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# Mutation Breeding Newsletter

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## RESEARCH NEWS

### Glutinous rice variety "R817" for good quality wine developed by radiation induced mutation

The variety has been developed by gamma irradiation of dry seeds of "Ai Shang Nuo" at Zhejiang Academy of Agricultural Sciences. The main characteristics are as follows:

1. It has higher yield: Average about 6000 kg/ha, maximum 7800 kg/ha in trials, about 10% above the control variety "Shang Nuo No. 4".

2. It is disease resistant: After artificial inoculation resistant to rice blast pathotypes A, A63, B1, B15, C3, C13, C15, D3, E1, G1.

3. The growing period of the variety is about 136 days in Hangzhou. 3 days earlier than the original variety. The seedling period could be long or short.

4. It has good grain quality suitable for making "Xiang Xue", "Shan Miang" and other well known rice wines.

The variety is been grown all over our province and in some neighbouring provinces. Its cultivation area was 2000 ha in 1984, more than 8000 ha in 1985 and is rapidly increasing.

(Contributed by ZHANG Mingxian, LUO Rongting and XU Baocai, Institute for Application of Atomic Energy, Zhejiang Academy of Agricultural Sciences, Hangzhou, People's Republic of China).

XA0201348

Performance of induced mutant derived oat varieties in Australia

The semi-dwarf varieties "Echidna" and "Dolphin" were released in 1984 and reached a growing area of 15% (ca. 23.700 ha) and 3% (ca. 4700 ha) respectively. Both varieties derive from a cross West x OT 207, the latter of which is a fast neutron induced semi-dwarf mutant of OT 184 carrying the gene DW6 [1-5]. For "Echidna", crops up to 7 t/ha have been recorded. Both "Echidna" and "Dolphin" are very resistant to lodging and grain shedding. As a result, farmers have changed their harvest priorities from barley-oats-wheat to barley-wheat-oats.

Further breeding aims at improving the grain quality of semi-dwarf germplasm derived from OT 207 and testing naked grain genotypes carrying the mutant gene.

[Excerpt from A.R. Barr, Oat Newsletter 36, April 1986]

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XA0201349

The value of the radiation induced mutant "Fushi" in peanut cross breeding

In the sixties the peanut variety "Shitouqi" was treated with beta rays from $^{32}P$ and a mutant called "FUSHI" was selected. Its seedlings are emerging fast, the plant has short internodes and small thick dark colour leaves. It is highly branched and bears tightly plump pods with thin shells. The yield is low, but the mutant has been used in cross breeding with marvellous success. The scheme shows the new peanut cultivars derived from "FUSHI".

1. Yueyou 22 (MBNL No. 25, p.9) emerges quickly and grows rapidly. It is robust with large light green leaves, bears flowers and pods tightly. Pods are of medium to large size. Its yield was 7,3% over "Shitouqi" and the variety reached a cultivation area of 130.000 ha.

2. Yueyou 33 is a selection from "Yueyou 22" and reached a cultivation of 20.000 ha.

3. By gamma irradiation of "Yueyou 22" another mutant variety "Fu 21" was developed. The plants of this cultivar are somewhat smaller, but it grows vigorously, has better resistance to bacterial wilt and less leave losses. The yield is higher and it was grown on 11.000 ha (MBNL No. 29, p.20).

4. When "Yueyou 22" was crossed with "Yueyou 431" at the Economic Crops Research Institute Guangzhou, another cultivar "Yueyou 551" evolved (MBNL No. 25, p.9). The plants are tall with small but thick leaves, light green and lustrous, late senescing. Yield was 20% over "Shitouqi", it was grown on 200.000 ha and became the main variety in Guangdong province.

5. From selection and cross breeding with "Yueyou 551" five more varieties were developed: "Yueyou 551-6", "Yueyou 551-38", "Yueyou

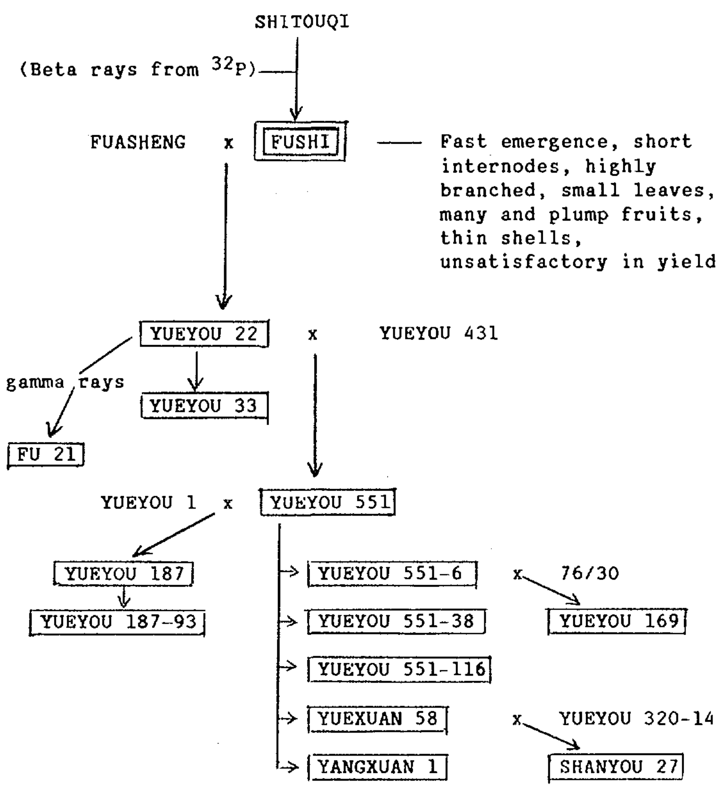
551-116", "Yuexuan 58" and "Yangxuan 1". Of these, Yueyou 551-116 was the most successful, yielding 6-12% over "Yueyou 551" and reaching a cultivation area of 130.000 ha. "Yuexuan 58" yielded 8.5% over "Yueyou 551".

6. By crossing the original "Yueyou 551", two new varieties were produced "Yueyou 187" and "Yueyou 187-93". Their yield was 9-10% over "Yueyou 551".

7. By crossing "Yueyou 551-6" a new variety "Yueyou 169" was developed, yielding 5% over the check "Yueyou 551-116".

8. Variety "Shanyou 27" evolved from a cross with "Yuexuan 58". It grows luxuriously, has lots of branches, a good canopy, and has strong rust resistance. The yield is about 10% over "Yueyou 551-116" and after reaching a cultivation area of more than 6.500 ha it seems to become one of the leading varieties in the province.

The derivative varieties of "FUSHI" have so far been grown on ca. 3 Mill. ha, gave the farmers an additional crop value of 500 Million Yuan and received several governmental awards.




(Contributed by JIANG Xienan and ZHOU Yongxing, Agricultural Science College of Guangdong Province, Guangzhou, People's Republic of China).

[Editor's comment: The breeding value of such an inferior mutant as "FUSHI" may be compared with the experience of using a chlorophyll deficient and other inferior peanut mutants in cross breeding at BARC Bombay, from which several improved peanut cultivars were derived, such as TG3, TG4, TG17 (ref. Mutation Breeding Newsletter No. 12, p.14)].



## Utilization of induced mutations for groundnut breeding in Uganda

Groundnuts (*Arachis hypogaea* L.) are on high demand in Uganda. There is, therefore, an urgent need to improve groundnut yields through breeding. The main objectives besides yield are the following:

1. To improve disease resistance:
   (a) rosette virus transmitted by aphids (*Aphis craccivora*);
   (b) leafspot caused by *Cercospora arachidicola* (early) and *Cercosporidium personatum* (late).

