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Sustainable Sugar production and E-20 Blending Program in India- a Challenge

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Abstract

Sustainability in the sugar sector means achieving production sustainability, economic sustainability and environmental sustainability. India being the highest with 18 % of the world population, has a challenge in all the sustainable areas. Challenge in production sustainability- India is the largest sugar consumer. Challenge in economic sustainability- sugar is considered as an essential commodity in India and so Govt. decides both the sugar MSP as well as the sugarcane FRP. Challenge in environmental sustainability- due to the strict control by the controlling agencies like CPCB, SPCB, MoE & F, CGWA etc. But sustainability is essential for the benefit of all the 5 stakeholders- the farmers, the millers, the consumers, the Govt. and the environment. Maintaining sustainability is therefore a great challenge under such adverse conditions. To cater the domestic demand of sugar being the no. 1 consumer in the world and to sustain blending of ethanol with petrol, India's need of sustainable sugarcane production is also a challenge under the conditions of: Less agricultural land with the world's highest population, Govt. of India policy of More Crop Per Drop (MCPD), more than half of sugarcane area is falling under subtropical zone, the effect of Al-Nino is almost cyclic in 2/3 years and varietal effect in sub-tropical India.

Key words : Sustainable Sugarcane Initiative, Ethanol, Feedstock, Diversion.

Sustainable Sugarcane Agriculture :

Increased demand of sugar every year due to population growth and urbanization and the demand for more ethanol blending percentage, the requirement of sugarcane is increasing year by year. Since we have limited cultivable area to be spared for sugarcane farming, the only alternative to meet out the demand is vertical growth, both in terms of quantity and quality. In other words, more yield and more recovery *i.e.* more sugar per hectare.

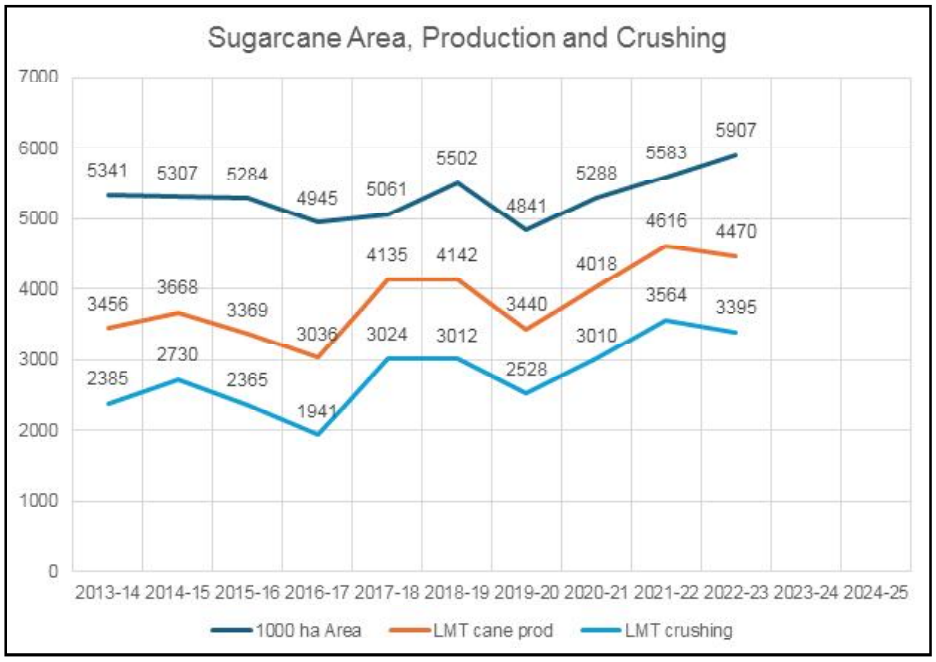
When we see from farmers viewpoint, the increased cost of cultivation, difficulty in availability of farm labor, unpredictable climatic aberrations, unavailability of sufficient irrigation water, insufficient knowledge on methods of cultivation and supply of proper

seed material are the major constraints in increasing the sugarcane production. When it is from miller's view point, more diversion of cane due to good price of gur, fluctuation in recovery, insufficient availability of raw material leading to shorter duration of season, instability in sugar price, economy of ethanol production in different routes, pressure of timely payment of farmer's dues etc. are the matters of concern. Against all these odds, sustainability in sugarcane production is to be obtained for proper profitability of the industry providing sufficient sugar and ethanol as per the requirement of the country's population as well as for maintaining the required blending percentage. For the preparation of the manuscript relevant literature[1-3] has been consulted.

