



Attaining Sufficient Yield of Sugarcane in Bangladesh: An Empirical Approach

Rana, M. S.^{1*}, Hossain, F.² and Roy, S. S.³

¹*School of Spatial Planning, Technical University of Dortmund, Germany*

²*Development Studies-specializing in Geography, Norwegian University of Science and Technology (NTNU), Norway*

³*Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Bangladesh*

ABSTRACT

The paper contains an empirical research approach on the demand and supply analysis for sugarcane in Bangladesh. In be more specific, how sufficient yield of sugarcane could be achieved, as well as sustained in the country, is discussed in the paper based on the analysis, along with exploring its strengths, weaknesses, opportunities and threats. Bangladesh imports around 1.26 million metric ton of sugar each year to meet its national demand deficit. The research shows that local growing of sugarcane rather imports of sugar would save around BDT8,937.94 million per year. In addition, local production of sugarcane and its processing to sugar would result in the by-production of molasses, *chobra* and spirit/ alcohol at massive scale that might considerably contribute to the national economy. The paper, in this regard, proposes eight contiguous districts of Bangladesh with high sugarcane productivity to form a regional belt where deficit amount of sugarcane could be grown every year. In addition, several policy recommendations are made with a view to sustaining this yield of sugarcane in the country.

Keywords: Demand Deficit, *Gur*, Import, Market Area, Sugarcane Belt, Sufficient Yield

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E-mail addresses:

srana.buet@gmail.com (Rana, M. S.),

fahim.bueturp06@gmail.com (Hossain, F.),

ssr.buet@gmail.com (Roy, S. S.)

* Corresponding author

INTRODUCTION

Bangladesh has a yearly production of 6.00 million metric tons of sugarcane that comes from the cultivation of 0.35 million acres land (BBS, 2007). However, the amount of production seems merely sufficient to meet the increasing demand for sugar and *gur* (jaggary) at the national level.

The average yearly demand for sugar in Bangladesh is 1.40 million metric ton, while the figure is only 0.30 million metric ton for *gur* (BSFIC, 2013a). On average, 0.17 million metric ton of sugar is processed from 2.31 million metric tons of sugarcane in the country each year (BSRI, 2013a). The production amount points to the yearly demand deficit of sugar by 1.23 million metric ton. As a result, the country needs to import 1.26 million metric ton of sugar on average to overcome this national demand deficit each year (Khan, 2009).

On an average, 11 kg sugar is produced from 100 kg of good quality of sugarcane (Russel, 2002). However, the local rate of sugar processing from sugarcane in Bangladesh is below the international standard. In Bangladesh, 1 kg of sugar is processed from 13.20 kg of sugarcane (BSRI, 2013a). Considering the local standard, 16.63 million metric tons of sugarcane is needed to produce the required amount, in addition to the current production in our country to fulfill the total national demand for sugar each year.

The average sugarcane production rate in Bangladesh is 17.26 metric tons/acre (BBS, 2007) which points to the requirement of additional 0.96 million acres land under sugarcane cultivation scheme in order to meet the demand deficit for sugar. The paper, in this regard, deals with exploring rationale of local yield of sugarcane and its monetary benefits against the import of sugar in Bangladesh. Moreover, the research aims at formulating policies with view to sustaining the local yield in the long run.

MATERIALS AND METHODS

Selection of the Study Area

Two districts were selected as study areas for conducting the survey. The selection of the study areas were based on the following criteria:

- i. District's average sugarcane production rate (metric ton/acre), i.e. the district with the highest sugarcane production rate figure is considered with priority.
- ii. Mill-zone/Non-mill zone area: Out of two study areas one should be located at mill-zone and another at non-mill zone area so that the variation in crop yield as well as the production cost rate data is captured well.
- iii. Proximity to Dhaka: Distance of districts (in kilometer) from Dhaka is also considered for the convenience of the field survey.
- iv. Regional variation: In case of contiguous districts, only one district fulfilling the above mentioned criteria better than other(s) is considered in order to ensure data authenticity.

