

Sustainable benefits to sugarcane farmers through a strong ethanol blending programme in India

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In India, the issues of the 5 million sugarcane farmers are different as their major produce is sold to sugar mills and they often receive payments at a later stage. The policies of government strongly influence this sector and the mills, including price control of sugar. In recent years the biofuel policy (ethanol blending) of the government has provided a new avenue of diversification for the sugar mills for increasing their profitability. Although the proposed targets of blend proportion are far below; it is expected that a strong blending programme is bound to emerge on account of environmental considerations and saving of the foreign exchange. So the sugarcane cultivation will be more beneficial for the farmers in coming years.

Key words: Benefers, Blending programme, Ethanol, Farmers, Sugarcane

INDIA is the second largest producer of sugarcane next to Brazil. Over 50 million people in India are associated with sugarcane cultivation and sugar industry for their livelihood. Presently, about 5 million ha of land is under sugarcane production. The average yield is around 70 tonne ha. There are about 453 working sugar mills with an average capacity of 35,000 tonne crushed/day. Sugar industry in India is well diversified and involved in business of power generation and ethanol production as well. Therefore, improving the productivity of farmers in the supply chain involving sugar mills is an important area. The government plays an important role in functioning of Indian Sugar Industry through its policies, controlling production and sale of sugar, export, maintaining the stocks and prices to be paid to farmers. There are periodic booms and busts with over supply leading to crash in sugar prices. In Brazil, the powerhouse of global sugar

production, there exist a choice to how to use sugarcane crop – make sugar or make ethanol. The automobile drivers exercise the choice of filling their fuel tanks with gasoline or hydrous ethanol based on the prevailing price of the fuel.

According to National Policy on Biofuels (NPB) 2009, 5% ethanol blending in petrol is mandated for the petrol vehicles in the transportation sector almost across the country. Also an indicative target of minimum 20% ethanol-blended petrol across the country has been set for 2017. The policy proposed that the minimum purchase price (MPP) for bioethanol should be based on the actual cost of production and import price of bioethanol. However, preparedness of the automobile industry is a major factor in the successful implementation of this policy as the conventional vehicles are mostly compatible with 5% ethanol-blended petrol, with almost no serious environmental implications. A blending of less than 10% has a few

disadvantages but there is no need to modify the engine. Blends above 15% ethanol, however, require engine modifications. With the aim to encourage domestic production of ethanol National Biofuel Policy was launched under Ethanol Blending Programme in the country. The Indian approach to bio-fuels is based on non-food feedstock to deliberately avoid a possible conflict between food and fuel.

Ethanol as biofuel

Although the calorific value of ethanol is lower than that of petrol; it has certain other advantages compared to petrol. Its vapour pressure is lower than that of petrol, resulting in lower evaporative emissions while its flammability is also lower than that of petrol, reducing the risk of vehicles catching fire. Besides there is no gum formation associated with ethanol, and anti-oxidants and detergent additives are not required. Other advantages of ethanol are that it

improves the octane number. This is the reason for its use as a 100% fuel in Brazil. E 85 (a blend of 85% ethanol and 15% petrol) also has fewer volatile components than petrol, which means fewer emissions from evaporation. Ethanol is also a cleanser and keeps the engine clean thereby improving the life of engines. Researches carried out by the public sector oil companies in India showed that the fuel efficiency improves significantly at 5% blending with petrol. Therefore, the consumers gain with better mileage per litre, longer life of engine besides lower environmental pollution. Since ethanol is an anti-freeze, it will benefit consumers in cold climates.

Demand and supply

India is the fourth largest producer of ethanol in the world after Brazil, the United States of America and China, producing approximately 2,000 million litres of ethanol. There are three main uses of ethanol in India like potable liquor (45%), chemical industries (35-40%), and blending with petrol (15-20%). The demand for ethanol is on rise on account of the growth of user industries and for transportation fuel in the country.