Graph below shows for the last 10 years the sugarcane area, production and crushing.

Vertical distance between area and production shows the yield whereas same between production and crushing shows the diversion. Though there is an increase in yield per hectare during last 5-6 years, it is not so much as per the requirement. Although, Yield is basically due to the variety, agro climatic conditions also play a vital role in achieving the same and that is what happened in last two seasons in India. Since the area under sugarcane cultivation is more or less same and is expected to remain same for the future years due to the limitation in the cultivable land in India, we have left with no choice but the vertical growth both in terms of weight as well as the sugar content.

The only way to have win-win situation for farmers, the millers and for the country as well is Sustainable Sugarcane Initiative (SSI).



The Sustainable Sugarcane Initiative (SSI) is an innovative set of agronomic practices that involves using less seeds, raising seeds in a nursery, and following new planting methods, with wider seed spacing, and better water and nutrient management to increase the cane yields significantly and also sugar recovery by using selected high sugar varieties.

Sustainable Sugarcane Initiative (SSI) can increase the yield with less water, lesser seed material, lesser chemical use and increased sugar recovery.

SSI can benefit to the farmers by way of using:

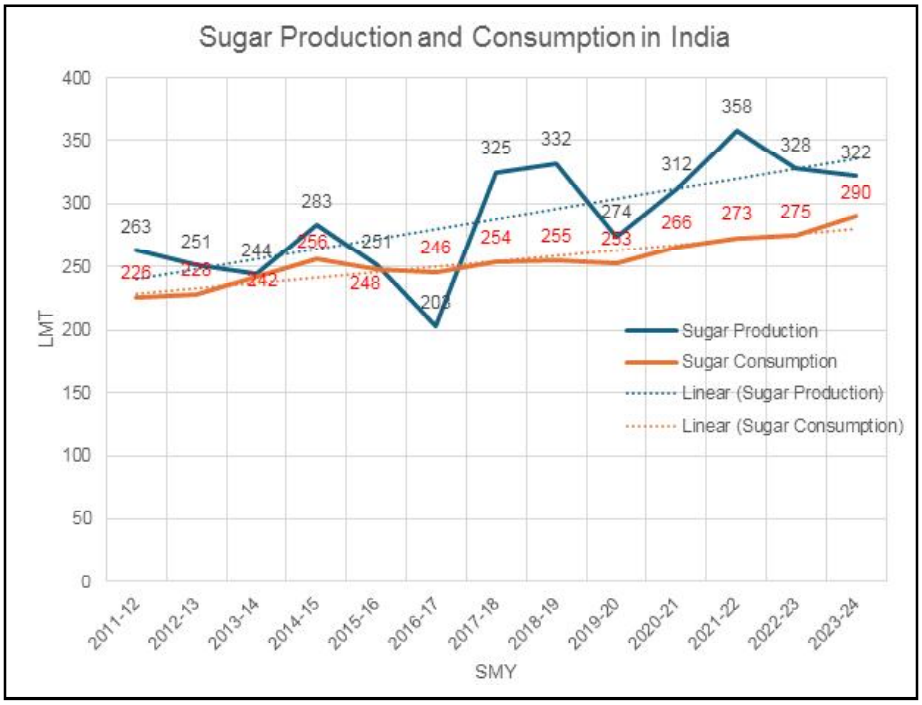
- Use of high yield and high sugar variety
- Use of climate resistant variety
- Less seed: Saving in seed material
- Healthy seedling of 25-35 days old from nursery
- Wide spacing for inter cropping
- Water saving: Easy for drip, low cost
- Less cost for transplantation
- Adapting to new varieties

SSI can benefit to the millers by way of:

- Increased recovery
- Improves the supply of raw material for longer duration of the sugar season
- Improves the profitability.
- Increases the efficiency of mills- more systematic supply during the season.

