

Sugarcane Pricing and Its Impact on Cane Supply and Sugar Production in Natore Sugar Mills Area

M.M. Alam, S.A. Sabur¹, S.M. Fakrul Islam² and M.M. Alam³

Bangladesh Sugarcane Research Institute,
Ishurdi, Pabna, Bangladesh.

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ABSTRACT

This study endeavoured to analyze pricing system of sugarcane and its impact on cane supply and sugar production was carried out in Natore Sugar Mills zone in 1997. The findings of the study reveal that gur maker purchased cane from the farmers during the period 1994-95 to 1996-97 at the rate of Tk. 1018.4 to 1206 per ton instead of Tk. 1005 per ton as fixed up by the Government. The change in total production of sugarcane in the study area is mainly due to change in prices of sugarcane fixed by the Government. Sugarcane supply to the mills in response to changes in price and determination of an effective price of sugarcane indicates that the price of sugarcane should be increased by Tk. 52.08 per ton in the mills gate, if the cane supply is not sufficient for milling due to lower cane price. Supply ratio response of cane to sugar mills for price ratio of gur to sugar indicates that price of gur restrain the supply of cane to the sugar mills. The farmers decision as how much cane will be supplied to the mills and production of sugar depends primarily on the price of cane fixed by the Government as well as price offered by the gur maker.

Key Words: Sugarcane pricing, Cane supply, Sugar production, gur, gur maker.

INTRODUCTION

Price of sugarcane is the most important factor to the farmers in allocating their land to sugarcane cultivation (Rahaman, 1975). In Bangladesh, sugarcane is the only raw material for manufacturing sugar and gur. At the farmers level the price for supply of sugarcane to sugar mills is fixed by the Government arbitrarily and purely on the basis of weight irrespective of its quality. The success of sugar production on the part of a sugar mill largely depends on successful procurement programme, which is guided by a procurement policy. Since pricing of sugarcane is the major component of procurement

¹ Professor, Dept. of Agricultural Marketing and Cooperation, BAU, Mymensingh.

² Assistant Professor, Dept. of Agricultural Economics, IPSA, Gazipur.

³ Scientific Officer (Ag. Econ), FSRDP, Bangladesh Sugarcane Research Institute, Ishurdi, Pabna.

policy, success of sugarcane procurement intern depends on extent of farmers response to sugarcane pricing policy as fixed by the Government. The interaction between said procurement policy and others i.e. price offered by gur producers for sugarcane, prices of other competing crops, extent of incentives offered by the mills authority etc develop a complex pricing system of sugarcane (Alam, 1997).

The stabilization of price of sugarcane and sugar within reasonable limit is unquestionably a necessary element for short-run planning. Wide fluctuation in prices may hinder long term growth plan and may have adverse impact on the efficiency of cane cultivation and sugar production. In Bangladesh, the problem of supply inducing price determination revolves around sugarcane as well as sugar. The total installed production capacity of 16 sugar mills is 202,000 tons of sugar (Anon., 1996). But the actual production is far below than the rated capacity due to inadequate supply of cane to the sugar mills. Thus, there is a wide gap between domestic demand and supply of sugar. The main factor behind this phenomenon is the irrational price policy of sugarcane and sugar. Thus, major objectives of this study were to analyze pricing system of sugarcane and to find out impact of sugarcane price on sugarcane supply to the mills and finally sugar production at Natore sugar mills zone.

MATERIALS AND METHODS

The study was based on collection of secondary data from Natore Sugar Mills zone, Natore which is one of the latest and matured sugar mills. Secondary data were collected from 13 production seasons (1984-85 to 1996-97) of Natore sugar mills zone.

The secondary data viz. i) sugarcane area in hectares, ii) sugarcane production iii) sugarcane supply to the mills iv) diversion of cane for gur making v) sugarcane procurement price of the mills vi) sugarcane price paid by gur makers vii) sugar production quantity by the mills viii) sugar and gur prices in the market were collected from the respective sugar mills and Bangladesh Sugar and Food Industries Corporation (BSFIC), BBS, District Marketing Office, Natore; Directorate of Agricultural Marketing, MOA, Government of Bangladesh for the period of 1984-85 to 1995-96 production seasons of sugarcane.

