.00	30419.00	29263.00

*PT = Planting technique.

Table 2. The dominance analysis

Planting patterns	Total costs that vary (Rs .lha)	Net field benefits (Rs.lha)
PT I(90 cm spaced double row strips)	4175	28781
PT2(100 cm spaced 100* 100 cm pits)	6191	29385
PT4(90 cm spaced 90*YO cm pits)	7454	30419
PT3(75 cm spaced 100* lOO cm pits)	7840.	28473(0)
PT5(75 cm spaced YO*90 cm pits)	8nO	29463(0)

PT = Planting technique: 0 = Dominated planting technique .

Table 3. The rnarzna l anarysis

Planting pattern	Total costs that vary (Rs.lha)	Marginal costs (Rs .lha)	Net field benefits (Rs.lha)	Marginal net field bene fits (Rs .lha)	Marginal rate of return (%) (5/3*100)
(I)	(2)	(3)	(4)	(5)	(6)
PT!	4174		28601		
PT2	6191	2017	29385	784	39%
PT4	7454	1263	30419	1034	82%

Table 4. Marzlual rate ot return for cost-overrun ontion

Planting pattern	Total costs that vary (Rs .lha)	Marginal costs (Rs .lha)	Net tield benefits (Rs .lha)	Marginal net field benefits (Rs .lha)	Marginal rate of return (%) (5/3*100)
(I)	(2)	(3)	(4)	(5)	(6)
PTI	5005		26544		
PT2	7428	2423	27741	197	8%
PT4	8944	1516	27185	444	29%

Tabk 5. Marginal rate of return for benefits reduction option

Planting pattern	Total costs that vary (Rs.zha)	Marginal costs (Rs./ha)	Net field benefits (Rs./ha)	Marginal net field benefits (Rs./ha)	Marginal rate of return (%) (5/3*100)
(I)	(2)	(3)	(4)	(5)	(6)
PT1	4502		22010		
PT2	6191	1689	22270	260	16%
PT4	7554	1263	22871	601	47%

('onclusions and Suggestions: On the basis of experimental data analyzed in this study. the farmers of sugarcane growing areas are recommended to use 90 cm spaced(90*90 cm) pits as the most suitable planting method of sugarcane cultivation. This planting method should skillfully be disseminated to the common farmers through demonstration plots, mass media like radio, television. newspapers, scientific journals and handouts. The recommended technique. however, suffers from one limitation. Digging of pits is highly labour intensive and a time consuming process. Also, there is a shortage of labour during peak periods. As a result therefore fanners will have to pay more for digging of pits, which will result in increased cost of plantation.Thus to save the farmer of manual labour some new technologies of digging pits have been evolved. which should be used.

By exploring some other aspects related to this new technique of planting sugarcane such as determining most appropriate sowing depth, shape and size of pits, standardization of planting density per pit and labour input, it can be made more beneficial.

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