2. To advance the maturity period of high yielding varieties so as to fit better into the rainfall pattern of the main growing areas.

3. To improve seed uniformity, seed size and quality (protein, oil).

4. To reduce plant height by shortening the internodes so as to have more flower production near the ground.

For mutation breeding three erect groundnut cultivars were used, "Roxo" a recommended commercial variety; "Red Beauty (Bl)" a recommended local variety and "No. 534" a tan skinned variety. Seeds of the three varieties were irradiated in 1976 at the FAO/IAEA Agricultural Section of the IAEA Laboratory Seibersdorf, with 1500 rad of fast neutrons (Nf) or 20 krad of $^{60}Co$ gamma rays. The pedigree method of selection was used until M9. During 1985 and 1986, seven mutant selections of "Red Beauty" and one from "Roxo" were tested in replicated yield trials. Results are given in the Table.

| Mutant line or variety (check) | | Yield in shell kg/ha | Wt. of 100 seeds (g) | Shelling % (average) |
|---|---|---|---|---|
| Bl $\gamma$-20 | 32/25/11/6/1 | 1070.5 | 39.75 | 69.8 |
| | 32/25/11/1/32 | 1372.1 | 40.25 | 67.6 |
| | 32/25/44/9/18 | 1049.2 | 37.50 | 70.2 |
| | 32/25/11/6/19 | 1029.5 | 39.25 | 70.4 |
| | 32/25/44/9 | 1060.7 | 38.75 | 74.0 |
| | 32/25/9/2 | 1216.4 | 38.00 | 64.3 |
| Bl Nf | 13/17/31/2/21 | 1152.5 | 40.75 | 68.6 |
| Bl (check) | | 1024.6 | 41.75 | 73.9 |
| Roxo (check) | | 1645.9 | 45.25 | 56.7 |

On the basis of plot yields some of the "Red Beauty" mutant lines outyielded the parent but not the commercial variety "Roxo".

(Contributed by C.M. Busolo-Bulafu, Serere Research Station, P.O. Soroti, Uganda).

## Nitrogen fixation in groundnut mutant

The x-ray groundnut mutant "TG-1" is known to have a higher photosynthetic and nitrogen fixation rate than its parent "Spanish Improved" [2,3]. A defoliation experiment showed that in both types, nitrogenase activity of nodules decreases significantly (by 56-78%) by curtailment in the supply of photosynthates. However, TG-1 maintained significantly higher levels than its parent [4].

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## Localization of induced genes for powdery mildew resistance in barley

Several mutants with changed mildew reactions have been selected after treating seeds of the variety "Bomi" with EMS or $NaN_3$. Studies have so far revealed the following: All but one (E292) are inherited in a monogenic recessive manner.

B1101 — partially resistant, allele of ml-o, dominant to ml-o but recessive to wild type. Yield equivalent to "Bomi".

N182 — partially resistant, located near Ml-g locus on chromosome 4.

E202 — highly resistant, except for specific pathotypes. Large necroses. Gametic selection reduces mutant frequencies in crosses. Not located on chromosomes 4 or 5L.

E61 — showing pathotype specificity, not located in or near the ml-o locus.

E292 — dominant, partially resistant, poor growth habit, not located in or near the ml-o locus.

Other mutants are under investigation.

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[Excerpts from G. Röbbelen and M. Heun, Barley Genetics Newsletter Vol. 15, 1985].

XA0201353

Dwarf mutant of *Papaver somniferum* with high morphine content

Opium poppy, *Papaver somniferum* L. is an important medicinal plant known for its morphine, codeine, and thebaine alkaloids. This Institute had earlier released two latex opium yielding poppy varieties, "Shyama" and "Shweta", which are now cultivated by the farmers under the supervision of the Narcotic Department of the Government of India. However, both these varieties became susceptible to downy mildew (*Peronospora arborescens*). Lodging due to heavy capsule weight is another problem affecting latex yield.

With these problems in mind, we undertook mutation breeding on the above mentioned two varieties employing gamma rays (5 kR, 15 kR, 20 kR) and EMS (0.2%, 0.4%, 0.6%) and combined mutagens (5 kR + 0.2% EMS, 5 kR + 0.4% EMS and 5 kR + 0.6% EMS). $M_1$ from the treated seeds (405 plants) was raised in winter 1984-85. $M_2$ generation of 13,500 plants (i.e. 270 $M_1$ progenies x 50 plants) was raised in winter 1985/86. A dwarf mutant with high morphine content was indentified in $M_2$ from the variety "Shweta" treated with 5 kR + 0.4% EMS. The mutant differs by its dwarf stature, compact leaf arrangements, multilocular capsules, increased capsule number, and small capsule size (Table). The mutant is under testing for its superior morphine production. It may be used as dwarf gene source in hybridization for improving lodging resistance. This mutant is a novel type, which was not available in our germplasm collection.

Table. Alkaloid content and other traits of dwarf poppy mutant and its parent in $M_2$. (mean $\pm$ SE based on 22 plants; alkaloid value based on 5 bulked samples in case of control and 15 samples in the mutant.)

| Characters | Dwarf mutant | Parent |
|---|---|---|
| Plant height (cm) | 47.71 ± 1.36 | 95.90 ± 1.08 |
| Peduncle length (cm) | 14.98 ± 0.50 | 21.72 ± 0.20 |
| No. of capsules/plant | 8.77 ± 0.85 | 2.54 ± 0.11 |
| Capsule index | 0.66 ± 0.02 | 0.85 ± 0.02 |
| Anther length (cm) | 0.33 ± 0.01 | 0.49 ± 0.01 |
| Length of filament (cm) | 1.33 ± 0.03 | 1.52 ± 0.02 |
| Straw weight (g)/plant | 12.60 ± 1.46 | 21.68 ± 0.19 |
| Morphine content (%) | 0.84 ± 0.03 | 0.42 ± 0.04 |
| Codeine content (%) | 0.07 ± 0.01 | 0.06 ± 0.01 |
| Thebaine content (%) | 0.07 ± 0.01 | 0.06 ± 0.01 |

(Contributed by S.P. Chauhan, N.K. Patra and H.K. Srivastava, Department of Genetics, Central Institute of Medicinal and Aromatic Plants, Post Bag No. 1, P.O. RSM Nagar, Lucknow 226016, India).

Resistance to Phytophthora in mutant lines of currant tomato and in their original forms

Information on the production of currant tomato mutants is contained in a previous report [MBNL No. 29, p 9-12].

Evaluation of fruit resistance against *Phytophthora infestans* (Mont.) de Bary was carried out with pathotypes $T_0$ and $T_1$. For artificial infection we used mainly a culture of $T_1$ (isolate 275), supplied by the Byelorussian Scientific Research Institute of Potato, Fruit and Vegetable Growing at Samokhvalovich. As inoculum for $T_0$, a local population of the potato pathotype from the village of Shebantsevo, Moscow province was used. The standard variety "Gruntovyj gribovskij 1180" was used as the control.

Green fruits were taken from the first or second raceme of 20 plants. They were inoculated by spraying in plastic cuvettes with moist filter paper. The cuvettes were covered with glass and maintained at temperature of 18-20°C. The results were checked 5, 9 and 12 days after inoculation. Under natural conditions, each of the 20 plants was also evaluated.

As result, three lines with increased resistance to Phytophthora were selected from the original wild-type of currant tomato (Table 1). Induced mutant forms were tested in the same way for resistance to *Phytophthora*. Table 2. contains data from 4 years study. Of 26 mutant lines studied, we identified seven whose fruit displayed a stable and enhanced resistance to *Phytophthora* under both laboratory and field conditions.

