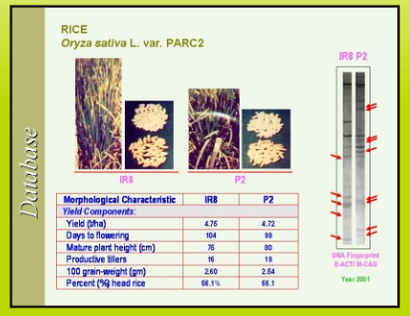
TOOLS FOR MUTATION BREEDING

Tissue culture and molecular technique based on polymerase chain reaction (PCR) of crops and ornamental plants are being employed as tools for production of beneficial mutant varieties and for mass propagation of crops at PNRI.

At PNRI, mass propagation is done through planting of seeds (rice, mungbean and soybean mutants, *Murraya* 'Ibarra Santos' dwarf ornamental plant); cuttings (*Dracaena* sanderana 'Marea', *Cordyline* 'Medina') and tissue culture (fruit crops such as cashew, mangosteen, pineapple, as well as ornamental plants like orchids and chrysanthemum).

Tissue Culture. Tissue culture refers to the technique whereby parts of a plant are grown aseptically in a suitable artificial culture medium under controlled laboratory conditions until the regenerated plants can be brought out and grown under natural or ambient conditions.

Molecular Technique Based on Polymerase Chain Reaction (PCR). The specific phenotypic or visible characteristics of each mutant plant are correlated to their DNA marker signatures using the amplified fragment length polymorphism (AFLP)-PCR molecular technique. These DNA profiles thus serve as specific identifications for each of the mutant plant in a similar way as fingerprints do for humans. The DNA fingerprints are recorded for data acquisition and encoded for inclusion in a computer graphic database of gamma irradiated plants developed by PNRI.



This molecular database can serve as resource material for plant breeders and commercial plant growers and exporters, as catalogue for selection of desired plant varieties intended for mass propagation, and as supporting document in the registration of mutants.

For more information on crop improvement through mutation breeding, please write or call:

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Crop Improvement Through Mutation Breeding

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Plant breeders use various techniques to improve the characteristics of crops. The Philippine Nuclear Research Institute (PNRI) uses the mutation breeding technique to develop new and improved varieties of certain plants.

Mutation breeding is a non-conventional method of plant breeding to improve crops by using mutational agents (mutagens) such as radiation or chemicals e.g. ethyl methyl sulfonate (EMS). Radiation can induce hereditary changes, or mutations, in treated/irradiated planting materials. Mutants with desirable attributes may arise/come out from these materials which will be selected and developed as new varieties.

MUTANT CROP VARIETIES DEVELOPED BY PNRI

Rice

PARC-2. The PAEC (now PNRI) developed the Philippine Atomic Rice Cultivar (PARC-2) or atomic rice which is an improvement of the high-yielding variety IRS-283-8. The grains of PARC-2 are longer with reduced chalky areas. This mutant variety is also resistant to tungro disease. In 1973, the Philippine Seedboard approved PARC-2 variety for release to farmers all over the country.

Milagrosa mutant. This is an an improved aromatic rice variety developed by PNRI from the Milagrosa variety in 1973. The Milagrosa mutant variety is non-seasonal, has longer grains and yields 32 percent more than the original variety. Milagrosa mutant was approved for release to farmers by a consensus at the meeting of the Philippine Rice Working Group in 1974.

Azmil mutant. In 1976, an improved variety was obtained from Azmil variety. The Azmil mutant yields 40 percent more than the original variety. This variety has been used in crosses with other rice varieties.

Bengawan mutant. PNRI also produced an improved rice variety in 1981 from the high-yielding Bengawan, an Indonesian variety. The Bengawan mutant yields 35 percent more and is shorter than the original variety. It matures early and does not lodge easily. This variety was multiplied and distributed to farmers by Maligaya Rice Research Training Center in 1983 to 1984.

Sigadis Milagrosa mutant. The Philippine Seedboard approved in March 1999 the Sigadis Milagrosa radiation-induced mutant variety developed through the collaborative efforts of PNRI and the Philippine Rice Research Institute. This mutant variety, officially named PSB Tc78 or Pampanga, yields 3.7 percent more than the check variety IR-72 and is resistant to blast, bacterial leaf blight, sheath blight and tungro disease.

Other mutant rice varieties. Traditional varieties which were improved through gamma irradiation are Denorado, Perurutong NBB and Malagkit Sungsong.

Mungbean

PNRI developed PAEC-1 and PAEC-3 mutant varieties in 1975. PAEC-3 has shiny yellow seeds which are larger than the original variety. PAEC-3 also has non- shattering pods. Other mutant varieties of mungbean developed by PNRI are: PAEC-2, PAEC-5, PAEC-9 and PAEC-10.

Foliage Ornamentals

The PNRI has developed the following: a dwarf, slow growing but floriferous mutant registered as *Murraya* 'Ibarra Santos' from *Murraya* paniculata (locally known as Kamuning); chlorophyll mutants *Dracaena* 'Marea' from *Dracaena* sanderana; and *Cordyline* 'Medina' from Ti Plant *Cordyline* fruticosa.

OTHER CROPS BEING STUDIED BY PNRI

The PNRI continues to produce mutant selections of rice, mungbean, soybean and peanut. In 2003, the PNRI started mutation breeding studies on developing improved varieties of high value crops like cashew and mangosteen. Mutation breeding studies are also done to improve ornamentals like orchids and chrysanthemum.

Rice

To incorporate the desirable qualities of the PNRI-developed mutant rice varieties with other varieties, the mutant varieties were crossed with other varieties such as IR-8 and Denorado. Mutant lines derived from these crosses are being grown for yield tests.

Mungbean, Soybean and Peanut

A new mutant variety of mungbean, PAEC-12, was obtained from the crosses of PAEC-2 and PAEC-10 mutants with other high-yielding varieties. The new mutant is being subjected to further evaluation. The effects of the different doses of gamma radiation on the peanut varieties recommended by National Seed Industry Council, namely Pn-8 and Pn-10, are being studied and evaluated. Selected mutant lines of irradiated local soybean varieties are being evaluated for drought tolerance and high yielding ability.

High-Value Fruit Crops

Mutation breeding studies using radiation are being undertaken by PNRI to develop high-yielding, early maturing and non-seasonal varieties of cashew and mangosteen.

Ornamentals

PNRI researchers are using gamma radiation coupled with tissue culture techniques and related biotechnology to develop new varieties and to further improve ornamental plant varieties such as orchids.