Data were analyzed with the purpose of achieving the objectives of the study. The following analytical models were used for the purpose of sugarcane price analysis.

Analytical Model

A. Producer's output response to changes in hectares and price

$$Q_t = a_0 + bA_t + U_t \dots\dots\dots (1)$$

Where, Q_t = Total output of cane during the time period t in the study area

A_t = Hectares of land under cane during the time period, t

a_0 = Constant

U_t = Error term .

and t = Runs from 1984-85 to 1996-97

$$Q_t = a_0 + b_1 A_t + b_2 P_{t-1} + U_t \dots\dots\dots (2)$$

Where, Q_t = Total output of cane during the time period t in the study area

A_t = Hectares of land under cane during time period, t

P_{t-1} = Price of cane per tons at mills gate during time period, $t-1$

a_0 = Constant

U_t = Error term .

and t = Runs from 1984-85 to 1996-97

B. Growers supply response of cane to the mills for changes of price

$$S_t = a_0 + a_1 P_{t-1} + U_t \dots\dots\dots (3)$$

When, S_t = Supply of cane to sugar mills during the period t in the study area.

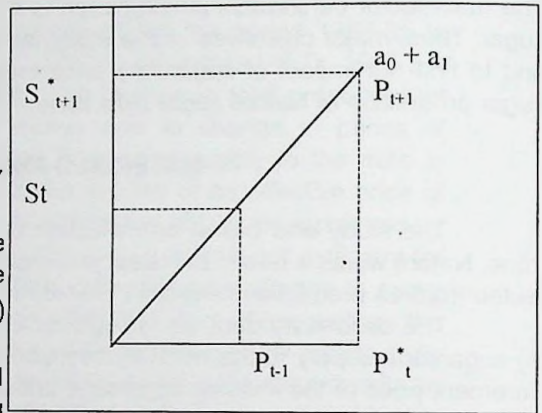
P_{t-1} = Announced price of cane during $t-1$ for the supply of cane to sugar mills during the period " t "

a_0 = Constant

U_t = Error term .

and t = Runs from 1984-85 to 1996-97

Let us assume that a support price P_t^* is announced in the year t to increase supply of cane to S_{t+1}^* (desired quantity) for the year $t+1$ compared to S_t which was supplied at announced price P_{t-1} on the assumptions that all



other supply shifter-price of cane offered by gur making, selling cost etc. are hold constant and incorporated in a_0 . The price of P_t^* may be called as " effective support price" at which growers will be induced to supply their cane up to desired level. The price P_t^* must be greater than P_{t-1} , because, growers income at this price (P_t^*) must be above the level which could occur under P_{t-1} . The added income is only possible when their supply is held at S_{t+1}^* . For analytical purposes, it is useful to find a function which transforms by inflating P_{t-1} in to P_t^* . To have such function let us consider equation (3) and evaluate at two points P_{t-1} and P_t^* . At each of those points shows that

Figure. 1: Determination of effective support price

$$a_1 = \frac{S_{t-1} \cdot a_0}{P_{t-1}} = \frac{S_{t+1}^* \cdot a_0}{P_t^*} \dots\dots\dots (4)$$

This relationship implies that

$$P_t^* = \frac{S_{t+1}^* \cdot a_0}{S_{t-1} \cdot a_0} P_{t-1} \dots\dots\dots (5)$$

If $a_0 = 0$ or small relative to S_{t+1}^* of S_t then,

$$P_t^* = \left(\frac{S_{t+1}^*}{S_t} \right) P_{t-1} \dots\dots\dots (6)$$

When P_t^* and P_{t-1} are identical the ratio $\left(\frac{S_{t+1}^*}{S_t} \right) = 1$

C. Growers supply response of cane to sugar mills & for changes of price ratio of gur to sugar

$$= a_0 + b_1 \dots\dots\dots + U_t \dots\dots\dots (7)$$

Where, $\frac{Q_t^G}{Q_t^S}$ = Ratio of cane diverted towards gur making supplied to sugar mills during the period.