With regard to leaf infection of these lines, positive results were not obtained. There appears to be no direct relationship between resistance to *Phytophthora* of the fruit and the leaves.

The mutant lines are of determinate type with early and medium ripening time. The average fruit weight is 5 - 33 g; in the case of the original specimen, it is only 0.9 - 1.7 g. The fruits have a pleasant sour-sweet taste and a thick skin. It is noteworthy that the mutant lines selected on the basis of their suitability for cultivation not only showed the resistance selected from the wild-type, but in a number of cases even turned out to be more resistant, particularly under field conditions. This may be due to the fact that the habitus of the mutant plants provides better light penetration and ventilation, and probably also due to the faster ripening (14-21 days earlier).

The mutant lines listed in Table 2 were sent for breeding purposes to the following Soviet institutions: the All-Union Scientific Research Institute for Vegetable Crop Selection and Seed-Growing, the Byelorussian Scientific Research Institute of Potato-Growing and Fruit and Vegetable Growing, the Majkopskaya Experimental Station, the Krymsk Experimental Breeding Station, the Georgian Scientific Research Institute of Agriculture and the Ukrainian Scientific Research Institute of Irrigation Farming. They were also sent to France and the Netherlands. Reports show that these mutant lines have continued to display resistance to *Phytophthora* and have therefore been included in breeding programmes.

Table 1. Fruit resistance to Phytophtora in selected lines of currant tomato (average over three years), VIR sample no. K-4053

| Line | $T_0$ pathotype | | $T_1$ pathotype | | Field values | |
|---|---|---|---|---|---|---|
| | Average lesion rating | Disease development (%) | Average lesion rating | Disease development (%) | Average lesion rating | Disease development (%) |
| K-4053/22 | 1.9 | 42.6 | 1.7 | 40.2 | 1.5 | 50.0 |
| K-4053/23 | 2.1 | 45.4 | 1.1 | 21.2 | 1.2 | 47.1 |
| K-4053/26 | 1.8 | 40.4 | 1.4 | 35.7 | 1.8 | 54.9 |
| Standard type | 3.3 | 75.5 | 3.5 | 82.7 | 3.5 | 83.9 |

Table 2. Fruit resistance to currant tomato mutants to infection by Phytophthora

| Mutant line | $T_0$ pathotype | | $T_1$ pathotype | | Field values | |
|---|---|---|---|---|---|---|
| | Average lesion rating | Disease development (%) | Average lesion rating | Disease development (%) | Average lesion rating | Disease development (%) |
| 108059/3 (GP-5) | 1.8 | 37.5 | 2.7 | 57.8 | 0.7 | 18.3 |
| 108059/13 (GP-6) | 2.5 | 49.9 | 2.4 | 51.4 | 0.7 | 17.0 |
| 108059/15 (GP-7) | 1.7 | 34.0 | 2.7 | 58.9 | 0.7 | 17.0 |
| 108059/5 (GP-9) | 1.6 | 33.6 | 2.6 | 55.8 | 0.8 | 18.9 |
| 108059/12 (GP-10) | 1.5 | 34.5 | 2.4 | 53.3 | 0.5 | 12.7 |
| 108059/10 (GP-11) | 1.9 | 42.4 | 2.4 | 51.0 | 0.6 | 15.3 |
| 112140/2-1 (GP-20) | 2.3 | 49.7 | 2.7 | 57.0 | 0.5 | 12.6 |
| Standard variety | 3.6 | 75.1 | 4.4 | 92.3 | 2.1 | 50.9 |

(Contributed by V.V. Khrustaleva and V.K. Shcherbakov, Department of Radiation Genetics and Radiobiology, N.I. Vavilov All-Union Scientific Research Institute of Plant-Growing (Moscow Branch), Moscow Province, Domodedovo District, Zelenaya roshcha Post Office, 142086 USSR).



## Mutant lines of currant tomato, valuable germplasm with multiple disease resistance

Studies were carried out for two years on eight mutant lines of currant tomato at the Krymsk Experimental Breeding Station of the N.I. Vavilov All-Union Scientific Research Institute of Plant-Growing (VIR). The station is situated in an area of commercial field tomato growing (Krasnodar region).

The mutant lines of currant tomato (VIR specimen No. k-4053) were obtained through chronic gamma-irradiation [MBNL No. 29, p 12] . A disease resistance evaluation of the mutants was carried out for

*Verticillium*-wilt (*Verticillium* *albo-atrum* Rein. and Berth.), for black bacterial spotting (*Xanthomonas* *vesicatoria* Dows.), for tobacco mosaic virus *Nicotiana* 1 Smith), for streak virus (*Nicotiana* 1), for the combination TMV with X and Y potato viruses, for cucumber virus (*Cucumis* 1), and also for top rot.

Table 1. Disease levels of currant tomato mutants in the Krasnodar region compared to tomato cultivars from different parts of the USSR

| Variety, mutants, hybrid | Degree of infection (point rating) 1 low 5 high | | | |
|---|---|---|---|---|
| | Verticillium wilt | Mosaic virus | Streak virus | Black bacterial spotting |
| Mayak 12/20-4 | 3 | 3 | 3 | 0.1 |
| Syurpriz 540 | 3 | 3 | 0 | 0 |
| Kubanskij shtambovyj 220 | 4 | 0 | 0 | 0.1 |
| Kolkhoznyj 34 | 3 | 2 | 3 | 0 |
| Podarok 105 | 3 | 3 | 1 | 0 |
| Kross 525 | 2 | 2 | 0 | 0 |
| Talalikhin 186 | 3 | 0 | 0 | 0 |
| Moldavskij rannij | 2 | 2 | 0.1 | 0 |
| 108059/3-1 | 1 | 0 | 0 | 0 |
| 108059/3-2 | 1 | 0 | 0 | 0 |
| 108059/26-1 | 1 | 0 | 0 | 0 |
| 108059/26-2 | 1 | 0 | 0 | 0 |
| 108059/27 | 1 | 0 | 0 | 0 |
| 108059/2 | 2 | 0 | 0 | 0.1 |

Table 2. Levels of *Verticillium* wilt among currant tomato mutants in comparison with the most resistant tomato germplasm derived from different parts of the world

| Sample, mutant line | VIR catalogue number | Origin | Disease developm. (%) | Spread of disease (%) |
|---|---|---|---|---|
| VEZ | vr. 9734 | Colombia | 31 | 92 |
| Mecano VF | vr. 8867 | Netherlands | 31 | 100 |
| Md-135 | vr. 9147 | USA | 30 | 100 |
| Melkoplodnyj udlinennyj | vr. 9717 | Vietnam | 27 | 100 |
| 108059/3-1 | | USSR | 4 | 15 |
| 108059/3-2 | | USSR | 4 | 15 |
| 108059/27 | | USSR | 17 | 68 |
| 108059/22 | | USSR | 19 | 60 |
| 108059/26-1 | | USSR | 19 | 76 |
| 112140/12 | | USSR | 20 | 72 |
| 108059/7 | | USSR | 25 | 88 |
| 108059/2 | | USSR | 25 | 100 |
| Standard variety (Kubanskij shtamboryi) | | USSR | 90 | 100 |

Fifty plants of each mutant line were evaluated and checks were made three times in each season. A comparison of the currant tomato mutants with the standard tomato varieties demonstrates the better resistance (Table 1) shown by the mutant germplasm to the main pathogens. The degree to which some currant tomato mutants were affected by Verticillium was lower than that of the most Verticillium-resistant samples of tomato evaluated between 1975 and 1981 (Table 2). The mutants of currant tomato should therefore be of interest as germplasm in breeding tomatoes for improved multiple disease resistance.