In the country, ethanol production is mainly done using sugarcane molasses. It is made by fermentation of sugars. The enzymes from yeast change simple sugars into ethanol and carbon dioxide. Potable ethanol and more than half of industrial ethanol is made by this process. The short supply is met through imports for the industrial sectors. There are some export items from India as well (Table 1).

Table 1. Import and export status of ethanol (million litres) in India

Year	Import	Export
2011	39	119
2012	34	177
2013	33	234
2014	107	175
2015	217	200

(Source: GAINS 2016)

The feedstock

Sugarcane molasses is a by-product of sugar manufacturing in

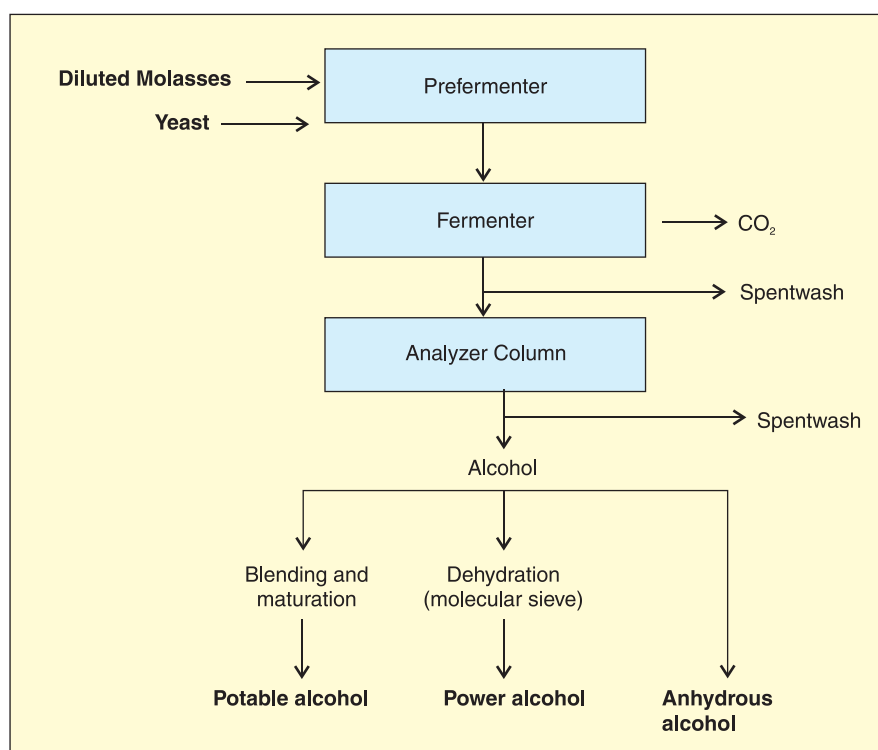


Fig.1. Ethanol production process from molasses

India. Three factors primarily determine sugarcane production in India: area under sugarcane production, sugarcane yield per hectare, and the proportion of sugarcane output that is crushed by sugar factories. The area under sugarcane production in India has increased nearly 2.5-fold since independence. Now the acreage is in the range of 5 million ha. There are variations in area in years and the crop has cyclical patterns of output – some years of bumper harvests followed by relatively poor crops. Farmers keep on shifting to other crops on account of cyclical patterns and also for the reasons that several crops can be grown more profitably or within a shorter time span compared to sugarcane.

As per the industry sources ethanol production in India is almost

entirely through the final grade molasses. The process of alcohol production from molasses is depicted in Fig. 1.

About 1 litre ethanol is extracted from 4 kg of molasses. The present status of production of sugarcane and molasses in India is depicted in Table 2.

In earlier times, sugar mills used to sell molasses at a throw away price to potable ethanol and other industries. However, now it is of importance to sugar producers as well as oil companies and overall oil economy of country. The present status of ethanol production is presented in Table 3.