$\frac{P_t^G}{P_t^S}$ = Ratio of wholesale price of gur to sugar during the period t.

a_0 = Constant

U_t = Error term .

and t = Periods from 1984-85 to 1996-97

D. Sugar production response to prices of cane

$$Sp = a_0 + b_1 P_{t-1} + b_2 GP_t + U_t \dots\dots\dots (8)$$

Where Sp = Sugar Production during time period "t" in the study area.

P_{t-1} = Previous years cane price

GP_t = Cane price offered by the gur maker during time period "t" in the study area.

a_0 = Constant

U_t = Error term .

and t = Periods from 1984-85 to 1996-97

RESULTS AND DISCUSSION

To ensure fair price to farmers in the mills zone "The Sugarcane Price Control Order, 1962" was made with the provision that only the owner or person in-charge or control of any sugar factory can purchase sugarcane from the farmers. No one is allowed to purchase sugarcane on behalf of such owner or person in-charge or control of the sugar factory. In Bangladesh as well as in the Natore Sugar Mills, the Government fixes price of sugarcane more or less on arbitrary basis. However, BSFIC fixes the sugarcane price on behalf of the Government and declare it every year before crushing season in the sugar mills on the basis of estimated per hectare return from cane and its competing crops. They also fix the prices of sugarcane both for mills gate purchasing centers and outside mills gate purchasing centers. The present cane price fixed by BSFIC amounting Tk. 1005 per ton in the mills gate centre and Tk. 991.6 per ton in the outside center is constant since 1990 (Alam, 1997). Their justification in favour of existing price is that the sugarcane growers get a total net profit of Tk. 17263.5 per hectare from sugarcane in comparison to a net profit of Tk. 12691.8 per hectare from its competing crops (appendix 1). Thus BSFIC kept cane price unchanged upto crushing season 1996-97. But in price fixation, BSFIC has not considered important factor like prices of gur which restrain supply of cane to sugar mills. The prices offered by gur makers to the cane growers is considerably higher than that of fixed by the Government. In 1996-97, mills gate price of sugarcane was Tk. 1005 per ton while price paid by the gur maker was Tk. 1206 per ton (appendix 2). In the present pricing system there is every likelihood of having the price of cane offered by gur makers disproportionately higher than Government fixed price of cane which resulted large scale sugarcane diversion to gur production in the mills zone and greatly hampered sugar production.

Sugarcane production is the function of area and productivity. Sugarcane area is influenced by various price and non-price variables while productivity mainly depends upon level of inputs, weather parameters and rate of adoption of new technology (Lal and Singh, 1985). Again sugarcane production is also influenced by price of sugarcane. Sugarcane price fixed by the Government and sugarcane price offered by gur makers have a significant impact on sugar production. In order to quantify possible impact of price on sugar production, analysed the 13 years (1984-85 to 1996-97) data from the secondary sources (appendix 1-4) in the study area and fitted them in the following model and was estimated using equation (as stated in methodology) by OLS method :

$$(1) \quad Q_t' = 2.47 + 1.15 A_t \quad [\text{Using equation (1)}] \quad R^2 = 0.18$$

(1.56)

$$(2) \quad Q_t'' = 1.4621 + 0.84067 A_t + 0.55949 P_{t-1} \quad [\text{Using equation (2)}] \quad R^2 = 0.64$$

(1.61) (3.53)

$$(3) \quad S_t = -3.53 + 2.30 P_{t-1} \quad [\text{Using equation (3)}] \quad R^2 = 0.41$$

(3.91)

$$(4) \quad \frac{Q_t^G}{Q_t^S} = 2.71 + 4.99 \frac{P_t^G}{P_t^S} \quad [\text{Using equation (7)}] \quad R^2 = 0.56$$

(3.72)

$$(5) \quad S_p = 6603 + 63.119 P_{t-1} - 46.313 GP_t \quad [\text{Using equation (8)}] \quad R^2 = 0.76$$

(4.31) (-2.79) DW = 1.7341

(The figures in the parenthesis are coefficient of "t" values of respective equation.)

