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Mutagen induced genetic changes as genetic resources for plant improvement (Review paper)

Genetic resources for developing improved cultivars are limited. By mutation induction, unselected variation can be created. It appears to be particularly relevant, that such variation occurs in directions not favoured by previous natural or human selection. By improving a particular trait in an otherwise satisfactory variety, about 1000 "mutant cultivars" were produced in 98 different plant species. The number of new cultivars developed by using induced mutants in cross breeding however is much smaller. In most cases, mutant parents were officially approved as cultivars before their use in cross breeding. It seems that the potential of induced mutants as genetic resources has not yet been fully recognised.

(A. Micke, Joint FAO/IAEA Division, Vienna, Austria)

Agronomic characteristics of induced heading-time mutants in rice

A large number of heading-time mutants were induced by gamma irradiation in the variety "Gimbosu" ranging from 2 weeks earlier to 3 weeks later. 28 early and 28 late mutants, showing at least 85% seed fertility were chosen to evaluate 7 other agronomically relevant characters: yield, culm length, panicle length, panicle number, floret number per panicle, fertility and 100 grain weight. Most of the higher yielding mutants were found to be later, but a number of earlier mutants yielded the same as the original variety. Most heading-time mutants showed various other alterations in yield related characters. Attention should be paid by the breeder to the possibility of simultaneously improving more than one character by mutagenesis.

(T. Tanisaka, Y. Moroe, H. Yamagata, Faculty of Agriculture, Kyoto University, Kyoto, 606 Japan)

Weak early heading and late heading variants found in selfed progenies of a backcross derivative of "Taichung 65" rice

Line $T65E^{x}$, carrying a heading-advancing gene $Ef\text{-}1^{x}$ was obtained as a mutant in the progeny of x-rayed seed of T65. To look into the nature of this allele, it was backcrossed to T65 several times. In a selfed progeny of BC_9F_4, weak plants occurred as segregants with about 1/4 frequency. They were chlorotic, had few tillers and headed 10d later than T65. The weakness and variation in heading time seem to be controlled by a recessive gene which is highly mutable. A transposable element might be involved.

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Linkage relationship between semi-dwarfing gene sd-1 and gene for grain shattering in rice

Most semidwarf rice cultivars carry the same gene sd-1. We observed an association between semi-dwarfness and grain shattering in isogenic lines carrying sd-1 from different sources in the background of the

Japanese tall cultivar "Norin 28". The shattering was found to be caused by a single recessive gene, sh-2, linked to the sd-1 locus. The shattering gene seems to have been transmitted to many semi-dwarf cultivars together with sd-1, not only from "Dee-geo-woo-gen" but also from the indica-cultivar "Ai-jio-nan-te" and the japonica cultivar "Shiranui".

(S. Oba, F. Kikuchi, Institute of Agriculture and Forestry, University of Tsububa, Ibaraki 305, Japan)

Variations in characters of diploid-like plants derived from gamma-irradiated tetraploids in rice (Oryza sativa L.)

Populations of artificial autotetraploids of rice (Oryza sativa L. cvs. "Nipponbare" and "Fukunishiki") were repeatedly irradiated with gamma-rays through several generations. Plants which did not differ in appearance from the original diploid plants occurred occasionally in the populations. Nine diploid-like plants were obtained so far, and their generations were advanced without irradiation in order to examine the mode of segregation of characters in their progeny. The results indicate that diploid-like plants with multiple mutant characters could be obtained and that dominant characters, i.e. awned spikelet and coloured apiculus, were included in the mutant characters. The diploid-like plants had 2n = 24 chromosomes.

(K. Yamamoto, H. Fukuoka, Y. Kageyama, G. Takeda, Faculty of Agriculture, University of Tokyo, Tokyo, 113 Japan)

Semi-dwarf mutants for rice improvement

MARDI and the National University of Malaysia embarked on a programme to induce resistance against blast in rice in 1978. MARDI also obtained semi dwarf mutants of cvs "Mahsuri", "Muda", "Pongsu seribu" and "Jarum Mas", which are under evaluation. The popular local rice variety "Manik" was subjected to gamma irradiation (15-40 krad) and 101 promising semidwarf mutants have been obtained following selection in M_2-M_6. 29 of them show grain yields of 6.0 - 7.3 t/ha, compared with 5.7t for "Manik". Other valuable mutants were found showing long grain, less shattering, earlier maturity, and glutinous endosperm. One mutant, resistant to brown plant hopper yields 6.3t/ha.

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Progress in the exploitation of new dwarfing genes in Chinese rice breeding

Use of dwarfing genes in rice breeding in China began in the late 1950's. Since then, the major source of dwarfism has been "Ai-Zi-Zhan" with a gene allelic to sd-1 from "Dee-Geo-Woo-Gen". Since the 1970's, Chinese rice breeders paid attention to exploring new dwarfing gene sources and these efforts resulted in at least 7 sources non-allelic to sd-1. The late indica variety "Gui-Yang-Ai No. 1" possessing gene dg(t) or sdg(t) proved to be most promising. The new sources include mutants induced by irradiation in "Nanjing 11" and "Nanjing 15". The new genes are integrated in breeding to further improve plant type and adaptability.

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