Economics

Sugarcane molasses is the primary feedstock for bio-ethanol in India. Sugarcane requires prime agricultural land, fertilizer and large quantities of

Table 2. Production of sugarcane and molasses in India

Particulars	Year				
	2011-12	2012-13	2013-14	2014-15	2015-16
Cane acreage (x ¹⁰⁰⁰ ha)	5,100	5,279	5,341	5,307	5,284
Sugarcane production (million tonne)	353.8	354.4	345.6	366.8	336.9
Molasses production (x ¹⁰⁰⁰ tonne)	1,1824	11,744	10,882	12,482	10,837
No. of sugar factories in operation	529	526	509	538	526

(Source: ISMA2016)



Fig. 2. Farmers transporting harvested cane to sugar mills



Fig. 3. An ethanol production unit at a sugar mill

Table 3. Use of molasses as feedstock and ethanol production on India

Particulars	Year				
	2011	2012	2013	2014	2015
Feedstock use × '000 tonne)	7,004	8,975	8,573	8,343	9,551
Ethanol production (million litres)	1,681	2,154	2,057	2,002	2,292
No. of refineries	115	115	115	115	160
Nameplate capacity	1,500	2,000	2,000	2,000	2,000
Capacity use (%)	112	108	103	100	115

(Source: GAIN 2015)

irrigation water. Sugarcane expansion in India for bioethanol production will therefore most likely increase agricultural inputs and therefore cost of overall production will increase. As discussed above, if we increase agricultural inputs for biofuel crops they will begin to impact food prices. Besides as India's biofuel programme expands, the land space to large-scale sugarcane cultivation will be going to increase. This may lead to a number of environmental problems such as land degradation, deforestation and water scarcity. To prevent direct competition with sugar, a ban on direct ethanol production from sugarcane juice is in operation. Otherwise, the price of sugar would increase due to diversion of sugarcane

use from sugar production to biofuels. To avoid this competition, bio-ethanol production from non-edible lignocellulose biomass such as wheat-straw, rice-straw, non-edible oil cake, *Sorghum bicolor*, *Saccharum spontaneum*, peels of fruits and vegetables could also be a good alternative subject to availability of appropriate technologies. Comparative economics of ethanol production from raw materials like sweet sorghum, grains like pearl millet and broken rice, sugarcane juice and sugarcane molasses based on experimental findings is depicted in Table 4.

The benefit cost ratio is arrived at 1.02 from sweet sorghum, 0.91 from grains, 0.89 from sugarcane juice and

1.19 to 0.84 from sugarcane molasses. The molasses is a good option, if the raw material cost is low.

Present scenario

The present status of use of molasses as feed stock in ethanol production and patterns of ethanol blending in India are presented in Tables 5 and 6, respectively. The directives of National Biofuel Policy provided an opportunity to sugar mills to diversify through distillery, ethanol and power plants. This has improved the demand for molasses and ensured better economics for the mills. Most of this ethanol is coming from Uttar Pradesh and Madhya Pradesh, followed by Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu. The industry has constraints in form of delays in obtaining permits, restrictions on interstate movements and ban on processing of cane juice for ethanol production.

On an average one tonne of sugarcane crop provides a good revenue (₹ 4,200) to the government through various taxes and cess imposed on cane production and its products and the farmers get (₹ 3,000) from factories. In case ethanol is produced directly from cane juice, the government loses this amount. This is one of the main reasons that millers/farmers are not allowed to produce ethanol from sugarcane juice. However, it is being increasingly emphasized that for better utilization of the infrastructure and profitability of sugar mills the constraints are removed and ban on using cane juice directly for ethanol

Table 4. Profitability of ethanol production from various feed stocks in India

Parameter	Sweet molasses	Sugarcane juice	Sugarcane (pearl)	Grains millet, broken rice)
Cost of raw material (₹/tonne)	801	3,000-5,000	1,200	7,000
Total cost of production (₹/tonne)	1,184	4,890-6,890	1,690	9,400
Ethanol output (litres)	45	270	70	400
Value of ethanol (₹)	1,215	5,805	1,505	8,600

1 Molasses prices have ranged between Rs.3000 and 5000 per tonne during the last few years. Hence the profitability of producing ethanol from it is highly dependent on fluctuating molasses prices. 2. Data on other feedstock cost is for the year 2009. The price of feedstock (sugarcane and grains) has increased in recent years.