Sugar production and consumption :

India's sugar production and consumption in last few years is shown below in graph:

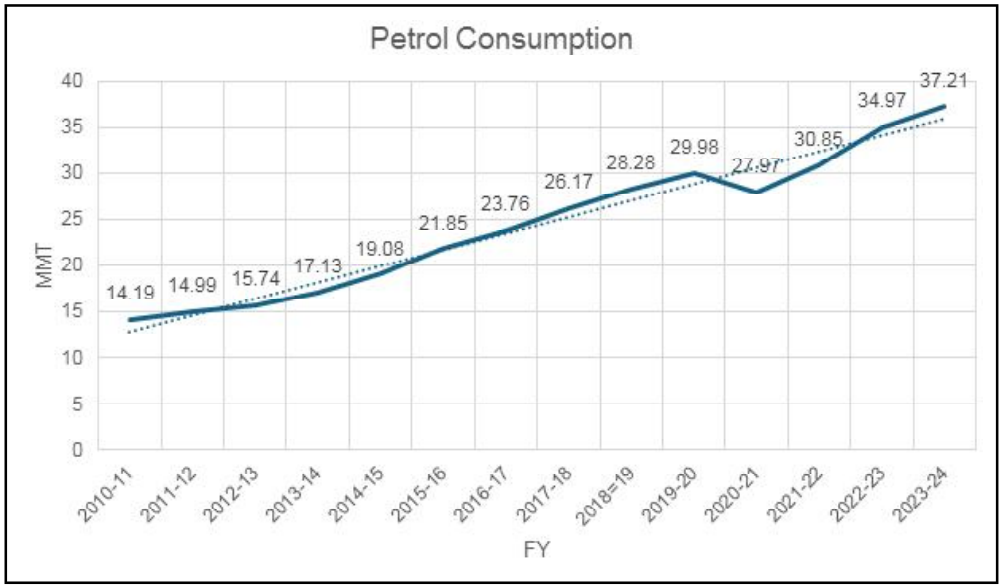


While sugar consumption in India is increasing almost linearly due to growth of population and urbanization, production shows ups and downs in about every two years which is not a desirable situation for sustainability. Sustainability in sugar production is required to meet the increased demand of sugar consumption and the target of 20 % ethanol blending with petrol.

E-20 Blending Program :

The quantity of ethanol required for blending with gasoline at the rate of 20% depends on its consumption which keeps on increasing year by year due to increase in vehicle population and industrialization. So increase in ethanol requirement in the coming years is not only to increase the blending % from the current level of 12 % to 20 %, but to maintain 20% at the increased rate of petrol consumption.

Petrol consumption in India for last several years is shown in the graph below:



There is an increase in petrol consumption at the rate of about 8.66% CAGR (taking an exception of 2020-21 as the COVID year). Now due to closure of diesel vehicles by several companies, this rate of increase may grow further. The table-1 below shows the requirement of ethanol from 2024-25 to 2029-30 with a base of 2023-24and increase @8.66% in Crore liters.

FY	Petrol Consumption	Ethanol required @ E-20
2023-24	37.21	992
2024-25	40.43	1078
2025-26	43.93	1172
2026-27	47.74	1273
2027-28	51.87	1383
2028-29	56.36	1503
2029-30	61.25	1633

India's planning for E-20 in 2024-25 will be requiring 1078 crore liters of ethanol and that will increase to about 1633 crore liters by 2029-30 *i.e.* there will be an additional requirement of 555 crore liters of ethanol for 20 % blending[1]. Neither the increase in sugar production nor in sugarcane production is to such an extent that it will meet the requirement of 1633 crore liters apart from 250 -350 liters for portable and chemical sectors. Hence, for a requirement of about 2000 crore liters by 2029-30, we must plan for about 1000 crore liters from molasses/ sugar and the rest 1000 crore liters from alternatives routes of ethanol production.