(Contributed by G.f. Govorova, Krymsk Experimental Breeding Station of the N.I. Vavilov All-Union Scientific Research Institute of Plant-Growing, Krasnodar Region, Krymsk, 353330 USSR; V.V. Khrustaleva, V.K. Shcherbakov, Department of Radiation Genetics and Radiobiology, N.I. Vavilov All-Union Scientific Research Institute of Plant-Growing (Moscow Branch), Moscow Province, Domodedovo District, Zelenaya roshcha Post Office, USSR).

XA0201356

## Mutant of Japanese pear resistant to Black Spot Disease

'Nijisseike' is one of the leading cultivars of Japanese pear (Pyrus serotinea Rehd.), but susceptible to black spot disease. Farmers try to prevent this disease by wrapping the fruit with a paper bag and by repeated spraying of fungicides. The disease is caused by a Japanese pear pathotype of Alternaria alternata (Fr.) Keissler. Susceptibility is controlled by a single dominant gene.

In 1962, grafted trees of this cultivar were planted at a distance between 53 and 93 m from the $^{60}Co$ source in the gamma-field (daily dose 15-4 rad). One branch on a tree planted at 53 m was detected as resistant in 1981. Under field conditions, black spots were observed on many fruits and leaves of the original trees by natural infection in early July, however, they were not observed on the mutant. To examine the resistance of the mutant, artificial inoculations were made using spores of the pathogen and the host specific toxin produced by germinating spores.

When some drops of the spore suspension are placed on leaves, the formation of black spots depends upon the leaf age. In a resistant cv. as 'Chojuro', black spot symptoms are formed only when inoculated on young leaves. An intermediate reaction was observed in the mutant, whereas the original 'Nijisseiki' showed severe symptoms. When inoculation was made on matured fruit skins, no black spot was formed on the mutant just like on the resistant cv. 'Chojuro', while many small black spots were formed and grew into large spots overlapping each other on the susceptible cv. 'Nijisseiki'.

In case of the crude toxin inoculation (4-0.04 ppm) of cv. Nijisseiki black spots were formed on the surface of the susceptible fruit skin, and necrotic lesions at the cut end of detached small pieces of leaves, although reaction on fruit skins was weaker compared with inoculation by spores. However, no symptoms were observed from the toxin application on the mutant and the resistant cv. 'Chojuro'. That the resistance of the mutant is classified as "moderate" could be due to a periclinal chimeric structure of the mutant.

[Excerpt from T. Sanada, T. Nishida and F. Ikeda, Technical News No. 29, Feb. 1986, Institute of Radiation Breeding, Ohmiya, Ibaraki-ken]

## A mutant recombinant of linseed with very low levels of linolenic acid

Two flax (Linum usitatissimum L.) mutants having reduced linolenic acid content in their seed oil (M1589 = 19.1% linolenic; M1722 = 23.4% linolenic) were crossed to determine whether further reductions could be achieved by recombination of the mutant genes. Extensive transgressive segregation was evident in the $F_2$ for both linolenic acid (1.2-36.6%) and linoleic acid (14.7-55.2%), which were strongly negatively correlated (r= -0.97), $F_2$ plants homozygous for both the M1589 and M1722 mutations had very low levels of linolenic acid (<2%) and high levels of linoleic acid (>46%).

(Abstract of paper in Can. J. of Plant Science 66 (1986) 499-503, Author: A.G. Green, CSIRO Div. of Plant Industry, G.P.O. Box 1600, Canberra City ACT 2601, Australia).



## Mutant heterosis in rice

In the variety TKM6 a high yielding semidwarf mutant has been induced. This TKM6 mutant was used in test croses with a number of other varieties and mutants to examine the extent of heterosis of dwarfs in rice and to select superior crosses. The following is an excerpt of the published data.

| | Plant height cm | No.of prod. tillers | TGW g | Grain per plant g | Yield increase over better parent |
|---|---|---|---|---|---|
| TKM 6 | 144.0 | 10.7 | 1.8 | 13.0 | |
| TKM6 mutant | 87.7 | 9.0 | 1.8 | 15.2 | |
| TKM 6 mut X TKM 6 | 136.3 | 18.3 | 1.8 | 30.0 | 97.6% |
| TKM 6 X TKM 6 mut | 140.3 | 15.3 | 1.9 | 25.6 | 69.1% |
| IR8 | 80.0 | 10.0 | 2.4 | 19.7 | |
| TKM6 mut X IR8 | 96.0 | 11.0 | 2.7 | 27.5 | 40.0% |
| IR8 X TKM6 mut | 96.0 | 11.0 | 2.6 | 26.7 | 35.6% |

It appears from the "backcross" of the mutant with its original variety, that an increase in number of productive tillers occurs in the hybrid, leading to a striking grain yield increase, while the semi-dwarf culm length (the main mutant character) reverts to the normal phenotype. In the cross with IR8 on the other hand, there is only a minimal increase in tiller number but a substantial increase in TGW leading to more than 30% yield increase over the better parent.

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XA0201359

Induced high yielding mutant in green gram (*Vigna radiata* (L.) Wilczek)

Green gram (mungbean) plays a significant role in meeting the protein requirements in India, with its predominantly vegetarian population. Therefore, an attempt was made to induce desirable mutants.

Dry seed of cultivar "Pusa 105" were irradiated with gamma rays ranging from 10 to 50 krad. A high yielding mutant (Hy I) identified in the $M_4$ generation from 40 krad dose, has shown significant increases in the number of pods/plants, number of branches/plant, and yield/plant (Table). Further work is in progress.

Comparison of the mutant "HyI" with the parent cultivar "Pusa 105".

| Character | Parent | Mutant |
|---|---|---|
| Plant height (cm) | 59 | 61 |
| No. of branches | 2 | 4 |
| Days to flowering | 34 | 35 |
| No. of pods/cluster | 4.4 | 7 |
| No. of pods/plant | 52 | 139 |
| Pod length (cm) | 7.2 | 7.5 |
| Yield/plant (g) | 32.4 | 70.1 |

(Contributed by H.R. Pulivarthi and T.N. Mary, Department of Botany, Nagarjuna University, Nagarjunanagar 522510 AP, India).

XA0201360

Semi-dwarf rice varieties in the United States

Semi-dwarf rice varieties are grown extensively in California and are beginning to be adopted in the northern United States. Their background is varied. Some derive their semi-dwarf status from Asian ancestors. Use has been made of TN-1, IR8, IR659-10-8-3 and IR1318 (containing TN1). Other semi-dwarfs in California derive their short stature from induced mutants. The principal parent is Calrose 76 derived from an induced mutation in Calrose (released in 1976).

The first US semi-dwarf variety was LA 110, developed at the Rice Experiment Station at Crowley, Louisiana from a cross TN-1 X M4 (from Sri Lanka) released in 1974. The next group of semidwarf varieties was developed in cooperation between the California Coop. Rice Research Foundation, The California Agricultural Experiment Station and the USDA Agric. Research Service. They are listed in the table.