The average sugarcane production rate in Bangladesh is 17.26 metric tons/acre aforementioned (BBS, 2007). Initially, the districts with sugarcane production rate more than the country average were considered in order to ensure data quality. Table 1 shows that the sugarcane production rate of Manikganj district is 193.22 metric tons/acre, and this is the highest figure compared to the rest. Above all, the district is the closest to Dhaka. Considering the

criteria aforementioned and putting priority on the first and third, therefore, Manikganj District was selected as the first study area.

All the criteria were attempted to be met when selecting the second study area. Accordingly, the Chuadanga District was chosen as it includes a considerable production rate, feasible distance from Dhaka and regional variation from the Manikganj District. Moreover, the area is also located within the Carew & Co. Sugar Mill Zone area.

Data Collection

Data on cultivation costs and earning from sugarcane were extensively collected from the survey on sugarcane farmers. The total number of farmers in the Manikganj District

is 171,068, and there are 173,698 farmers in the Chuadanga District (BBS, 2010). At 95% confidence level and confidence interval of 5, a total of 384 farmers were sampled for both districts. The whole sample size was then divided into two according to the district's percentage share to total farmers. Accordingly, 191 farmers were sampled to be surveyed in the Manikganj and 193 in Chuadanga.

RESULTS AND DISCUSSION

Whether to Import or to Produce Locally?

The amount of average yearly import of sugar in Bangladesh is 1.26 million metric ton (Khan, 2009), which costs around BDT 77,450.35 million in total as per sugar purchasing rate of BDT 61,468.53 /ton

TABLE 1
Key information of the initially selected study districts

Districts	Sugar Cane Production		Production Rate (metric tons/ acre)	Name of Sugar Mill Located within the District ^{††}	Distance of Districts from Dhaka (km) ^{†††}
	Area (acres) [†]	Production (metric ton) [†]			
Manikganj	7,705	1488,789	193.22	-	63
Thakurgaon	1,525	245,455	160.95	Thakurgaon Sugar Mill	407
Khagrachari	1,489	75,188	50.49	-	259
Barguna	270	7,044	26.09	-	247
Netrokona	204	5,296	25.96	-	158
Chandpur	1,852	47,120	25.44	-	115
Chuadanga	32,088	801,736	24.98	Carew & Co. Sugar Mill	215
Sherpur	531	13,242	24.94	-	188
Gaibandha	8,152	187,802	23.04	-	268
Patuakhali	109	2,445	22.43	-	204
Nilphamari	551	11,321	20.55	-	359
Tangail	9,009	181,203	20.11	-	92
Jhenaidah	13,207	262,735	19.89	Mobarakganj Sugar Mill	178
Joypurhat	3,665	69,387	18.93	Joypurhat Sugar Mill	249
Kushtia	34,656	619,246	17.87	Kushtia Sugar Mill	183

[†]Source: BBS, 2007; ^{††} Source: BSFIC, 2012; ^{†††} Source: RHD, 2007

(including all types of duties and freight costs) (Sugaronline, 2012).

Thus, as mentioned earlier, in order to avoid the import of 1.26 million metric ton of sugar, the amount of sugarcane required to produce locally is 16.63 million metric tons from cultivating 0.96 million acres of land a year. Per acre sugarcane production cost is BDT 13,380.00 for a single crop season (see Fig.1).

Therefore, to produce 16.63 million metric tons of sugarcane, the production cost required is BDT 12,894.67 million. In sugar mill, the cost for 1 metric ton sugarcane processing is BDT 3,344.02 (including packing and other raw materials cost, salary and wage at factory, repairing and maintenance, insurance, VAT, electricity and fuel costs and other costs) at 7.17% of recovery performance (BSFIC, 2013b).

Thus, to process a total of 16.63 million metric tons amount of sugarcane, processing cost required is BDT 55,617.74 million. Hence, the total cost required for producing and processing the required amount of sugar avoiding import is BDT 68,512.41 million per year. This indicates that the local production of sugarcane would save around BDT 8,937.94 million per year.