There are three other roots of ethanol production.

1. Food source with sugary and starchy food like rice, wheat, maize, cassava.
2. Non-food source with sugary and starchy feed stock like sugar beet, sweet sorghum
3. 2-G source of ethanol *i.e.* cellulosic ethanol

For food source feed stock, there is always a threat of food verses fuel. The cultivation of this source crop is generally the same as that of sugarcane. Hence, this source can be utilized only when there is surplus production.

Cellulosic ethanol production is still in nascent stage and the cost of production is much beyond the economic range.

Non-food feed stock is now the alternative that seems to become the main attraction for sustainability of ethanol blending program in India.

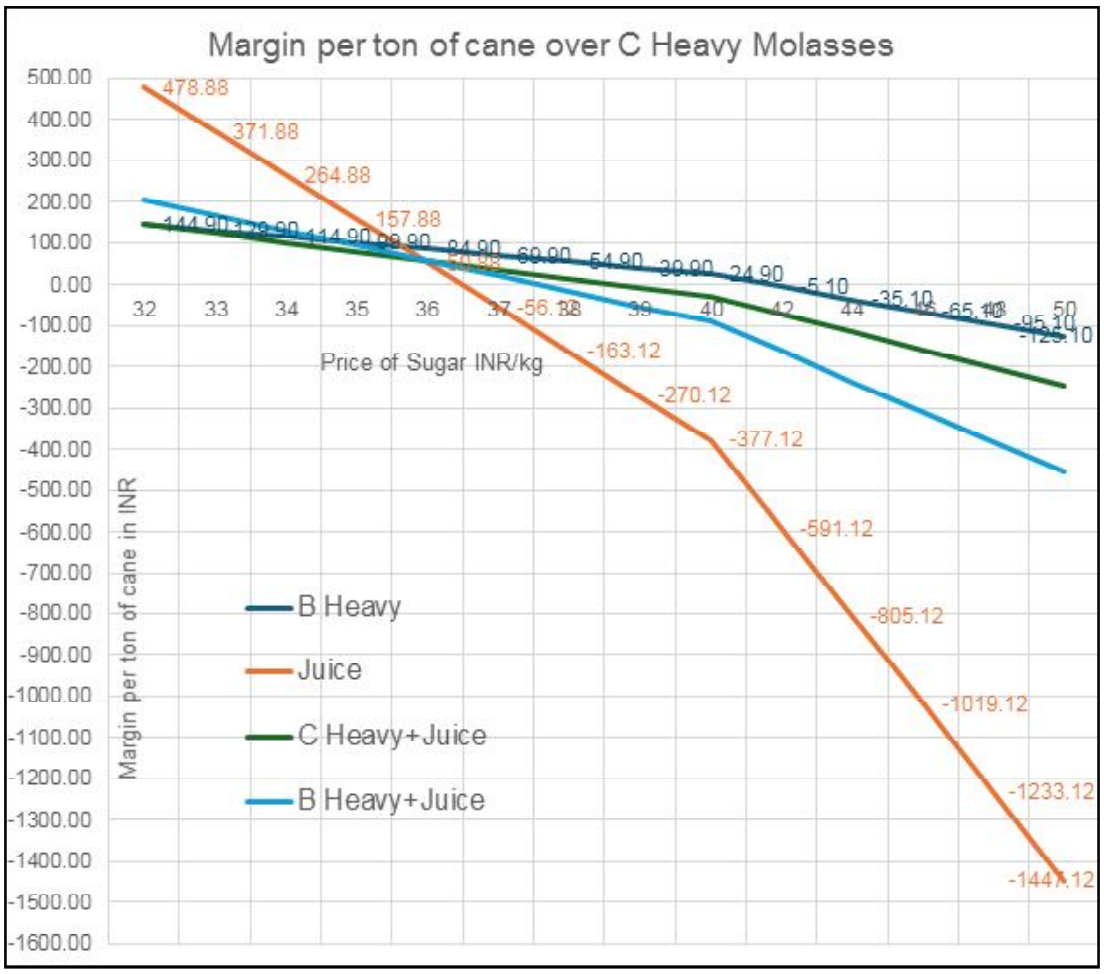
Economy of ethanol production from Sugarcane Juice/ B Heavy molasses and C Heavy molasses :

Sustainability in production is attained if there is availability of sustained raw material and there is profit to the industry. A positive Economy in ethanol production is attained when the market price of sugar and the ethanol price fixed by the Govt. gives a positive earning at the end of every day. The issue is discussed below with the help of graphs drawn for the earnings per ton of cane at different market prices of sugar.