In the equation (1), regression indicates a positive output response for the hectares under cane and coefficient (1.15) is not significant. The coefficient of determination, (R^2) indicates that about 18 per cent variation in output response as explained by explanatory variable hectares of cane (A_t). In other words, 82 per cent variability in output response is caused by per ha yield, price and other factors, which are not taken into account in this model. We may further conclude that a lower degree of association between output and hectares of cane. In the context of price analysis of sugarcane, another alternative model where output of cane was taken as dependent variable and hectares and price of cane (at mills gate) per tons of one-year lag as independent variables was tested. The lag one year in price is justified by consideration that the amount of sugarcane to be produced depends upon the price prevailed at planting time (Kumar, 1984). The equation (2) shows that the coefficient of regression (0.84067) for hectares of land (A_t) is insignificant while coefficient of regression (0.559449) for previous year's price (P_{t-1}) is highly significant at one per cent level and regression coefficient shows a positive relationship. It is worth mentioning that, change in prices of sugarcane offered by the Government have significant influence on the changes in total output of sugarcane. In equation (3) regression indicates a positive supply response for one-year lag price of sugarcane (at mills gate) and the coefficient (2.30) is highly significant at 1 per cent level. The model provided coefficient of determination (R^2) of 0.56. Expressing this in percentage, we can say about 56 per cent variation in supply response is explained by explanatory variable of previous years cane price (P_{t-1}). In other words, it can be concluded that coefficients of determination R^2 indicates a higher degree of association between cane supply to the sugar mills and the previous years price of cane offered by the Government. It is further mentioned that, the price of sugarcane offered by the Government have significant influence on the cane supplied to the mills.

From equation (4) one can easily determine an effective support price at which one may expect desired supply of cane to sugar mills for the year 1997-98. The desired quantity of cane for the Natore sugar mills is estimated on the basis of cane crushing capacity and optimum working period in a season, The daily crushing capacity of Natore

sugar mills is 1500 tons and optimum crushing period in a season as worked out by the mills is 120 d. Therefore, total desired quantity of cane in a season is $1500 \times 120 = 1,80,000$ tons

$$\text{Or, } S_{t+1} = 1,80,000$$

$$\text{Or, } S_t = 1,71,132 \text{ (actual supply in } t = 1996-97)$$

Again, $P_{t+1} = \text{Tk. } 1005.00/\text{ton}$ (Price announced by the Government in $t-1 = 1995-96$ for 1996-97)

It is observed from equation (5) and equation (3) that $a_0 = -3.53$ which is very small in comparison to S_{t-1}^* and S_t . Hence we can determine "effective support price" for desired supply of cane in the year $(t+1)$ i.e; 1997-98 from equation (6) and is equal to

$$P_t^* = \frac{180000}{171132} \times 1005$$

$$= 1057.0787$$

$$= 1057.08 \quad \frac{P_t^G}{P_t^S}$$

From the above estimated price, it may be pointed out that price of cane should be fixed at Tk. 1057.08 per ton instead of Tk. 1005.0 announced by the Government in 1996-97 to ensure desired supply of cane in 1997-98 cropping season. However, it is to be noted that price of cane suggested in this studies for 1997-98 has been fixed by the Government for 1998-99. The study indicates that price of sugarcane may be increased by Tk. 52.08 per ton in the mills gate if the cane supply is not sufficient for milling.