In addition, the production of sugar results in some by-products like molasses, *chobra* (cane tops and bagasse) and spirit/ alcohol which may contribute to the national GDP. In the 2009-10 fiscal year, 32,716.69 metric tons of molasses, 313,527.00 metric tons of *chobra*, and 4352,000.00 litres of spirit/alcohol were produced as by-products from the processing of 866,573.00 metric tons of sugarcane at average 7.17% recovery rate of sugar (BSFIC, 2013c). The statistics

Costing per <i>Bigha</i> [†]	Earning per <i>Bigha</i>
<p>Land Preparation & Plantation Cost: BDT 2,246</p> <p>Irrigation Cost: BDT 720 (<i>Irrigation for 2-3 times</i>)</p> <p>Fertilizer Cost: BDT 534 (20 kg Urea for 2 times, 1.5 kg of Nitrogen, 0.3 kg of Phosphorus and 3.25 kg of Potassium for single time)</p> <p>Labor Cost: BDT 960 (<i>8 laborers in total</i>)</p> <p>Total Production Cost: BDT 4,460</p>	<p>Growing Duration of Sugarcane: 12 months</p> <p>Average Price per kg of Sugarcane: BDT 2.14</p> <p>Average Total Earning from the Cultivation of 1 <i>Bigha</i>: BDT 23,417</p> <p>Net Profit from the Cultivation of 1 <i>Bigha</i>: BDT (23417-4460) = BDT 18,957</p>
<p>Total Production Cost per Acre: BDT (3*4460) = BDT 13,380</p>	<p>Total Net Profit from 1 Acre: BDT (3*18957) = BDT 56,871</p>
<p>[†] 1 <i>Bigha</i>= 1/3 acre Source: Field Survey, 2012</p>	

Fig.1: Costing and earning details for per *Bigha* sugarcane cultivation in a single season

indicates that on average, 0.04 metric ton of molasses, 0.36 metric ton of *chobra*, and 5.02 liters of spirit/alcohol are produced as by-products from the processing of one metric ton of sugarcane. Therefore, the additional production of 16.63 million metric tons of sugarcane towards meeting the national demand deficit may result to the by-production of around 0.63 million metric tons of molasses, 6.02 million metric tons of *chobra* and 83.53 million litres of spirit/alcohol. In Bangladesh, the wholesale market price of molasses and spirit/alcohol are BDT 18,496.69 per metric ton and BDT 59.32 per litre, respectively, as recorded at 2009-10 fiscal year (BSFIC, 2013d). This indicates that local production of 16.63 million metric tons of sugarcane has the potentials to generate a rough additional income of BDT 11,690.20 million from molasses and BDT 4,955.09 million from spirit/alcohol. Moreover, 6.02 million metric tons of *chobra* produced as by-product would contribute to this additional income by considerable percentage. In the fiscal year of 2003-04, these by-products of sugarcane contributed 4.23% GDP within the sugarcane economy which eventually, resulted in 0.03% GDP contribution to the national economy (BSRI, 2013b).

The study findings henceforth recommend for sustainable local production of sugarcane than importing since import involves wastage of huge amount of money both in terms of loss of capital and opportunities. The study, therefore, is forwarded to the policy formulations with a view to attaining sufficient as well as sustainable local yield.

The Concept of Sugarcane-Belt

Application of belt concept in sugarcane production could counter-act to the disadvantages of haphazard cultivation of the crop. In this concept, high sugarcane yielding areas or the areas having the potentials to contribute to both local and national sugarcane economy could form a belt from where additional quantities of sugarcane required to meet the national demand deficit would be cultivated. The belt should have self-sufficiency, as well in terms of provision of labour forces and lands required to cultivate the given amount. The belt concept could be implemented by patronizing sugarcane cultivation within the belt through ensuring availability of good quality seeds, inputs and other technical supports.