Table 5. Use of molasses as feedstock and ethanol production on India

Particulars	Year				
	2011	2012	2013	2014	2015
Feedstock use (×000 tonne)	7,001	8,975	8,573	8,343	9,551
Ethanol production (million litres)	1,681	2,154	2,057	2,001	2,292
No. of refineries	115	115	115	115	160
Nameplate capacity	1,500	2,000	2,000	2,000	2,000
Capacity use (%)	112	108	103	100	115

(Source: GAIN 2016)

Table 6. Pattern of petrol consumption and ethanol blending in India.

Year	Petrol consumption (million litres)	Ethanol blend (million litres)	Blend Rate (%)
2011	20,716	365	1.8
2012	21,842	305	1.4
2013	23,749	382	1.6
2014	25,848	350	1.4
2015	29,651	685	2.3

(Source: GAIN 2015)

production is lifted as has been demonstrated by the Brazilian sugar industry.

Many in the industry, farming community and even among state authorities are now of the opinion that increasing ethanol production to counter the sugar glut could be an effective strategy. In Maharashtra, there are around 170 sugar factories and 250 distilleries. However, only 17 factories produce ethanol from molasses. If the government permits all the factories to produce ethanol,

millions of foreign exchange spent on import of petrol is saved besides the environmental benefits. Most importantly such measures will enable the industries to pay cane dues to the farming community well in time as well.

FUTURE THRUSTS

Despite the national policy on biofuels in place and fixing the price of ethanol in the range of ₹ 48.50 to 49.50/litre; the target set in the policy has not been achieved. There is

need of revamping of this policy and also facilitation of an environment to support a strong bioethanol blending programme in the country by removing the present constraints. This will not only reduce India's dependence on fossil fuel imports but also ensure energy sufficiency. Apart from lesser emphasis from present sugarcane centric policy where some proportion of sugarcane juice is permitted for ethanol; thrusts on the development of second generation biofuels (energy crops, agricultural residues, residential wastes) and third generation biofuels (algae cultured in waste water or sea water) will provide energy security.

SUMMARY

A stable ethanol blending programme in the country will ensure sustainable benefits to the sugarcane farmers, who are frequently affected in bumper sugarcane crops and its lack of market demand. Such incentives will motivate small- and medium-farmers to increase their efforts towards scientific management sugarcane of crop as there will be better returns.

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Attracting and Retaining Youth in Agriculture (ARYA)

Realizing the importance of rural youth in agricultural development especially from the point of view of food security of the country, ICAR has initiated a program on "Attracting and Retaining Youth in Agriculture.

The objectives of ARYA project are:

- To attract and empower the youth in rural areas to take various agriculture, allied and service sector enterprises for sustainable income and gainful employment in selected district;
- To enable the farm youth to establish net work groups to take up resource and capital intensive activities like processing, value addition and marketing; and
- To demonstrate functional linkage with different institutions and stakeholders for convergence of opportunities available under various schemes/program for sustainable of youth.

ARYA project will be implemented in 25 states through KVKs, one district, 200-300 rural youth will be identified for their skill development in entrepreneurial activities and establishment of related micro-enterprise units in the area of Apiary, Mushroom, Seed processing, Soil testing, Poultry, Dairy, Goatry, Carp-hatchery, Vermi-compost etc. KVKs will involve the Agricultural Universities and ICAR Institutes as technology partners. At KVKs also one or two enterprise units will be established so that they serve as entrepreneurial training units for farmers. The purpose is to establish economic models for youth in the villages so that youths get attracted in agriculture and overall rural situation is improved.

The trained youth groups will function as role model for other youths and will demonstrate the potentiality of the agri-based enterprises which will help in improving their confidence levels and encourage them to pursue farming as profession, generate additional employment opportunities to absorb under employed and unemployed rural in secondary agriculture and service related activities in rural areas.