In the equation (7), supply ratio of equation indicated a positive response price ratio of $\frac{P_t^G}{P_t^S}$ meaning that if the price ratio of gur to sugar increases, the supply ratio

of cane for gur making to sugar mills will also increase. The regression coefficient (4.99) is highly significant at 1 per cent level. The coefficients of determination, (R^2), indicating that 56 per cent of supply ratio response is explained by price ratio of gur to sugars. In the equation (8), the sugar production by the mills show a positive response with the previous years cane price indicating that as mills gate price of sugarcane increases, the sugar production by the mill also increase while the price of cane offered by the gur maker shows a negative sugar production response indicating that as price offered by gur maker increases, sugar production by the mills decreases. The coefficient of determination, indicates that about 76 per cent of sugar production is explained by mills gate price of cane and the cane price offered by gur makers. The DW statistics of 1.7341 shows that there was no auto correlation between variables.

Thus when the price of sugarcane offered by gur makers is higher than that of Government mill gate price, price of gur is also higher in local market. This situation results in less amount of sugar produced in the mills. Higher price offered by gur maker hampered the sugar production of the mills. Hence, sugar production by the mills depends on fair prices of the sugarcane fixed by the Government.

Therefore, can be concluded that price of cane may be increased by Tk. 52.08 per ton in the mills gate for the 1998-99 cane crushing season if the cane supply is not sufficient for milling. The sugarcane price should be re-adjusted from time to time considering the increase of price or other competitive crops and cane price paid by gur makers. Therefore, determination of an effective prices of sugarcane and sugar, formation of national price policy and reflection of such policies in the market are urgently needed for orderly improvement of sugarcane, its supply and eventually the sugar production.

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Appendix 1 : Estimated net profit from sugarcane and its competing crops (1996) per ha in Bangladesh.

Crop	Production Cost (Tk./ha)	Yield (ton/ha)		Price (Tk./ton)		Gross Revenue (Tk./ha)	Net Profit (Tk./ha)
		Crop	By-product	Crop	By-product		
1. Aus	11527.5	2.30	1.84	6030	536	148552.4	3327.7
T.Aman	13041.6	2.76	1.84	6030	670	17875.6	4834.0
Total	24569.1					32730.8	8161.7
2. Aus	11527.5	2.30	1.84	6030	536	148552.4	3327.7
Potato	34965.3	11.52	-	3752	-	43223.0	8257.7
Total	46492.8					58078.2	11585.4
3. Jute	13318.2	1.84	2.76	8040	1072	17752.3	4434.1
Potato	34965.3	11.52	-	3752	-	43223.0	8257.7
Total	48283.3					60975.3	12691.8
4. Jute	13318.2	1.84	2.76	8040	1072	17752.3	4434.1
T.Aman	13041.6	2.76	1.84	6030	670	17875.6	4834.3
Total	26359.8					35627.9	9268.1
5. Aus	11527.5	2.30	1.84	6030	536	148552.4	3327.7
Tobacco	13414.6	.92	-	24120	-	22190.4	8776.4
Total	24942.1					37045.6	12104.1
6. Aus	11527.5	2.30	1.84	6030	536	148552.4	3327.7
Wheat	12478.4	2.76	1.84	6700	670	19724.8	7246.4
Total	24005.9					34580.0	10623.1
7. Jute	13318.2	1.84	2.76	8040	1072	17752.3	4434.1
Wheat	12478.4	2.76	1.84	6700	670	19724.8	7246.4
Total	25796.6					37477.1	11682.5
8. Sugarcane	37388.4	54.38	-	1005	-	54651.9	17263.5

Source : BSFIC, working paper of "sugar and sugarcane policy-1996".

Appendix 2 : Govt. cane price and the price offered by the gur makers during 1984-85 to 1996-97 at Natore Sugar Mills zone.