This study propose the Sugarcane-Belt covering Gaibandha, Sherpur, Jamalpur, Tangail, Pabna, Manikganj, Rajbari, and Kushtia districts, as shown in Fig.3. In total, 98,013 acres of agricultural lands in these eight districts are currently allocated for sugarcane cultivation and this proposed belt has current production of 2.97 million metric tons of sugarcane in a year (BBS, 2007).

Basis for Selecting the Belt Districts

Location Quotient (LQ)

Gibson *et al.* (1991) stated that Location Quotient (LQ) yields a coefficient or a simple expression of how well represented a particular industry is in a given study region. Isard (1960) defines Location Quotient (LQ) as a related device for comparing a

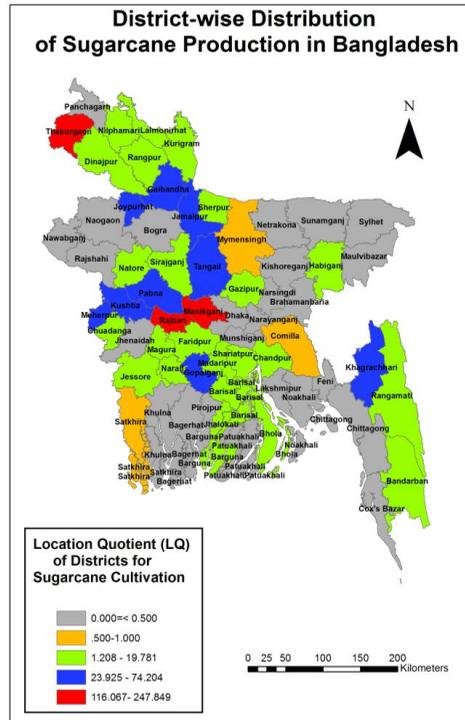


Fig.2: Overall district-wise distribution of sugarcane production in Bangladesh

region’s percentage share of a particular activity with its percentage share of some basic aggregate.

The Location Quotient (LQ) value of a district for sugarcane production points to the district’s contribution to the national sugarcane production. The average LQ of Bangladesh for sugarcane production is 19.77, as calculated from the district wise agricultural production data provided in Bangladesh Bureau of Statistics (BBS, 2007). The formulae used to calculate LQ for a district for sugarcane production is as following:

$$LQ \text{ for District "X"} = \frac{\text{Quantity of Sugarcane Produced in District "X"} \times \text{Total Quantity of Agricultural Products Produced in the Whole Country}}{\text{Quantity of Total Agricultural Products Produced in District "X"} \times \text{Total Quantity of Sugarcane Produced in the Whole Country}}$$

Fig.2 shows the comparative LQ values of all districts of Bangladesh for sugarcane production. The districts having Location Quotient (LQ) value of more than the country average are considered initially to form the belt. Table 2 presents the list of eleven districts fulfilling the criterion.

