THE HINDU

Mutation breeding of oil seeds, pulses and cereals
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The focus:Since we import 40 per cent oilseeds and 20 per cent pulses, BARC focused its attention primarily on these crops.— photo: K.K. Mustafah

Do you know that when we eat a dosa or idli from anywhere in Maharashtra, there is 90 per cent chance that the urad dal in them came from mutation breeding, a promising technology developed by the Bhabha Atomic Research Centre (BARC), Trombay.

Since we import 40 per cent oilseeds and 20 per cent pulses, BARC focused its attention primarily on these crops. Heritable mutations of genes occur spontaneously in all living beings; but their rates are extremely low — of the order of one in a million. Isolating living organisms with beneficial characteristics from nature and multiplying them by selective breeding is a very slow process. Scientists speed up the mutation rate a thousand fold by exposing seeds or in some instances parts of the plant to ionising radiation. Breeders produce plants from these irradiated seeds. They combine plants with different desirable characteristics to develop high yielding, early maturing and disease resistant plants.

Pigeon pea and mung bean suffer viral attacks; soya beans are hit by bacteria; drought and salinity affect pulses and oil seeds; some plants are sensitive to temperature.

Pre-harvest sprouting and in situ germination are other worrying conditions. Scientists have overcome most of these adversities by genetic manipulation.

Improved quality
They can improve the quality and nutritional content of oil seeds and the bread making quality of wheat. Wheat plant can be made heat tolerant and resistant to stem rust. They have developed many varieties of rice. Some are early harvestable ; others salt tolerant; a few are disease resistant. Reduced height Basmati is another notable contribution.

The development of better crop plants takes time. Scientists test the improved crops at least for three years in BARC fields before they are entered for evaluation trials conducted by the agricultural universities etc. Promising new varieties are further evaluated in adaptive, district and mini-kit trials on the farmers' fields.

BARC scientists set up linkages with farmers to produce quality breeder seeds and participate actively in Kisan Melas held in farmers' fields to popularize the technology.

They developed 41 new crop varieties (Trombay varieties) by radiation induced mutation and cross-breeding; these have been released and officially notified by the Ministry of Agriculture, Government of India for commercial cultivation.

Farmers in virtually every State benefited from the technology. It started in 1973 with Trombay Groundnut (TG-1) cultivated mainly in Gujarat and Maharashtra. Maturing in about 130-135 days, with large seeds, the crop gave a modest increase in yield of 15 to 20 per cent.
Besides high yield, early maturity and early water use efficiency, some of the Trombay groundnut varieties have fresh seed dormancy of 20-30 days thus preventing in-situ germination, a nightmare for farmers due to end of season rains when the crop is ready for harvest.
Scientists from the University of Agricultural Science and BARC produced a large seed variety of groundnut. Hundreds of farmers are producing even up to 7 tonnes/ha of some varieties of groundnuts in some States.

A drought tolerant early maturing variety and an early maturing large seed variety of groundnuts are being cultivated in large desert areas in Rajasthan.

Export-worthy

BARC has also developed early maturing, confectionary grade, large seed groundnut seed varieties (100 seeds more than 60 grams) suitable for export.
As early as 2002-2003, the breeder seed indent for Trombay Groundnut varieties by the Department of Agriculture & Cooperation, Ministry of Agriculture, stood at 932 out of 3,137 quintal (29.7 per cent) of national indent.

In an address at the Indian Nuclear Society Technical Seminar, Dr S.F. D'Souza, Associate Director listed the mutant varieties of crop plants developed at Trombay and lucidly described their socio-economic impact

The breeder seed indent for Trombay Urad bean (black gram) then stood at 93.4 quintal out of 222.05 quintal (42.06 per cent) of national indent. Farmers grew them on 5.10 lakh hectares out of 5.49 lakh hectares (about 93 per cent) in Maharashtra. Maharashtra State Seed Corporation, Akola has distributed 21,000 metric tonnes of a certified variety of black gram seeds to the farmers.
BARC developed many varieties of high yielding, disease resistant moong beans. One of them a disease-resistant, early maturing (55-59 days) variety for summer season made available an additional area for moong bean cultivation under crop diversity programme. Jawaharlal Nehru Krishi Vishwavidyalaya, N G Ranga Agricultural University and Indira Gandhi Krishividyalaya collaborated with BARC in some of the programmes. Currently farmers cultivate Trombay moong bean varieties over 300,000 hectares in India.

India leads

In developing and applying mutation breeding using ionising radiation, India has a leading role among all nations.
Many varieties of mutant crops cultivated on tens of thousands of hectares enhance income in rural areas, contribute to environmentally sustainable food security and improve human nutrition in India.

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