Year	Cane price (Tk/ton)		Cane price offered by the gur makers (Tk. /ton)	Wholesale Price (Tk/ton)	
	Mills gate	Out side		Sugar	Gur
1984-85	522.6	509.2	670.0	17760	12300
1985-86	576.2	562.8	696.8	20900	12860
1986-87	656.6	643.2	670.0	19080	9600
1987-88	656.6	653.2	670.0	22430	12650
1988-89	737.0	723.6	804.0	24710	15950
1989-90	951.4	938.0	830.8	25510	14150
1990-91	1005.0	991.6	951.4	26500	13400
1991-92	1005.0	991.6	1018.4	28000	12750
1992-93	1005.0	991.6	1072.0	27500	15100
1993-94	1005.0	991.6	1045.0	28500	14200
1994-95	1005.0	991.6	1018.4	29000	15300
1995-96	1005.0	991.6	1179.2	28500	18100
1996-97	1005.0	991.6	1206	29500	19200

Source : BSFIC and Natore sugar mills

Appendix 3 : Area, production of sugarcane, sugar and Govt. price of sugarcane at Natore Sugar Mills zone during the period 1984-85 to 1996-97.

Year	Area under sugarcane (ha)	Production of sugarcane (tons)	Sugar production (tons)	Mill gate price of sugarcane (Tk/ton)	Yield of sugarcane (ha/tons)
1984-85	6944.5	219656.96	818.5	522.6	31.63
1985-86	7080.6	2,41,623.21	54,37.1	576.2	34.12
1986-87	7359.6	390259.75	17,980.5	656.6	53.03
1987-88	9390.5	343651.24	12,937.6	656.6	36.60
1988-89	6980.8	302000.00	5,326.5	737.0	43.26
1989-90	7584.6	298550.00	17,392.4	951.4	39.36
1990-91	7498.8	405750.00	21,548.5	1005.0	54.11
1991-92	7487.7	370040.00	18,881.0	1005.0	49.41
1992-93	7486.8	3,36,700.00	17,280.0	1005.0	44.97
1993-94	7490.9	3,88,710.00	22,492.0	1005.0	51.92
1994-95	7896.0	439387.00	25,725.0	1005.0	55.65
1995-96	7710.6	382012.65	18,011.0	1005.0	49.54
1996-97	7732.5	368765.00	13,815.10	1005.0	47.69

Source : BSFIC and Natore sugar mills

Appendix 4 : Production, supply to the mills and diversion of cane for gur making in Natore Sugar Mills area during 1984-85 to 1996-97.

Year	Production of sugarcane (tons)	Supply to the mills (tons)	Diversion of cane for gur making (tons)	Cane used as seed, chewing etc. (tons)
1984-85	219656.96 (100)	20415.0 (9.30)	1,63,540 (74.45)	56116.96 (11.25)
1985-86	2,41,623.21 (100)	77372 (32.02)	1,05,705 (43.75)	585446.21 (24.2)
1986-87	390259.75 (100)	2,36,072 (60.43)	1,10,815 (28.37)	43372.75 (12.11)
1987-88	343651.24 (100)	163116 (47.47)	1,52,575 (44.40)	27960.24 (8.13)
1988-89	302000.00 (100)	67588 (22.38)	1,32,000 (43.7)	102412.00 (33.91)
1989-90	298550.00 (100)	166449 (55.76)	72,200 (24.18)	59901.00 (20.06)
1990-91	405750.00 (100)	2,39,468 (59.02)	1,14,195 (28.14)	52037.00 (12.84)
1991-92	370040.00 (100)	2,23,026.35 (60.27)	1,51,385 (30.10)	35628.65 (9.63)
1992-93	3,36,700.00 (100)	2,65,388.24 (78.82)	40,154 (11.93)	31157.76 (9.25)
1993-94	3,88,710.00 (100)	2,63,941.1 (67.90)	85,777 (22.07)	389919.90 (10.03)
1994-95	439387.00 (100)	3,21,549.55 (73.19)	91,136 (20.74)	26701.45 (6.07)
1995-96	382012.65 (100)	2,09,658.75 (54.89)	1,73,763 (37.63)	28590.90 (7.48)
1996-97	368765.00 (100)	1,71,132.00 (46.41)	1,75,500 (47.59)	22133.10 (6.00)

Figures in the parenthesis indicate percentage