Basis :

1.	Sugarcane crushed:	one ton
2.	Standard Recovery	10.70 %
3.	Loss in Recovery due to B Heavy diversion	1.5 %
4.	C Heavy Molasses % cane	4.5%
5.	B Heavy Molasses % cane	6.5%
6.	Ethanol yield from C Heavy Molasses	235 L/T
7.	Ethanol yield from B Heavy Molasses	310 L/T
8.	Ethanol yield from Sugarcane (10.70% Rec)	74 L/T
9.	Ethanol plant capacity for 5000 TCD plant	75 KLPD
10.	Tariff of Electricity exported per unit	5 INR
11.	COP of power per unit	2.5 INR
12.	Price of Filter cake per ton	275 INR
13.	Price of C Heavy Molasses per ton	10000 INR
14.	Conversion from cane to sugar per kg	7 INR
15.	Conversion from C Heavy to ethanol	12 INR
16.	Conversion from B Heavy	12 INR

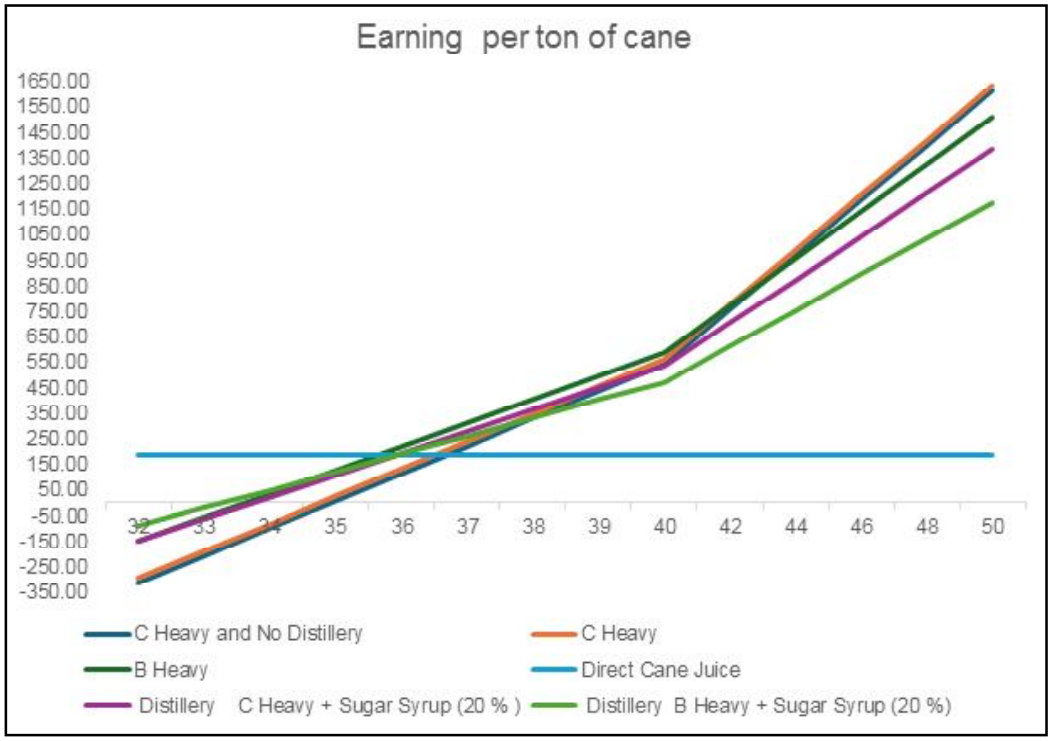
	to ethanol	
17.	Conversion from Cane to ethanol	17 INR
18.	FRP of cane at 10.25 basic recovery	340 INR
19.	FRP increment at each 0.1 increase of Recovery	3.32 INR
20.	Price of ethanol from C Heavy per liter	56.28 INR
21.	Price of ethanol from B Heavy per liter	60.73 INR
22.	Price of ethanol from sugarcane juice	65.61 INR