Semidwarf long grain varieties were developed in Texas: Bellemont (1981) and Lemont (1983), both using IR659-10-8-3 as source of semidwarf culm. Two other long grain varieties Leah (1982) and Toro-2 (1984) released by the Rice Research Station in Crowley, Lousiana, derive their short stature form C19902, a line developed at Crowley, but still reaching a height of 89-94 cm. There are other short statured varieties in the US which are not truly semidwarfs, such as Bond and Newbonnet in Arkansas, Skybonnet and Pecos in Texas. The general trend is towards shorter varieties. Calrose 76 and M7 are being replaced. M-201 and L-202 are the shortest and have excellent lodging resistance. Their background is IR8 or TN1. Too short varieties like Bellemont may have seedling emergence problems.

The area of cultivated varieties can only be estimated based upon seed production. According to such estimates, total rice area in California 1984 was 184,100 ha, of which 178,100 (ca. 97%) were under semidwarf varieties. The total rice area in the US 1984 was 1.139,000 ha, of which 249,500 ha or 21,9% were under semidwarf varieties.

Table: Rice varieties in California

| Variety | Year of release | Source of dwarfism | Height cm | Yield ha | Total area % 1981 | 1984 |
|---|---|---|---|---|---|---|
| Short grain | | | | | | |
| S-201 | 1980 | Calrose 76 | 88 | 9.05 | 22. | 20.5 |
| Calpearl | 1981 | IR1318 and Calrose 76 | 85 | 9.98 | | 7.0 |
| Medium grain | | | | | | |
| Calrose 76 | 1976 | induced mutation of Calrose | 95 | 9.07 | 7.0 | |
| M-7 | 1977 | Calrose 76 | 96 | 9.08 | 15.0 | 1.1 |
| M-9 | 1977 | IR8 | 93 | 8.57 | 32.2 | 10.9 |
| M-101 | 1979 | M-7 | 88 | 8,96 | 5.0 | 3.3 |
| M-201 | 1982 | IR8 | 87 | 9.31 | | 46.4 |
| M-301 | 1980 | M-7 | 97 | - | 5.0 | - |
| M-302 | 1981 | M-7 | 94 | 9.09 | 0.1 | 5.6 |
| M-401 | 1981 | induced mutation of Terso | 93 | 9.34 | 0.1 | 1.8 |
| Long grain | | | | | | |
| L-202 | 1984 | TN1 | 80 | 8.98 | - | 0.1 |
| Sweet | | | | | | |
| Calmochi-202 | 1981 | induced mutation of Calrose | 94 | 8.31 | 0.1 | - |
| Non semidwarfs | | | | | 13.5% | 3.3% |

Reference: D.G. Dalrymple, Development and Spread of High Yielding Rice Varieties in Developing Countries, Bureau for Science and Technology A.I.D. Washington DC.



## High yielding and disease resistant mutants of sorghum in Venezuela

The programme was assisted by IAEA under project VEN/5/005 since 1978. It aims at improvement of plant type, earliness and resistance to Macrophomina in the locally adapted varieties Criollo Rojo Pequeño (CRP) and Criollo Blanco Alto (CBA). The mutagenic treatment consisted of seed irradiation at 20, 30 and 40 kR of gamma rays and chemical mutagenesis using sodium azide followed by 5000 kR gamma radiation.

The 16 best mutants were evaluated in multilocation trials during $M_6$-$M_9$ 1981-1984: Mutants from CRP namely 1279, 1543, 1265, 2085, 1251 and 1359 and four mutant from CBA, 109, 467, 469 and 81-1227 were found to be superior to their parents and the existing commercial hybrids. Their distinguishing features are given below, the agronomic data in the Table. CRP 1279, 1543 and 2085 are already under large scale cultivation by farmers and under process for cultivar certification by the Ministry of Agriculture.

Distinguishing features of Sorghum parents and their mutants:

Criollo Rojo Pequeño (CRP) Parent: A semi-dwarf (120-130 cm) local type, 10-12 leaves of medium size (total foliar area 1750-200 $cm^2$), flag leaf semi-erect and medium in size (130-150 $cm^2$, dark green. About 60% of the leaves are green at grain maturity; 53-56 days for 50% flowering and 96-100 days for maturity; small sized, compact head ( 20 cm excluding peduncle); 2-3 ear bearing tillers; slightly asynchronous in maturity by one week; reddish brown grain of medium size; good vertical, deep root system; resistant to lodging and drought; moderately susceptible to *Macrophomina* (charcoal rot) and *Fusarium*; 15-20 panicles/m at 50 cm X 10 cm spacing; excellent exsertion of panicle (12-15 cm); panicle weight nearly 30-35 g each, seed well filled, endosperm white, red subcoat and testa; rapid in germination and root development from seedling; appears to be a dwarf different in origin from the available U.S. sorghum dwarfs; good regeneration of ratoon after harvest, susceptible to semiloopers in April sowings. A very promising locally adapted type, superior to recommended American hybrids which are highly susceptible to charcoal rot.

Mutants from CRP

CRP-1261: Earlier than parent by 5 days; good in drought resistance; good root distribution; panicle size similar to the parent but more panicle/ unit area; root activity as measured by $^{32}P$ injection is 18.5% at 60-90 cm depth compared to about 2% on the conmmercial hybrids and 6% in CRP at that soil depth.

CRP-1359: Height about 25 cm less than CRP, panicle size smaller, grain size similar but more panicles per row. Slower leaf drying.

CRP 1543: Panicle size 20-25% larger than CRP, more compact and larger grain similar in shape and size to "Feterita", grain 15-20% larger than CRP, better exsertion of panicle but height similar to CRP. Slower leaf drying. Earlier than parent by 5 days.

CRP-2085: Panicle larger than CRP and 50% more panicles/row; superior in exsertion of panicle, grain size also 10-15% larger; more leaves green at harvest. Taller than CRP by 20 cm.

CRP-1265: Panicle size 25% larger; 80% more panicles/row; grain size similar to CRP, earlier than CRP by 3 days, superior to parent in resistance to charcoal rot and *Fusarium*.

CRP-1279: Taller in height by 5-10 cm, panicle size similar to CRP but 25% more panicles; grain size larger; susceptible to drought. Earlier by 3 days. Subsequent selection for survival in severe drought, progeny testing of survivors and mass selection during the next two cycles improved resistances and yield.

Hybrid check P-815 B: Few panicles/row (5 panicles/metre, grain very small and light in weight due to poor seed-filling and hollow belly in grain, panicle size much larger than CRP (>60% in length and excellent in exsertion) but rapid in leaf drying (all the leaves dry at harvest) highly susceptible to charcoal rot and drought and also leaf diseases, root activity mostly (>95%) in top 15-20 cm. Leaf size 50% larger in width and 25-30% longer than CRP.

Criollo Blanco Alto parent (CBA) A very tall (280-300 cm) trial type, 20-22 large leaves, with about 12 leaves green at harvest, sensitive to small changes of combinations of temperature and day length, particularly in October sowing when day and night temperatures are high (37°C day, 3o°C night), days to 50% flowering vary from 70-75 in June sowings to 80 or more in August sowings and 90-95 in October/November sowings in Zulia State; large compact head (>25 cm), large and thick stem, nontillering, long internodes, large dark green leaves (180-200 $cm^2$ each), flag leaf medium size (150 $cm^2$ or more); maturity 130-150 days depending on sowing date, 65-80 g/panicle, seed size large, white, well-filled, endosperm white and semi-glutinous, subcoat purple colored; excellent in resistance to drought and lodging in spite of tallness; several buttress roots, other roots deeper in distribution, resistant to *Macrophomina*, tolerant to *Fusarium*, very rapid (16-20 days) in seed filling; regeneration of ratoon crop is variable but superior to American hybrids and poorer than CRP. An excellent source of resistance to charcoal rot and *Fusarium*. Poor in competition under close spacing of 50 cm or less, which is recommended for dwarf mutants as compared to 70-75 cm of normal spacing.