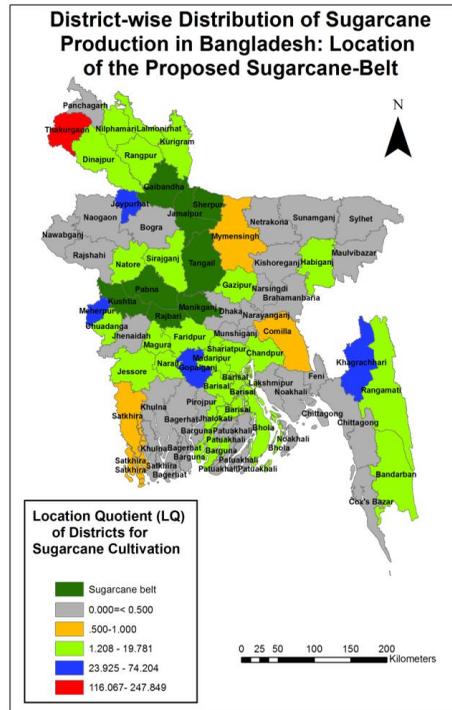


Fig.3: Location of the proposed Sugarcane-belt

TABLE 2
LQ value and Production Rate of districts for sugarcane production

Districts	Location Quotient (LQ) Value	Production Rate (tons/acre)
Manikgonj	247.74	193.22
Thakurgaon	143.15	160.95
Rajbari	116.01	14.15
Meherpur	74.17	13.39
Tangail	53.67	20.11
Pabna	48.49	3.91
Gaibandha	45.36	23.04
Jamalpur	34.88	14.16
Kushtia	32.94	17.87
Khagrachari	30.47	50.49
Gopalganj	29.64	13.11
Sherpur	6.19	24.94

Source: BBS, 2007

However, the LQ value of a district cannot sufficiently elucidate its productivity as this tool is concerned with the district's total output but the production rate. A district with larger cultivable land area can produce higher quantity and may therefore hold bigger LQ value. In transposition, the quantity of output produced by a small district may seem off-set to the national level production though the district might have greater productivity in terms of production per acre than the larger district. While selecting districts to form a special crop-belt, therefore, per acre production of district should also be considered to ensure sufficient yield of that crop from minimal utilization of lands.

Production Rate (metric tons/acre)

Production rate of a district indicates how prolific or productive the district is for cultivating the given type of crops. The country average production rate is 16.95 metric tons/acre for sugarcane cultivation (BBS, 2007). The districts with production rate greater than the country average are initially considered and then validated by the LQ values of those districts to be finally selected for the belt. Other districts with considerable LQ values but lower production rates (and vice-versa) are also considered based upon the location factor or geographical contiguity to the belt areas.

Location Factor

Manikganj, Rajbari, Tangail, Gaibandha, Jamalpur and Kushtia with both the LQ

values and Production Rates greater than the country averages are selected to form the sugarcane belt. Pabna holds considerable LQ value but very low production rate, as shown in Table 2. Nevertheless, Pabna district is considered to form the belt as it is geographically contiguous to the primarily selected sugarcane belt. Accordingly, Sherpur district with lower LQ value but higher production rate than the country's average is considered for its geographical contiguity.

On the other hand, Thakurgaon, Meherpur, Khagrachari and Gopalganj districts have considerable productivity but they are geographically isolated. Therefore, these districts are not considered in forming the belt area.

Availability of Lands under Crop Cultivation

The proposal of this research is to produce the additional 16.63 million metric tons of sugarcane required to meet the national demand deficit per year in the proposed sugarcane-belt. In order to produce this huge amount of sugarcane, the land area required is 0.96 million acres. Manikganj, Rajbari, Tangail, Gaibandha, Jamalpur, Kushtia, Sherpur and Pabna are the eight districts selected with a total of 2.48 million acres of agricultural lands under crop cultivation (BBS, 2010).

Manikganj, Rajbari, Gaibandha, Kushtia and Pabna districts are, in addition located on the bank of three major rivers of Bangladesh-Padma, Jamuna and Brahmaputra, which makes these districts to have huge amount

of lands in the 'char' (river side sandy land) area. It is worth mentioning that *char* lands are highly suitable for sugarcane cultivation (BSS, 2012).

Key Information on the Proposed Sugarcane-Belt

Sugarcane-belt consists of eight districts of Bangladesh, namely, Manikganj, Rajbari, Tangail, Gaibandha, Jamalpur, Kushtia, Sherpur and Pabna (see Table 3 and Fig.3). These districts are characterized by high sugarcane productivity as well as significant contribution to the national sugarcane production.

The average sugarcane production rate of the selected belt is 38.93 metric tons/acre, whereas the country average is 16.95 metric tons/acre. In collective manner,

the Location Quotient value of the belt area is 73.16. Information in relation to other aspects such as area under sugarcane cultivation, production amount, number of agricultural labour, amount of lands under crop cultivation and culturable waste and fallow lands associated with the belt area are given in Table 3.

