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Sweet sorghum for food, feed and fuel

Sweet sorghum could help dryland farmers tackle the ongoing problem of feed scarcity

ICRISAT

Food, feed and fuel are three of the necessities of life but it is not often that all three requirements can be provided by one crop. Sweet sorghum (*Sorghum bicolour* (L.) Moench) not only provides grain for human consumption and stover (stalks and leaves) for fodder, but it is increasingly being used in India as feedstock for industrial biofuel production.

Known as a "smart" multipurpose crop, sweet sorghum is also known by many scientists and farmers as the "camel among crops" as it is well adapted to the semi-arid tropics, is drought tolerant and very water-use efficient. As a dryland crop for biofuel production, it is highly favoured for its effective conversion of atmospheric carbon dioxide into sugar, making it a viable alternative to sugarcane or maize for the production of ethanol. "Sweet sorghum extracts only one seventh of the water that is used up by sugarcane," states Dr Belum VS Reddy, Principal Sorghum Breeder at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Achieving feed security

Increasing production of sweet sorghum for biofuels undoubtedly provides important income to poor dryland farmers. However, selling sweet sorghum stover to distilleries, instead of keeping it on-farm and using it to feed livestock adds to problems of fodder scarcity. However, once the juice for ethanol production has been extracted from the stalks, the bagasse (stalk residue) can be combined at the distillery with leaves stripped from the stems; this returned to farmers, provides a nutritious animal feed, rich in micronutrients and minerals.

Stover from ordinary grain sorghum is already a popular choice for livestock fodder. In markets in Hyderabad, Andhra Pradesh, stover has been identified that has been sourced from several Indian States, transported over distances of more than 350 km and sold for half the value of sorghum grain. High quality stover fetches premium prices, about Rs3-4/kg of dry stover.

Sweet success

Scientists at ICRISAT and the International Livestock Research Institute (ILRI), working collaboratively with national partners* in a public-private partnership, have shown that the feed quality of combined bagasse and stripped leaves from several sweet sorghum hybrids is similar to that of premium stover from grain sorghum. The combination feed is nutritious and readily digestible and cattle trials have demonstrated that palatability (feed intake) is also high.

The researchers estimate that this combination feed could be sold for almost double the price of dry sorghum stover, at nd about Rs6/kg, providing important additional income to poor farmers. A bagasse-based feed block has already been manufactured in collaboration with a Hyderbad-based company, Miracle Fodder and Feeds, which is providing very promising results in initial trials with both large and small ruminants.

Maximising the benefits

Livestock find sweet sorghum bagasse both palatable and digestible

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These are not all the benefits provided by sweet sorghum. The grain, as well as the stover, is used by some distilleries for biofuel production and the by-products of this process can also be used to further increase levels of nutrition of the feed blocks, along with fortification with other supplements.

By making use of the by-products of biofuel production, dryland farmers are not only able to earn valuable additional income but the product is also nutritious and easily transportable. However, in order to capitalise on this emergent sweet sorghum value chain, it is essential that distilleries return the bagasse and stripped leaves to the farmers after juice extraction if farmers are to make use of the feed themselves.

Alternatively, the establishment of decentralised juice extraction and syrup-making units based to serve farmers in and around a cluster of villages would mean that the sweet sorghum stover for biofuel

production could remain on-site, making it easier for farmers to benefit from the by-products. The syrup will then be transported to a central distillery to convert it in to ethanol.

Whatever the ultimate outcomes of the research, the multiple advantages in growing sweet sorghum have far-reaching implications beyond India. Grain sorghum is grown on over 11 million hectares in Asia and over double (23.4 million ha) are planted to the crop in Africa. Researchers at ICRISAT estimate that by planting sweet sorghum instead of grain sorghum, dryland farmers can earn US$40 per ha per crop in addition to the existing benefit from the grain.

Trials for growing and promoting the multi-benefits of sweet sorghum are planned in Mali, Kenya, Ethiopia and Zimbabwe.

**National partners: Rusni Distillery in Medak District, Andra Pradesh, and the National Research Center for Sorghum (NRCS) of the Indian Council of Agricultural Research.*

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