CBA-109: Height almost half of CBA, three times more panicles/row, >30 days earlier in maturity, number of leaves (12) about 50% of parent, flag leaf similar in size and orientation, excellent exsertion of panicle like parent, with almost similar or slightly smaller panicle, grain size large like parent; more susceptible to charcoal rot under artificial inoculation but equal to parent under natural infection.

CBA-467: Short, but 4-6 times more panicles/row, all leaves except three lower ones are green at harvest, flag leaf size similar to the parent. There is variation in panicle size, some larger than the parent, grain size similar. Resistance to charcoal rot but lower than parent.

CBA-469: Similar to CBA-467 in several features, but shorter by 30 cm; grain 15% larger than parent, panicle size smaller than parent but three or 4 times the number of panicles/row. More susceptible to disease under artificial inoculation but similar to the parent under natural infection.

CBA 81-1227: Taller than other mutants by 40-45 cm; earlier than parent by 25-30 days grain size and panicle size similar to the parent; 3 times more panicles; more of green leaves. Better than parent in exsertion of panicle; 14-15 leaves/plant compared to 10-12 leaves of other mutants and 20-22 leaves of parent, high resistance to charcoal rot.

All CBA mutants are earlier than the parent by 25-33 days.

Table:

Agronomic data of the best mutants of sorghum derived from Criollo Rojo Pequeño and Criollo Blanco Alto (1981-84)

| Genotype | Height cm | Days to 50% flower | Days to mature | No. of leaves total | No. of leaves harvest | Resistance to Macrophomina* | No. of panicles $m^2$ | Yield kg/ha |
|---|---|---|---|---|---|---|---|---|
| CRP Parent | 136 | 65.7 | 97.6 | 12.2 | 5.4 | 4.50 | 13.6 | 3393 |
| Mutants | | | | | | | | |
| CRP-1261 | 142 | 63.3 | 103.0 | 9.2 | 5.0 | 3.56 | 23.6 | 4729 |
| 1359 | 149 | 64.0 | 101.8 | 10.7 | 5.2 | 3.60 | 20.4 | 5019 |
| 1543 | 148 | 61.3 | 96.3 | 9.8 | 5.1 | 3.00 | 24.8 | 4917 |
| 2058 | 154 | 62.3 | 98.7 | 10.3 | 5.4 | 3.93 | 25.6 | 4275 |
| 1265 | 146 | 64.0 | 98.0 | 10.0 | 5.6 | 3.56 | 24.0 | 4431 |
| 1279 | 139 | 62.0 | 100.1 | 9.6 | 4.4 | 3.73 | 22.0 | 4553 |
| CBA Parent | 293 | 95.0 | 125.9 | 18.9 | 12.6 | 2.50 | 2.8 | 1364 |
| Mutants | | | | | | | | |
| CBA 109 | 151 | 63.3 | 97.7 | 11.5 | 5.0 | 4.20 | 17.6 | 5291 |
| 467 | 140 | 65.0 | 96.2 | 11.8 | 6.0 | 4.80 | 15.6 | 5830 |
| 469 | 145 | 62.0 | 95.0 | 11.1 | 5.8 | 5.80 | 20.8 | 5818 |
| CBA 81-1227 | 200 | 70.3 | 99.9 | 14.2 | 8.1 | 2.00 | 14.0 | 4551 |
| Savanna V Hybrid-Check | 145 | 62.3 | 101.2 | 9.2 | 1.9 | 8.93 | 10.0 | 2650 |
| C.D.5% | 18 | 4.8 | 4.7 | 2.10 | 2.08 | 1.84 | 3.3 | 674 |

* Artificial inoculation by tooth pick method

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(Contributed by A. Reinoso, B.R. Murty and F. Taborda. Faculty of Agronomy, University of Zulia, Maracaibo, Venezulea).




## A higher yielding mutant of black gram with improved nodule formation

Dry seeds of black gram (Vigna mungo (L) Hopper) var.$T_9$ with 12.2% moisture content were irradiated at 10,20 and 30 krad of gamma rays. This was followed by combined treatment of one set in each dose with freshly prepared 0.25% EMS in phosphate buffer at 7.0 pH at 30$\pm$1°C for 6 hours. In $M_2$ population of 20 krad two mutants with pentafoliate instead of trifoliate leaves were found. This character was true breeding in $M_3$ $M_6$ generation. Crosses revealed monogenic recessive inheritance of this character. The proposed gene symbol is p5. This mutant has normal maturity period and the plant height is the same as $T_9$ (ca. 50 cm).

Preliminary yield trials indicate superiority of the mutant line over control. The mutant line also shows a significant improvement in number and weight of root nodules, potentially improving green manuring value (Table) Improvement of root nodulation in mungbean mutants was reported before by others [1,2].


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[2] THAKARE, P.G., DAVID, K.A.V., THOMAS, J. and BHATIA, C.R., Increased nitrogen fixation in an induced mung bean mutant. Mutation Breeding Newsletter No. 22 (1983) 7-8.


Table:

Agronomic characters of black gram mutants and their parent
(Average of 15 $M_3$ plants in 3 replications)

| Variety/ mutant | Branches/ plant | Leaves/ plant | Pods/ plant | TGW (g) | seed/ plant (g) | Roots + nodules (g) | Dry wt. of nodules (g) |
|---|---|---|---|---|---|---|---|
| $T_9$ parent | 2.2 | 3.3 | 28.3 | 28.2 | 4.94 | 3.23 | 0.46 |
| Mutant | 4.6 | 29.0 | 35.8 | 30.2 | 6.05 | 7.79 | 0.95 |


(Contributed by Singh, R.K. and Raghuvanshi, S.S. Plant Genetic Unit, Department of Botany, University of Lucknow, Lucknow - 226007, India).



XA0201363


## High yielding small grain mutant of rice variety "Pankaj"

By treatment with EMS a mutant has been produced from the variety "Pankaj" which has better tillering, longer panicle and more grains per panicle. In multilocation trails at Burdwan, Suri and Rampurhat in West Bengal it yielded significantly more than "Pankaj" and "Mahsuri" at all locations, with a mean 5.2t. The mutant named "BU 79" would be a suitable substitute for "Pankaj" and similar long-duration rices.


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HAJRA, N.G. and HAJRA, S.G. (Regional Research Centre, Kunjaban, Tripura) and MALLICK, E.H. (Rice Research Station Bankura 722101, India). Int. Rice Research Newsletter 11(2) (1986) p.3.

Radiation induced mutants in cassava (Manihot esculenta Crantz)

Stem cuttings and true seeds of three promising cultivars of cassava were exposed respectively to 1 to 5 kR and 10 to 50 kR acute gamma rays from a $^{60}Co$ source. Treatments of stem cuttings beyond 5 kR and seeds beyond 50 kR were lethal. One mutant each in the cultivars M4, H-165 and H-2304 was obtained from the stem irradiated populations. Another mutant was found in the seed irradiated progeny of H-2304. The mutant of M4 is characterised by light green (chlorina) leaves. The mutant of H-165 shows significantly shorter petiole (22,5 against 35.2 cm) and narrow leaf lobes, while the H-2304 mutant shows speckled leaves, branching and early flowering. The mutant found in the seed irradiated progeny of H-2304 is having yellow tuber flesh indicating the presence of carotene.

