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Managing indigenous and exotic plant genetic resources

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NBPGR

The National Bureau of Plant Genetic Resources (NBPGR) has added another feather to its cap! After pioneering the creation of genetically modified potato with enhanced protein content, scientists at NBPGR have developed transgenic rice having higher level of proteins.

The gene inserted was AmA1 of Amaranthus (the same that was inserted in potato). AmA1 gene has been added to five rice varieties cultivated in India, including IR-72 and Pusa Basmati. Rice normally contains about seven percent protein and the gene addition is expected to improve the amount of protein and also the amino acid content. But farmers will have to wait for at least a year before they can grow the GM rice, as it has yet to be cleared by the GEAC.

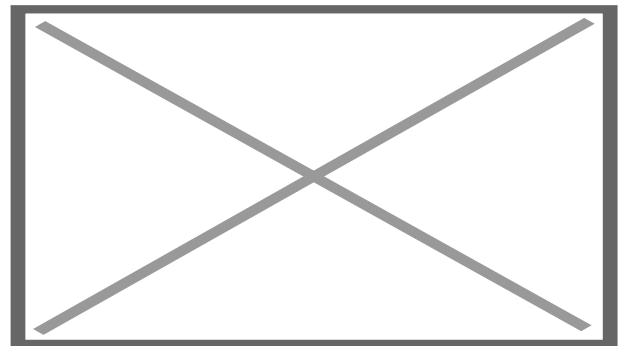
The Bureau scientists are now working on inserting the AmA1 gene into cassava and sweet potato, staple food of many poor people around the world, which are carbohydrate rich and protein poor.

Established in 1976, NBPGR acts as the national nodal institute for acquisition and management of indigenous and exotic plant genetic resources for food and agriculture and to carry out related research and human resources development for sustainable growth of agriculture. It strengthens plant genetic resources management by maintaining a national database and networking with national active germplasm sites (NAGS), molecular characterization of promising genotypes, regeneration of plant material, introduction of elite genotypes, development of core collection and utilization of the genetic resources.

Besides this, NBPGR has the authority to issue import permits and phytosanitary certificates. The bureau has the power to conduct quarantine checks on all seed materials and plant propagules (transgenic material) imported from abroad for research purposes.

Informing more about the bureau, Dr BS Dhillon, director, NBPGR said, "Over the years, priorities on Indian agricultural structure have been changed a lot. We have seen the green revolution, now another challenge is knocking our doors. To meet these new challenges we are committed to undertake introduction, exchange and quarantine of plant genetic resources. Characterization, evaluation, documentation, conservation of crop genetic resources and promotion of their use, in collaboration with other national organizations, is also an area where we at NBPGR are working."

He added, "Developing an information network on plant genetic resources is urgently required and we have accepted this challenge. Apart from this we conduct research, undertake teaching and training, develop guidelines and create public



awareness on plant genetic resources. "

With the advent of "New Policy on Seed Development" in 1988, mandatory requirements of issuing import permit before import of any seed/plant material in the country and ensuring phytosanitary standards was introduced. Based on its scientific strength and capabilities, the Bureau was identified as a nodal agency at the national level for this purpose. Also, to document the performance of promising germplasm and promote their exchange and use, the ICAR started the registration of potentially valuable plant germplasm at NBPGR.

Optimistic of the biotech applications in agriculture, Dr Dhillon felt that there is a need of more effective interaction within research community as well as with the industry representatives.

One of the key facilities at the bureau is the national research center on DNA fingerprinting. This was started in 1996 and since then it is working on developing experimental protocols and fingerprinting the crop varieties. Dr JL Karihaloo, project director and center in-charge said, "With the advent of molecular techniques for genotype characterization, it is strongly felt that DNA technology has tremendous potential in resolving cases of infringement of breeders and farmers rights and is also useful in assessing quality of plant material."

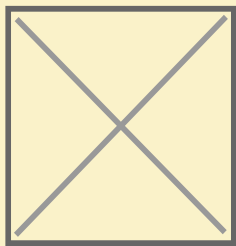
It is notable that NBPGR has successfully implemented the Indo-USAID (1988) and Indo-UK (1989) projects to develop human resources and strengthen the conservation facilities at its headquarters and the regional stations. Talking about another facility at the bureau, Dr Dhillon said, "Established in 1996, the National Genebank (NGB) facility of NBPGR consists of 12 long-term storage modules with a storage capacity of 1 million seed accessions. Well-equipped cryo preservation and in vitro conservation facilities were developed to cater to the conservation of recalcitrant seed species and vegetatively propagated materials supported by the Department of Biotechnology. The NGB ranks fourth in the world in terms of germplasm holdings." "For strengthening the conservation activities at the regional stations, germplasm storage modules were installed and made operational at seven stations namely Akola, Bhowali, Hyderabad, Jodhpur, Shimla, Shillong and Thrissur during 1995-2002," he added.

