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Mission: Pearl millet biomass transformation

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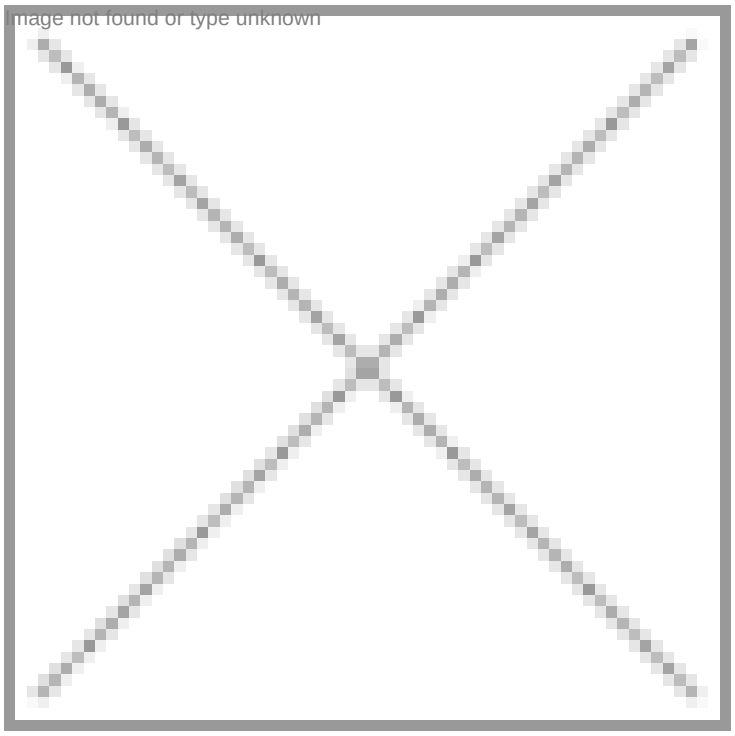

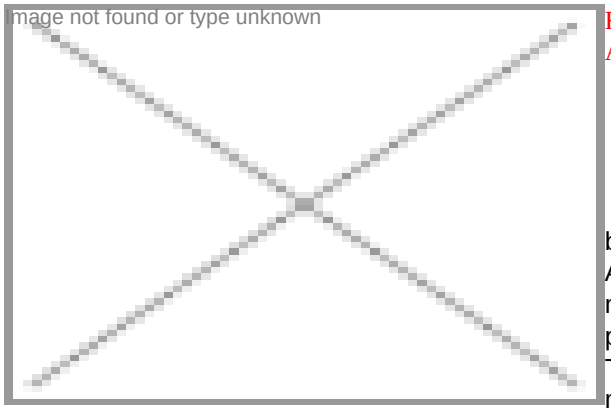

Funding from the Department of Biotechnology served as a great boost to Avesthagen's unique project that focuses on developing pearl millet as an

Food sources such as maize and sorghum are often used to produce biofuels. However, these are extensively used as edible food substances, making them a non-viable option for the production of biofuels in the long run. In order to tackle this problem, Bangalore-based Avesthagen decided to use pearl millet, a hardy local crop grown in marginal land, for the biofuel industry. The company utilized its patent position on cellulases and xylanases and combined it with its patented Triple Star technology to develop a package that generated the pearl millet transformation patent. The uniqueness of this technology is that it doesn't interfere with the food and separates the requirement of material for both food and biofuel industry.

The project conceived by Dr Villoo Morawala Patell, founder and CMD Avesthagen, was initiated in 2009. The objective was to develop pearl millet transgenics that are endogenously adapted to yield high biomass under both drought and saline conditions, using Avesthagen's proprietary Triple Star technology and vacuolar-localized glycolases for self-degradation after harvest of grain. It received a Biotechnology Industry Partnership Programme funding of `1.5 crore. Part of it was in the form of a grant and the remaining was a soft loan. The remaining cost, which was equivalent to 1.5 crore, was shared by the company.

However, after isolating all the cellulose and xylene-digesting enzymes from diatoms, the challenge was to make these

enzymes thermo active (80oC) so that the plants harboring these enzymes would not have adverse effect on their growth. Moreover, the other challenge was to store these enzymes in a proper place in the plant for later utilization. The R&D team adopted a systems biology approach, made the cellulose digesting enzymes thermostable and stored them in vivo in vacuoles of the plant cell for further utilization.

Talking about the importance of the BIPP funding, Dr Morawala-Patell says, â€œBIPP is critical for this kind of capital-intensive and robust ideas to see the light of the day. Traditionally, financial institutions are comfortable funding well-established companies but are quite wary of funding early-stage R&D. Moreover, if the biotech industry has to sustain its innovation quotient during early stage R&D, SMEs need to be encouraged and funded by the government.â€?

The way forward

Currently, all the glycolases genes have been identified and the research team at Avesthagen is in the process of generating self-glucogenic pearl millet transgenics. In future, it is expected that the transgenic lines would express glycolases and store these enzymes in the vacuole, an abundant organelle in drought stressed plants. This strategy will sequester the hydrolytic enzymes from the cellulose fibril polymerizing machinery and protect the plant from auto-degradation during the growth and maturation of the crop.

After harvest and threshing of the grain, the crop residue will be homogenized to release the enzymes from the peroxisome.It is expected that this technology would digest the crop residue without further addition of cellulose digesting enzymes, using minimal resources that may be implemented at the level of the farm. Dr Patell says, â€œSelf glucogenic pearl millet and the harboring technology will significantly reduce the external enzyme requirement. Increased biomass will be utilized for the biofuel industry whereas the increased grain yield due to Triple Star will help the food industry. Farmers will be greatly benefited by the incremental revenue that the self glucogenic technology would yield.â€?

Rahul Koul in New Delhi