Policy Recommendations

Emphasizing Char Area Production

River-side sandy soil or *char* areas are highly suitable for sugarcane cultivation. Tangail, Pabna, Jamalpur and Kushtia are the four districts of the selected sugarcane-belt that have around 153,000 acres of fallow and 23,000 acres of culturable waste lands, as shown in Table 3 (Yearbook of Agricultural Statistics of Bangladesh, 2011).

TABLE 3
Information on the proposed sugarcane-belt

Districts forming Sugarcane-Belt	Area under Sugarcane Cultivation (acres) †	Production Amount of Sugarcane (metric tons) †	Sugarcane Production Rate (metric tons/acre)	Number of agricultural Labour ††	Amount of Area under Crop Cultivation (acres) †††	Culturable Waste (acres) ††††	Fallow Land (acres) ††††
Manikganj	7,705	1488,789	193.22	81,957	186,696	-	-
Jamalpur	29,576	418,872	14.16	212,634	391,038	8,000	38,000
Tangail	9,009	181,203	20.11	213,685	498,146	4,000	57,000
Rajbari	12,384	175,254	14.15	76,716	149,109	-	-
Kushtia	34,656	619,246	17.87	150,564	259,317	3,000	2,000
Pabna	35,295	138,170	3.91	198,378	387,463	8,000	56,000
Sherpur	531	13,242	24.94	142,024	248,681	-	-
Gaibandha	8,152	187,802	23.04	280,222	358,717	-	-
Total	137,308	3222,578	(average) 38.93	1356,180	2479,167	23,000	153,000

†Source: BBS, 2007; ††Source: Agricultural Census, 2008; †††Source: BBS, 2010; ††††Source: Yearbook of Agricultural Statistics of Bangladesh, 2011

(Note: '-' sign indicates that the data for the district is not available)

Moreover, as they are situated on the bank of a river, Gaibandha, Pabna, Manikganj, Kushtia and Rajbari districts have huge amount of cultivable or cultivable fallow lands in the *char* area. These *char* areas, along with other fallow lands and culturable waste lands, could be brought under the sugarcane cultivation scheme which would ensure maximum utilization of *char* lands and thus higher production possibility of sugarcane. Proper patronization (e.g., extension of irrigation, provision of seeds, inputs and training, etc.) from the Ministry of Agriculture (MoA) and/or Bangladesh Sugarcane Research Institute (BSRI) would help in this regard in bringing those lands under sugarcane cultivation.

Agricultural Labour Policy

On an average, 24 labour-days are required to cultivate 1 acre of sugarcane (Field Survey, 2012). As mentioned earlier, 0.96 million acres of land are required to be cultivated with sugarcane within the selected belt area in order to meet the national demand deficit for sugar. Therefore, a total of 23.13 million labour-days are required to cultivate the required amount in a season. The statistics estimates that 110,140 labour-days are required per day in the sugarcane field within the belt area. However, as shown in Table 3, the selected sugarcane-belt area has a supply of around 1356,180 agricultural labours (Note: agriculture labour is defined as labour exchanged for wages in cash or kind or both for agricultural activities on land operated by other households) (Agricultural Census, 2008). It is important

to mention here that the number of actual agricultural labours available within the belt area could be bigger since land-owners have also been found to giving labour to their own fields at times.

Land Renting Policy

The study shows that the average agricultural (sugarcane) labour charge in the rural parts of Bangladesh is BDT 120 per day (Field Survey, 2012). Therefore, considering 25 working days in a month, a sugarcane labourer can earn BDT 3000 monthly. However, a rural family with an average of 4 family members would need BDT 3000-3500 per month to be run properly (Field Survey, 2012). Therefore, the monthly income of BDT 3000 of a labourer is merely sufficient to run his family since there might appear some unexpected costs at times.

