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Indiaâ??s biofuel push needs better seeds and smarter crops

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In an exclusive AgroSpectrum interview, Bhupen Dubey, CEO, Advanta Seeds, explains how maize, sugarcane and sorghum can expand Indiaâ??s biofuel feedstock base while strengthening farm incomes and protecting food security

In this exclusive AgroSpectrum interview, **Bhupen Dubey, CEO, Advanta Seeds**, discusses how India can expand its biofuel economy beyond E20 without compromising food security. He explains why maize, sugarcane, sorghum and other biomass crops will be central to building a diversified and reliable feedstock base, and how genetics can improve starch yield, biomass output, fermentability and energy production per hectare. Dubey highlights sorghum as an underexplored opportunity for India's bioenergy transition. With lower water requirements, reduced input costs, livestock-feed value and benefits from crop rotation, sorghum can support both farm profitability and energy security. He outlines Advanta's sorghum portfolio, including Brachy Sorgho, Jumbo Diamond, Jumbo Super and Mega Sweet, and discusses the company's research into breakthrough seed technologies for grain, biomass and sweet-sorghum applications. The conversation also examines the food-versus-fuel debate, the importance of assured procurement and pricing, the role of improved genetics in raising farm productivity, and the need to align the seed industry with ethanol, CBG and other bioenergy value chains. Dubey argues that India's next biofuel phase will depend not only on expanding processing capacity, but also on developing crops specifically suited to the requirements of a growing bioeconomy.

As India expands beyond E20, how do you see crops such as maize, sugarcane and other biomass crops contributing to the next phase of the biofuel economy without creating pressure on food security?

The assumption that India has agricultural waste available in plenty is becoming increasingly important to the energy transition. What is taking place in Uttar Pradesh and across India is not merely an evolution in the energy sector; it is a bioenergy revolution. Food security is gradually becoming part of a larger energy-security framework. Sugarcane, broken rice, maize and other agricultural feedstocks can support the next phase of ethanol production if they are integrated into a visionary policy and processing framework. The issue is not to divert food crops indiscriminately towards fuel. It is to improve productivity, use surplus and damaged grain where appropriate, build processing capacity and create additional markets for farmers.

The distinction is important. India can use surplus grain, broken rice, sugarcane derivatives and agricultural residues for ethanol while protecting essential food supplies. The right approach will require predictable procurement, assured pricing and the ability to shift between feedstocks depending on crop availability, market conditions and national requirements. The expansion of biofuels should therefore not be viewed only as a fuel policy. It is also a crop, seed, processing and rural-income policy. With the right planning, biofuel demand can create an additional market for farmers instead of competing with food security. Sorghum is an important part of this diversified feedstock strategy. It is a low-input, high-productivity crop that uses almost 50 per cent less water than several other grain crops. Its lower water requirement makes it relevant to regions where water availability limits the expansion of more water-intensive crops.

Maize is emerging as an important feedstock for ethanol. What genetic and agronomic interventions are needed to significantly raise maize productivity and starch yield per hectare—and can seed technology materially improve the economics of ethanol production?

Maize is an important example of how genetics can improve the economics of the biofuel value chain. The crop is already used extensively for food, industrial applications and poultry feed. Current maize varieties typically contain around 65–75 per cent carbohydrates, but the industry now needs to focus on traits that improve starch yield, fermentability and total ethanol output per hectare. At present, maize can produce approximately 350–360 litres of ethanol per tonne, depending on the variety, grain quality, processing efficiency and plant conditions. Improving yield alone is not sufficient. The objective should be to increase the combined output of grain, starch and ethanol from each hectare. Seed technology can contribute by developing varieties with higher productivity, improved starch content, better grain quality and stronger tolerance to heat, drought, pests and other stresses. Agronomic practices must evolve alongside genetics. Plant population, nutrient management, irrigation, harvesting and post-harvest handling all influence the quality of feedstock available to an ethanol plant.

The farmer will invest in improved seed and agronomy only when there is a dependable market. India is moving towards approximately 55 million tonnes of maize production, but the next challenge is to connect that production with competitive procurement and adequate processing capacity. Three factors will determine adoption. The farmer must see a clear economic benefit, buyers must be willing to procure the crop at a competitive price, and processors must have the capacity to absorb additional production. Productivity gains can materially change the economics. Current yields of around 3.5 tonnes per hectare can potentially rise to 7–8 tonnes per hectare through improved genetics, better agronomy and suitable local practices. A pilot project in Gujarat is examining this productivity opportunity.

The biofuel industry needs a reliable, predictable feedstock supply. Can crop breeding move beyond yield to develop varieties specifically optimised for biofuel characteristics such as higher starch, fermentability, biomass yield or energy output?

Crop breeding must move beyond a narrow focus on yield. For the biofuel industry, the relevant measure is the amount of usable energy produced per hectare. Breeding programmes must therefore consider starch content, fermentability, biomass output, moisture, stress tolerance and the efficiency with which the crop can be harvested, transported and processed. Sorghum is an important example. It requires almost 50 per cent less water than several grain crops and can deliver significant biomass with relatively low agricultural inputs. It also works well as a rotation crop. When planted after maize, sorghum can support soil health and improve the productivity of the following crop.