Keeping in view the strength and stature acquired by NBPGR over the years, ICAR has approved seven sub-projects of national importance under the World Bank aided National Agricultural Technology Project to it. Of these, two mission-mode sub projects started in 1999, namely, "Sustainable Management of Plant Diversity [NATP (PB)]" and "Household Food and Nutritional Security" were included in the Prime Minister's coveted Jai Vigyan National Science and Technology Mission.

The Bureau is moving in tandem with the developments occurring globally. To have access to the latest information, a separate unit for computerized documentation namely Agricultural Research Information Services (ARIS) was set up in 1997. All the labs of headquarter and regional stations were connected by e-mail, and a home page was created. Complete automation of the library was also done.

Recognizing the importance of plant genetic resources as a discipline, the Bureau in collaboration with the Postgraduate School, IARI started a MSc degree course in 1997 on this subject. For its dedicated and meritorious services to the nation, NBPGR was conferred the Best ICAR Institute Award in 1997.

"Integrated effort needed for the industry"



At NBPGR, issues like importing germplasm, conducting quality checks of imported transgenic material are decided, which are crucial for the industry. Today when expectations run high and challenges have taken a new shape Dr BS Dhillon, director, NBPGR, is all set to face them with a focused approach. Discussing this and much more with BioSpectrum, Dr Dhillon expressed his thoughts and ideas about the country's agriculture scenario.

How has been NBPGR's experience in maintaining the quality of imports of plant material, germplasm and transgenic material? What are the challenges that it faces?

Plant quarantine is high on our mandate. Maintaining the quality of imports is a big challenge in itself. We are very alert in checking the quality standards, especially in transgenics—we look for any terminator genes. At our bureau, we have world-class facilities for conducting these checks. The major challenge ahead of us is the wrong publicity spread about transgenics and export of germplasm. So far India has secured its diversity unlike any other developing nation which is a very motivating fact. But we need to focus on our growth. The division of plant quarantine, which is responsible for maintaining quality of such imports in India, consists of experienced scientists and well-trained technical staff in the disciplines of entomology, nematology and plant pathology (bacteriology, mycology, virology). There are well-developed procedures for a systematic and step-wise quarantine processing of germplasm in the well-equipped laboratories for each discipline. The most important facilities include soft X-ray plant, vacuum fumigation system, multi-gas detector, ambient air analyzer, hot water treatment, ultra-centrifuge, UV spectrophotometer, ELISA reader, deep freezer, etc.

What have been the recent developments at NBPGR?

Last year, under the plant exploration and collection of germplasm program a total of 141 plant explorations were undertaken across the country and 7,693 collections were made comprising of germplasm of horticultural crops and their wild varieties. Under the quarantine processing and clearance of germplasm we processed 89,916 samples of various crops for quarantine clearance. Out of these samples the imported samples were about 83,662 and only 6,254 were exported. These samples included true seeds, rooted plants, tissue culture plantlets, etc. Apart from these we are also focusing on our center's work on DNA fingerprinting. We are working on maintaining the DNA fingerprinting database and statistical analysis package.

How are the ifs and buts on transgenics affecting the Indian industry?

It is critical to reply to this, being the representative of this bureau. Growth has been affected in a negative way by the objections and hurdles, which came across India's first transgenic experience in the case of Bt cotton. Proper screening is essential in the case of transgenics and we have to follow the guidelines. But even after that, we need to consider the first hand feedback from farmers. We need to consider the Indian point of view also in transgenics. Moreover, I think in India, transgenics are in the primary stage, we are late starters as compared with other developing nations but we are not bad starters.

What are the efforts required for increasing the pace of growth of the Indian agricultural industry?

First of all, we need to tap the upcoming trends in the industry. Innovative ideas are required for this sector. But most of all, an integrated effort is needed among the scientist community. I think, all the ICAR institutes should come forward and exchange their ideas with each other for the growth of the industry. Linkage, in terms of industry and academicians, is important. I think that this part is still lacking somewhere. Decentralized structure can also improve the situation of the Indian agricultural scenario.

How much has NBPGR contributed towards maintaining these linkages?

We have developed a good network with different divisions of ICAR, IARI, Indian Institute of Horticulture Research and various other ICAR institutes. We have strong links with DBT, DST and Dept of Environment and Forests, various other agricultural universities, research foundations and NGOs for several collaborative programs. Apart from this, NBPGR is in touch with international agricultural research centers, FAO, UN Development program, World Bank and several other organizations dealing in genetic resources.

Since plant quarantine is one of the major thrust areas at NBPGR, what are the on going projects in this division? What are the challenges that lay ahead?

There are many projects going on at the moment. Quarantine processing of germplasm under exchange and supportive research is an eminent thrust area at the bureau. We are also focusing on seed health testing, especially the germplasm of various agricultural/horticultural crops for pest-free conservation. The national containment/ quarantine facility for transgenic planting material is also doing well at the quarantine division of NBPGR. Apart from this, diagnosis and development of seed certification protocols for management of seed transmitted viral diseases of grain legumes is another focus area. In terms of