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Resource Productivity in Sugarcane Production

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ABSTRACT

The present study was conducted during the cropping season 1983-84 to estimate the marginal productivity and to examine the efficiency of input use in sugarcane production at Thakurgaon Sugar Mills commercial farms. The study reveals that the marginal value product of Furadan 3G was considerably higher than the cost of white grub control. The effects of hired labour was significantly high. The marginal productivity of other variable inputs indicate that one additonal taka investment on seeds, fertilizer, pesticides, fungicides would increase taka 3.54 of the farms, while an additional one taka investment on labour and on Furadan 3G would increase taka 4.75 and taka 1.88 of the farms respectively.

INTRODUCTION

The introduction of newly recommended sugarcane production technologies can play a vital role in increasing per hectre cane yield and sugar content manifold (SRTI Annual Report, 1984). Though reliable and adequate data of the past are not available, there are indications in recent years that production of cane/ha have decreased in the greater Dinajpur district albeit all the yield increasing inputs such as chemical fertilizers, high yielding variety seedcane, pesticide (dieldrin) and capital were (made) available owing to heavy infestations of white grubs (SRTI Annual Report,1981;1983). Furadan 3G has been recommended for the control of white grubs having high opportunity costs (Miah, et. al. 1983).

The objective of the present study is to determine the marginal productivity and to examine the efficiency of input use derived from the production function with special reference to Furadan 3G input use.

MATERIALS AND METHODS

A large scale farm demonstration trials were laid out during the cropping season 1983-84 at Mohan, Salandar and Jamalpur farms under Thakurgaon Sugar Mills area. All recommended cane production practices were followed through out the growing period. The production practices include healthy seeds of recommended variety, early plantation in November, fertilizer dose, row spacing 3 to 3.5 feet between two rows, earthing up, trench planting, tractor ploughing, depth of ploughing 15-23 cm, seed treatment with Aretan-6, soil treatment with Dieldrin, hand weeding (three times), pest and disease control, mainly mechanical operations. Furadan 3G was applied and irrigated through furrows in 26 plots of three farms.

For working out the economics of other variable inputs, hired labour and Furadan 3G input use in sugarcane production, various cost components of human labour, irrigation, seeds, manures, chemical fertilizers, pesticides, fungicides (cash capital) were computed on the basis of farms cost acounting method.

The variables used in production function were value of output, value of variable inputs utilized [chemical fertilizers, manures, seed, pesticide (dieldrin), fungicide (Aretan-6), other costs], expenditure on hired labour and expenditure on Furadan 3G/ha.

Linear and Cobb-Douglas type of production functions were fitted but the Linear type of production function was chosen for the analysis because it gave a better fit to the data and found statistically more reliable.

The model is : $Y=f(X_1, X_2, X_3)$,
Where, Y = output per hectare in Taka
X_1= other variable inputs utilized in Taka per ha (chemical fertilizers, manure, seed expenditure, pesticides (dieldrin), fungicides expenditure, other costs)
X_2= expenditure on hired labour per hectare in Taka,
X_3= expenditure on Furadan 3G per hectare in Taka.

Production function is estimated by the method of ordinary least square. Before fitting the production function, zero order correlation matrices are worked out and the correlation coefficients are examined to detect the multicollinearity problem. If the value of the coefficient of correlation between any two explanatory variables is greater or equal to 0.5, then it can be treated as a problem of multicollinearity. It has also been suggested that inter-correlation or multicollinearity is not necessarily a problem unless it is high relative to the overall degree of multiple correlation among all variables simltaneously (Klein, 1973). It shows that there exists high correlations between area and hired labour. The correlations of other varible inputs, hired labour and expenditure on Furadan 3G did not exceed the value of r› 0.50 and this does not led to the problem of multicollinearity in the regression. Sugarcane area cultivated has been excluded from the production function analysis.

RESULTS AND DISCUSSION

The average per hectare expenditure on Furadan 3G in sugarcane was TK. 3572.40 and it constituted on an average 22.40 % of the total costs. Average net returns of treated areas with Furadan 3G was TK. 10,324.90 of the farms (Table 1).

Table 1. Average expenditure on Furadan 3G, value of output and net returns per hectare at Mohan, Jamalpur and Salandar farms.

Farms	Area (ha) treated with Furadan 3G	Expenditure on Furadan 3G (TK).	Average value of all variables (TK).	Yield TCH	Value of output (TK.)	Net return (TK.)
Mohan	21.74 (63.33)+	3524.75 (23.02)‡	15314.50 (100)	50.96	27313.56	11999.06
Jamalpur	10.37 (30.21)	3580.40 (20.57)	17409.60 (100)	46.69	25025.65	7616.05
Salandar	2.22 (6.46)	3743.00 (25.24)	14828.50 (100)	44.97	25228.91	10400.41
All farms	34.33 (100)	3572.40 (22.40)	15948.07 (100)	48.74	26272.97	10324.90

*Average values of all variables include expenditure on seed, fertilizer, manure, labour, pesticides (dieldrin), other costs and expenditure on Furadan 3G.
+Figures in paentheses in column (2) indicate percentages of total area under cultivation.
‡Figures in parentheses in column (3) indicate percentages of per ha expendifure on Furadan 3G.

The marginal value products (MVP) derived from the production function are presented in Table 2. The output elasticities of other variable inputs, human labour and Furadan 3G were postive. The marginal productivity of other variable inputs indicate that one additional Taka invested on seed, fertilizer, manure, pesticides (dielerin),, fungicides would increase TK. 3.54 of the farms. An additional one Taka invested on labour would increase TK. 4.75 of the farms. One additional Taka invested on Furadan 3G ceteris paribus would increase TK. 1.88 of the farms.

Table 2. Regression coefficients of inputs, marginal value products and ratio of marginal productivity to marginal factor costs.

Estimated coefficients	Regression coefficients	Marginal value products (in Taka)	Ratio of marginal value product to marginal factor cost.
Constant term	-19721.33	-	-
Other variable inputs(X_1)	3.54	3.54	3.13
	(0.89)		
Hired labour(X_2)	4.75+	4.75	4.20
	(1.38)		
Furadan 3G(X_3)	1.88	1.88	1.66
	(1.20)		
No. of observation	26	-	-
R^2	0.1465		

Figures in parentheses are t-values.
+Significant at 10 % level of probability.

The marginal factor costs of the inputs were computed from an alternative return on investment. In this study, the average short term interest rates can be taken as 13 %. The marginal factor cost of an additional Taka spent on inputs is therefore 1.13.

The optimum levels of input use is determined at the point where marginal value product is equal to marginal factor cost. If the ratio of marginal value product to marginal factor costs is computed and presented in Table 2. The coefficients from the regression analysis was then tested for statistically significant difference to obtain a ratio of 1 (Hartley and Carter, 1958). The study reveals that the ratio of marginal productivity of variable inputs, human labour and Furadan 3G to marginal factor cost were higher than unity. However, the increased value of crop output attributable to high cost of Furadan 3G did not only exceed the cost of control rather MVP was considerably higher than the cost of the input. Further research is needed in other areas where different levels of technologies are used in sugarcane production.

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