Farmers have observed soybean yield improvements of around 20 per cent after sorghum in certain rotation systems. This makes sorghum relevant not only as a bioenergy crop, but also as part of a more sustainable farm-management strategy. Sorghum also provides low-cost and highly nutritious livestock feed for the dairy and meat industries. That additional market can improve the economics of cultivation and reduce the risk of relying only on ethanol or biomass buyers.

Sweet sorghum offers another opportunity. Field trials have demonstrated output of around 56 litres of ethanol per tonne of biomass, depending on the variety and processing conditions. Sorghum can complement Napier-based biomass systems and other feedstock models. Advanta delivers sorghum genetics to more than 50 countries and has developed a portfolio of products for different agricultural and bioenergy requirements. Its India-focused sorghum products include Brachy Sorgho, Jumbo Diamond, Jumbo Super and Mega Sweet. The company's research workforce is working on plant genetics to develop breakthrough seed technologies for grain, biomass, sweet sorghum and livestock-feed applications.

The focus must now be on repurposing research and development for the bioenergy phase. Breeding programmes should be designed around the needs of the entire value chain—from the farmer and aggregator to the ethanol or biogas plant. A variety that produces high biomass but is difficult to harvest, transport or process may not be commercially useful. The ideal feedstock must combine agronomic performance with processing efficiency, low input requirements, dependable biomass output and value for multiple end users.

One of the biggest challenges for crop-based biofuels is the food-versus-fuel debate. How should India design its crop and seed strategy so that ethanol expansion creates an additional market for farmers rather than competing with food requirements?

The food-versus-fuel debate is rooted in an earlier period when India faced severe shortages and had limited production capacity. That assumption does not fully reflect the country's current agricultural and economic position. India has transformed significantly, and the availability of food support for around 80 crore people demonstrates the scale of the country's food-distribution system. The answer is not to ignore food security, but to move beyond a shortage-driven mentality. India needs a flexible feedstock strategy that can respond to food requirements, crop availability and energy demand. Sugarcane, maize, broken rice, damaged grain and agricultural residues should be incorporated within a regulated and transparent framework.

An ethanol capacity of around 2,000 crore litres will require a reliable feedstock base. The government will need to support this through price assurance, procurement mechanisms and adequate processing capacity. Farmers will produce more when they know that the market exists and that the price will justify the investment. Improved seed technology can increase output without necessarily expanding the cultivated area. In maize, productivity can rise significantly through better genetics and agronomy. In sorghum, farmers can gain from lower water use, reduced input costs, livestock-feed value and the benefits of crop rotation.

The crop strategy should also recognise that food security is not measured only by grain availability. It includes water security, soil health, farm incomes, livestock productivity and the resilience of rural communities. A crop such as sorghum can contribute to several of these outcomes simultaneously. Sorghum can be planted after maize, use less water and provide grain, biomass, sweet juice and livestock feed. Its value therefore extends beyond a single ethanol output. Such multi-use crops can help create an additional market for farmers without placing excessive pressure on food production. India must also protect itself from geopolitical disruptions. A sudden international crisis should not force the country to choose between food and fuel. A diversified domestic feedstock system, combined with strategic reserves and flexible procurement, can provide greater resilience.

Looking ahead, which crops or next-generation feedstocks do you believe are commercially underexplored for India's biofuel transition—and what would it take for the seed industry to build a dedicated pipeline around them?

Sorghum remains one of the most commercially underexplored crops for India's biofuel transition. Its lower water requirement, biomass potential, suitability for crop rotation, livestock-feed value and adaptability to different regions give it strategic importance. The crop can support several end uses. Grain sorghum can contribute to ethanol and feed markets. Sweet sorghum can provide fermentable juice. Biomass sorghum can complement Napier and other energy crops. Its residues can also add value to livestock and bioenergy systems.

Its wider adoption will depend on a complete value chain. Farmers need access to suitable seed, agronomic guidance, harvesting equipment and assured buyers. Aggregators need systems for collection and transport. Ethanol, biogas and livestock-feed producers need technologies capable of handling different biomass characteristics. The seed industry must therefore develop a dedicated bioenergy pipeline rather than treating biofuel crops as an extension of conventional breeding. The focus should be on varieties that deliver measurable energy output, stable performance, efficient harvesting, low water use and compatibility with local processing systems.

The Pune research station, spread across approximately 80 acres, is supporting research, evaluation and field development for new crop and bioenergy applications. Such facilities are important because new varieties must be tested under different agroclimatic conditions before they can be recommended at scale. The future will depend on crop rotation, diversified feedstocks and region-specific breeding. No single crop can meet India's entire biofuel requirement. Maize, sugarcane, sorghum, Napier grass, broken rice and agricultural residues will each have a role, depending on water availability, soil conditions, food requirements, local markets and processing capacity. Sorghum's greatest advantage is that it can sit at the intersection of energy, agriculture and livestock. It can reduce water use, lower input costs, support soil health, improve the productivity of following crops, provide nutritious feed and generate biomass for ethanol and other bioenergy applications.

India's next biofuel phase will be successful when farmers see bioenergy as a dependable market, processors receive consistent feedstock and consumers benefit from a more secure and cleaner energy system. The transition beyond E20 will not be driven by ethanol capacity alone. It will be shaped by the quality of the crop, the productivity of each hectare, the reliability of procurement and the ability of the seed industry to develop crops specifically for India's emerging bioeconomy.

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