Considering the issue, land renting policy is proposed here with a view to enhancing the earning capability of the labourers. Under this policy, all agricultural labourers within the belt area are supposed to cultivate at least 1 *Bigha* (Note: 1 *Bigha*= 1/3 acre) land with sugarcane on land renting basis each year. A local body for sugarcane cultivation is recommended to be built up within the belt area, and in this regard, that one body would take care of implementing the proposed land renting policy.

Cultivation of sugarcane in 1 *Bigha* land generates seasonal profit of BDT 18,957, as calculated and presented in Fig.1. Therefore, a labourer with 1 *Bigha* rented land cultivated with sugarcane would be able to earn an additional income of BDT

1,579.75 per month. This additional earning would help the labourers to have savings of a reasonable amount per month. Moreover, other crops like pulses could be cultivated in the same land in parallel to the sugarcane. This might allow them to earn more and improve their quality of life.

Industrial Policy

Out of 15 government-run sugar mills in Bangladesh, three (Zeal Bangla Sugar Mill, Pabna Sugar Mill and Kushtia Sugar Mill) are located within the proposed sugarcane-belt. Nine other sugar mills are geographically located in the adjacent districts to the proposed belt area. All these mills should have maximum access to the belt area, especially for raw materials (i.e., sugarcane). The market area for each of sugarcane mills should be geographically defined to ensure systematic and effective production of sugarcane in fields. Improved transportation networks should also be established between these mills and the corresponding parts of the belt area.

SWOT Analysis

Based on the findings of the study, the strengths, weaknesses, opportunities and threats for the local production of sugarcane within the proposed belt area are as follows:

Strengths

Char area: Availability of large amount of ‘*char* lands’ within the proposed belt area, which is highly suitable for sugarcane cultivation.

Favourable environment: Most of the districts within the proposed belt area have favourable environment in terms of temperature, relative humidity and soil quality for sugarcane cultivation (Hoque, 2001).

NGO Activities: Most of the districts within the proposed sugarcane-belt area are characterized by adequate concentration of NGO activities (NGO Affairs Bureau, 2013). Some of these NGOs can offer financial help in the form of micro-credit to the farmers to promote the cultivation of sugarcane.

Availability of Labourers: There is sufficient supply of agricultural labourers within the proposed belt.

Optimum Distance of the Belt Area from Other Parts of the Country: The proposed sugarcane-belt is located almost at the central part of the country. This location factor would reduce the transportation cost of sugar as well as sugarcane throughout the whole country.

Weaknesses

Longer Growing Duration: Cultivation of sugarcane requires 12 months from plantation to harvesting time and this might discourage farmers to grow this particular crop.

Illegal Ownership of Char Lands: Most of the char lands in Bangladesh are occupied illegally by local influential people. They would locally try to resist any kind of intervention in their illegally occupied lands.

This issue might reduce the production possibility of sugarcane in those char areas.

Opportunities

Fuel: Cane tops and bagasse could be used as cheap fuel within and surrounding the belt area.

Absorption of Local Agricultural Labourers: Agricultural labourers would be required in sugarcane field on regular basis. This could ensure their income certainty throughout the year.

Threats

Aggression of Tobacco: Nowadays, farmers in Kushtia are inclined to tobacco cultivation instead of sugarcane for more profit (Akhter, 2011).

Flood Prone Area: Char lands lie within the flood prone area and therefore, the production might get damaged on sudden basis.

CONCLUSION

Local production of sugarcane in Bangladesh would save wastage of BDT 8,937.94 million per year. Moreover, a huge amount of money could be earned in this sector through the by-production of molasses, spirit/alcohol and *chobra*. These two issues point to the logical reasoning behind going for sustainable local growing of sugarcane. However, the belt concept would help to promote production of sugarcane since regionalization, especially in the case of agricultural activities, results to the efficient outcomes always

In this study, eight districts were selected to form the sugarcane-belt based on their location quotient value for sugarcane production, production rate, location factor and land supply ability. Policy recommendations were also made in the research to attain enhanced production and improved quality of life for agricultural labourers within the proposed belt area.

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