The mutants may be useful in studies related to basic information as well as in practical breeding. The chlorina mutant in M4 showed slow growth and high HCN content in leaves. Late branching may be a useful trait in the traditionally non-branching clones of cassava to maintain the desirable leaf area index during high leaf fall period. Early flowering could be useful in a recombinant breeding programme. The tuber yield of the short petiole mutant in H-165 increased by 20% - 25% through closer planting. The narrow leaf lobes of this mutant permit better light penetration to lower leaves.

(Contributed by G.G. Nayar and P.G. Rajendran, CTCRI, Sreekariyam, Trivandrum - 695017, Kerala, India).

In vitro techniques for mutation breeding of tropical root and tuber crops

To assist IAEA Technical Co-operation projects, the Agricultural Section of the IAEA Laboratory in Seibersdorf is developing techniques for *in vitro* mutation breeding of cassava (*Manihot esculenta*) and yam (*Dioscorea alata*, *D. rotundata*). The first aim was to induce morphogenesis (plant regeneration) in tissue culture and establish techniques for *in vitro* propagation. Subsequently, the *in vitro* mutation breeding technology is being developed.

(i) Cassava is one of the important staple food crops of tropical countries. Pest and disease resistance as well as low toxic cyanide content are among the objectives for genetic improvement. For *in vitro* mutation induction we use shoot-tip and node culture.

Shoot apices (1 and 2 mm long) are aseptically dissected from cassava buds and cultured on MS medium with 1 mg/l thiamine, -naphthalene acetic acid, 6-benzyladenine and gibberelic acid. Elevated concentration of 6-benzyladenine is used for multiple shoot formation. The rapid multiplication was induced in liquid medium, when flasks were placed on a gyratory shaker with 60 rpm at 28°C during 16/8 light/dark photoperiod. Nodes with axillary buds from *in vitro* growing plantlets were irradiated with gamma rays. Doses of 30 to 45 Gy allowed the survival of approx. 50 percent of explants and subsequent shoot proliferation from axillary buds. Radiosensitivity of cassava genotypes may be different and this will be investigated in future experiments.

(ii) Yams are likewise important tuber crops, particularly in West Africa, South-East Asia and the Caribbean. The main breeding objectives are improved yield, shortened growth period, improved storability (resistance of tubers to fungal attack), shoot tip cultures have been utilized for clonal propagation, and germplasm preservation and exchange. At present, the IAEA Laboratory at Seibersdorf is trying this technique for mutation induction. Somatic embryogenesis in cell and tissue culture is worked on to develop a single-cell technology for mutation breeding.

Shoot tips with two pairs of leaf primordia were excised from axillary buds of greenhouse plants. MS medium supplemented with -naphthalene acid, 6-benzyladenine and gibberelic acid was found suitable for shoot as well as root development. In vitro plantlets are dissected at the internodes and nodes with axillary buds are used for in vitro propagation. Plantlets derived from axillary buds can be easily transplanted into soil and grown to adult plants. 30 Gy of gamma rays was found as appropriate dose for treatment of nodal cuttings. The experiments on mutation induction in in vitro culture are carried out in collaboration with IITA. Fellows from Ghana, Uganda, Nigeria, Venezuela and Zambia have been trained in in vitro techniques of root and tuber crops.

(Contributed by F. Novak, Plant Breeding Unit, Joint FAO/IAEA Programme, IAEA Laboratory Seibersdorf, Austria).

## Pioneer in mutation genetics

The "Award of 7th July", the highest award for scientific achievements of the Republic of Serbia in Yugoslavia, was given in 1986 to Prof. Dr. Katarina Borojevic, Institute of Biology, Faculty of Natural Sciences, University of Novi Sad.

"Katarina Borojevic is one of the pioneer scientists in mutation genetics of plants in our country. Her research contributed to the theory of mutation in plant and has also practical value in breeding of wheat. She also developed tests for monitoring environmental pollution using mutations in plants. Now she is studying mutations in cell culture of wheat, and develops research and material for applying gene engineering in plants" (Board of 7th July Award).

Congratulations!!!

## LIST OF CULTIVARS

The Plant Breeding and Genetics Section of the Joint FAO/IAEA Division undertakes the collection and dissemination of information on commercially used agricultural and horticultural cultivars developed through the utilization of induced mutations. This list does not claim to be comprehensive. Its content is strictly based on information transmitted by the breeders themselves and/or other institutions involved. Listing of a cultivar does not imply its recommendation by FAO/IAEA.

| Name of new cultivar | Place and date of release (or approval) and name of principal worker and institute | Kind and date of mutagenic treatment [parent variety] or mutant crosses (mutant underlined) | Main improved attribute of cultivar |
|---|---|---|---|
| Arachis hypogaea L. (peanut) | | | |
| Virginia No. 3 | Argentina, 1979<br>Manfredi Exp. Staton | seed irradiation<br>[NC 2] | large pods |
| Brassica pekinensis (Chinese cabbage) | | | |
| Longbai No. 1 | China, 1984 | seeds, gamma rays 63 krad<br>[F4 line of cross Jiaorye x Tonghua] | early maturity (growth period only 75-80 d) high yield, good storage property |
| Carica papaya (papaya) | | | |
| Pusa nanha | India, 1986<br>Mansha Ram<br>IARI Regional Station<br>Pusa, (Samastipur)<br>Bihar 848125 | gamma rays 15 krad<br>1969<br>[Ranchi] | reduced plant height from 218 to 106 cm; girlt of trunk and length of leaf from 193 to 86 cm |
| Eremochola ophiuroides (Munro) Hack. (centipedegrass) | | | |
| AU Centennial (AC-17) | USA, 1983<br>J.F. Pedersen<br>Ray Dickens<br>Dept. of Agronomy and Soils<br>Auburn Univ. and Alabama<br>Agric. Exp. Station<br>Auburn AL 36849 | seed, gamma rays 30-40 kR<br>1976<br>[common centipedegrass] | dwarf, high leaf density turf grass, vegetatively propagated |

| | | | |
|---|---|---|---|
| <u>Fagopyrum sagittatum Gilib</u>. (buckwheat) | | | |
| Aelita | USSR, 1978<br>E.S. Alekseeva<br>Agric. Institute<br>Kamenets-Podolsky 281900 | gamma rays<br>[Improved Radekhovskaya] | yield more than 4 t/ha<br>more branches |
| Galleya | USSR, 1979<br>E.S. Alekseeva<br>Agric. Institute<br>Kamenets-Podolsky 281900 | seeds, gamma rays 20 krad<br>[Victoria] | increased productivity<br>suitable for mixed cropping |
| Lada | USSR, 1979<br>E.S. Alekseeva<br>Agric. Institute<br>Kamenets-Podolsky 281900 | gamma rays<br>[Improved Radekhovskaya] | higher yield, more branches |
| Podolyanka | USSR, 1984<br>E.S. Alekseeva<br>Agric. Institute<br>Kamenets-Podolsky 281900 | combined radiation and<br>chemical mutagen<br>quality | compact, short stemmed, early<br>ripening, excellent grain |
| <u>Glycine max</u> (soybean) | | | |
| Heinong 28 | China, 1986<br>Soybean Institute<br>Heilongjiang Acad. of Agric.Sci.<br>Harbin | seeds, thermal neutrons<br>$5x10^{11}$ $N/cm^2$<br>[Heinong No.16 x<br>Zyuushoo Nagaka] | growth period 121 d, strong<br>stem, yield high (2.79 t/ha)<br>good quality (protein 38.7%,<br>fat 21.3%) |
| <u>Gossypium hirsutum</u> (cotton) | | | |
| Badnawar-1 | India, 1961 | cross with <u>Indore-2</u> | |
| Indore-2 | India, 1950<br>Institute of Plant Industry<br>Indore | x-rays, seeds<br>[MU-4 = Dhar Kambodia] | cultivated till 1961<br>up to 120 000 ha |
| Khandwa-2 | India, 1971 | cross with <u>Indore-2</u> | |
| M.A. 9 | India, 1948<br>Mysore | seeds, x-rays<br>[$C_o$-2] | drought resistant |
| <u>Hibiscus</u> (ornamental) | | | |
| Purnima | India, 1979 | gamma rays, chronic 20 kR<br>[Alipore Beauty] | variegated smaller leaves |