The above graph is a comparison of ethanol production from B Heavy, Sugarcane juice/syrup, combination of C Heavy and juice, Combination of B Heavy and juice with that of C Heavy. Positive margin means profit in INR above C Heavy diversion and negative margin means loss in INR in comparison to C Heavy diversion The following are the

observations:

1. Ethanol from juice/syrup gives the maximum margin than other schemes up to sugar price of 36 INR/kg.
2. Beyond that price, it gives a maximum loss too.
3. In case of only B Heavy diversion, the margin is positive till the price of sugar is 41 INR/kg.
4. In case of C Heavy + Juice diversion, the margin is positive up to a sugar price of 38 INR/kg.
5. In case of B Heavy and Juice diversion, the margin is positive up to a sugar price of 37 INR/kg.



This graph shows the earning/profit in INR per ton of cane crushed. The following are the observations from the graph.

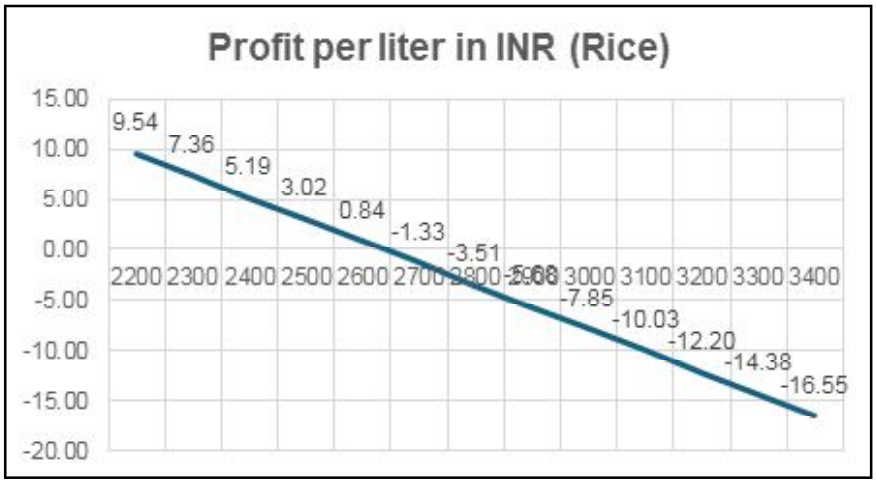
1. In the case of cane juice diversion there is a fixed profit of INR 150 + and is independent of price of sugar.
2. No other scheme if profitable if the sugar price is below 35 INR/kg.
3. Selling final molasses gives the maximum loss till the price of sugar is below 35 INR/kg followed by C Heavy diversion,
4. In case of sugar price above 40 INR/kg, C Heavy diversion gives maximum profit
5. B Heavy diversion is most profitable when the price of sugar is below 40 INR/kg
6. There is maximum utilization of plant and machinery of the distillery when the scheme is Cane Juice +B Heavy.
7. There is maximum production of ethanol when the scheme is Cane Juice +B Heavy as the sugar diversion is maximum.

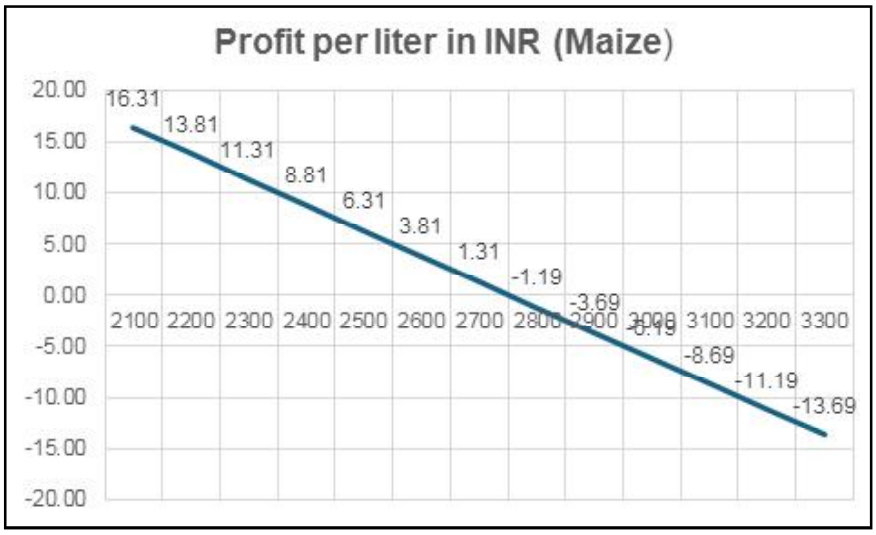
8. Liquidation of fund is better in case of Juice diversion as the farmers can be paid their dues in time.

Since sugar is an essential commodity, it remains ahead of ethanol. To have sustainability in both sugar production as well as blending program, one must fix the price of sugar, and ethanol from various sources in such a way that the industry will be compelled chose the same path as desired for the country.

Other alternatives :

Rice and maize are the two major food -source feed stocks that are in use in ethanol production and there is sufficient plant capacity available for production. It is only the economy of production that decides both the raw material use and its quantity. Below are the two graphs showing the ethanol production economy in case of rice and maize.





It is observed that ethanol production from rice and maize is not profitable when the cost of rice and maize is above 26 and 27 INR/ kg respectively. Hence to maintain sustainability of ethanol production from rice and maize, steps are to be taken either to supply raw material at a lower rate or purchase ethanol at a higher rate, whichever is economical as per the situation.

The other alternative to produce ethanol is the non-food source of feedstock *i.e.* Sugar beet and sweet sorghum. These feedstocks are in use in lab scale only. Lab scale results are so encouraging that this year it is taken on an industrial scale and the results are awaited. Lab scale results are as follows:

Sweet sorghum[3]*:*

Ethanol Yield per ton	50 L
Stalk yield per hectare	50 T
Price expected to be given to the farmers	275 INR/quintal stalk

The profit expected per liter of ethanol is better than any other feed stock being used at present.

Sugar Beet[2]*:*

Ethanol Yield per ton	95 L
Stalk yield per hectare	90 T
Price expected to be given to the farmers	400 INR/quintal stalk

The profit expected per liter of ethanol is much better than any other feed stock being used at present.

These two sources being from nonfood source, there is no fear of food verses fuel and are short duration crops and lesser water required for its cultivation. Hence, sweet sorghum and sugar beet must be encouraged to be cultivated and used for ethanol production.

1. Sustainability is a challenge, and it must be accepted. Production sustainability, economical sustainability and environmental sustainability must be maintained for the smooth running of the schemes.
2. Sustainable Sugarcane Initiative is the Mantra for sustainable sugarcane production.
3. Profitable industry leads to sustainability. Hence, prices of raw material and finished products are to be decided accordingly.
4. Selection of proper scheme of diversion is the criteria for better profit of the industry.
5. Nonfood feedstock should be chosen as an alternate source of ethanol production to avoid the situation of food verses fuel.
6. Sustainability always provides a win-win situation for all the stake holders of sugar and the ethanol industry.

References :

1. Narendra Mohan, Ananthalakshmi Ranganathan and VivekPratap Singh (2022), An Overview of B Heavy Molasses Diversion for Boosting Ethanol Production, *SISSTA 51st Convention*, 316-322.
2. Paroha S, S. Singh and A Gupta (2020). *International Journal of Agriculture Sciences, 12*(8): 9776-9778.
3. Umakanth A.V, Seema Paroha, Ashok Kumar, Ananthalakshmi Ranganathan and D Swain (2024), *Journal of Scientific Research and Reports*, *30*(4): 1-9.