| Name of new cultivar | Place and date of release (or approval) and name of principal worker and institute | Kind and date of mutagenic treatment [parent variety] or mutant crosses (mutant underlined) | Main improved attribute of cultivar |
|---|---|---|---|
| Hordeum (barley) | | | |
| Doublet | UK, 1983<br>Welsh Plant Breed. Station<br>Aberystwyth SY23 3EB | Triumph x Goldspear 1976 (produced by doubled-haploid technique) | yield 7% above "Triumph", same good malting quality |
| Heriot | UK, 1983<br>Scott.Crops Res.Inst.<br>Edinburgh | Trumpf x HB 855/467/8/ | semiprostrate with short stiff straw late heading, similar to "Triumph" under Scott. conditions, outyielded "Triumph" by 4% res. to mildew, yellow and brown rust, Rhynchosporium |
| Moskovskii 2 | USSR, 1984<br>D.N. Nettevich<br>Res. Inst.f. Agric. in Central District of Non-Chernozem Zones<br>Moscow | cross Nutans 244 x dwarf mutant "Fakel" (ethyleneimine [Moskovskii 121]) | 3,75 t/ha comp. with 3,29 t/ha for standard Moskovskii 121, TKW 44-50 g, Protein 9,15% |
| Malus pumila (apple) | | | |
| Courtagold | France, 1972<br>L. Decourtye<br>INRA<br>Angers | gamma rays (1962) [Golden Spur] | Drastic reduction in tree size, mainly due to shorter internodes; used as pot plant and in gardens |
| Courtavel | France, 1972<br>L. Decourtye<br>INRA<br>Angers | gamma rays (1962) [Starking delicious] | Drastic reduction in tree size, mainly due to shorter internodes; used as pot plant and in gardens |
| Nicotiana tabaccum | | | |
| GSH-3 | India, 1979<br>Central Tobacco Research Inst.<br>Rajahmundry 533104 | cross of neutron induced mutants (LTH x M4) x CTR1 Special | good quality and yield |

| | | | |
|---|---|---|---|
| *Oryza sativa* (rice) | | | |
| Chenzao No. 5 | China, 1979<br>Chenzhou Institute of<br>Agric. Science<br>Hunan Province | 35 kR, gamma rays<br>[IR8] | early maturity, good tillering,<br>more spikes |
| DB 250 | Vietnam, 1986<br>Phan Phai<br>Tran Duy Quy<br>Agric. Genet. Centre<br>Hanoi | seeds, gamma rays (25 kR)<br>and 0.02%<br>N-dimethyl-N-nitrosourea<br>[F9 of cross $TB_1$xIR 22] | 135-150 cm, strong culm, adapted<br>to deep water<br>TGW 26-27 g, yield up to<br>4.5 t/ha, leading submergence<br>tolerant variety |
| Erjiufeng | China, 1982<br>Jiaxing Agric. Inst.<br>Zhejiang Province | Yuanfenzao x IR29 | resistance to blight, medium<br>maturity, high yield |
| Hangfeng | China, 1983<br>Fan, Hongliang<br>Lu Jiaan<br>Cai Fugen<br>Zheng Zuling<br>Crop Breeding and Cultiv. Inst.<br>Shanghai Acad. of Agric. Sci. | cross (Kenqui x<br>Keging No. 3) x Reimei<br>(gamma ray mutant from<br>Japan) | short culm, resistant to lodging,<br>many tillers, high seed set,<br>fine quality; 1986: 20.000 ha |
| Marathon<br>(Mara 136) | France, 1985<br>M. Marie INRA<br>Montpellier | gamma rays<br>[Maratelli] | resistant to Pyricularia |
| Mutashali | Hungary, 1980<br>I. Kiss-Simon<br>Res. Inst.f. Irrigation<br>Szarvas | seeds, fN 2000 rad<br>[Dunghan Shali] | resistant to Pyricularia oryzae<br>(blast), resistant to shattering<br>and lodging; 4000 ha 1979-86<br>yield records 5-6 t/ha |
| NN 22-98 | Vietnam, 1983<br>Phan Phai<br>Tran Duy Quy<br>Agric.Res. Centre<br>Hanoi | seeds, N-ethyl-N-<br>nitrosourea (0.02% 18h)<br>[IR 22] | strong culm, adapted to deep<br>water; higher TKW<br>mean yield 4.5 t/ha |

| Name of new cultivar | Place and date of release (or approval) and name of principal worker and institute | Kind and date of mutagenic treatment [parent variety] or mutant crosses (mutant underlined) | Main improved attribute of cultivar |
|---|---|---|---|
| Oryza sativa (rice) contd. | | | |
| Oryzella | Hungary, 1983<br>I. Kiss-Simon<br>Res. Inst.f.Irrigation<br>Szarvas | seeds, EMS 2% 2h 25°C<br>[hybrid Chiapelli x Duborszkij 129] | earlier than hybrid lines with fairly high yield; long grain with good milling, cooking and eating qualities; 3000 ha 1982-86, yield records 4.5-5.5 t/ha |
| Qikesui | China, 1986<br>Heike Institute<br>Heilongjiang Academy of Agric. Science | seed, gamma rays 22.5 krad<br>[Hejiang 12] | seedling tolerant to low temperature<br>strong stem, lush growth |
| R 462 | China, 1985<br>Inst. Appl. Atomic Energy<br>Jiangsu Acad. Agric. Science | irradiated anther culture<br>gamma rays 2 kR<br>[501 Xuan] | short stature, higher yield |
| Rasmi<br>(=PTB 44) | India, 1985<br>K. Karunakaran<br>Regional Agric.Res. Station<br>Pattambi 679306 | gamma rays, 22 kR (1973)<br>[Oorpandy] | awnless, high yield, tall, grain yield 3-4 t at 40:20:20 NPK, tolerant to salinity like "Oorpandy" |
| Salir | Portugal, 1983<br>Estacao Agronomica Nacional<br>Oeiras | seed gamma rays<br>[Saloio] | high yield |
| Shuangchiang 30-21<br>(= SH-30-21) | China, 1957<br>(Taiwan) | seed, x-rays<br>[Shuangchiang] | higher yield, early maturity |
| Shadab<br>(IR 6-18) | Pakistan, 1987<br>G. Bari, G. Mustafa<br>A.M. Soomro, A.W. Baloch<br>Atomic Energy Res. Centre<br>Tandojam (Sind) | seeds, EMS (0.5%) 1969<br>[IR 6] | high yield, improved grain quality, more tolerance to soil salinity, better resistance to stem borer |

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| Oryza sativa (rice) contd. | | | |
| Sifu 851 | China, 1985<br>Inst. Nucl.Agric.<br>Zhejiang Agric.Univ. Hangzhou<br>and Yuhang County Agric. Sci.<br>Institute | cross Guoji 24 x Zhefu 802 | matures 3-4 d earlier than "Guanglu short No. 4", but yields 12.5% more; matures 1-2 d later than Erjiufeng and yields 10%more; long grain |
| Taifu No. 4 | China, 1979<br>Jiangchuan County<br>Yunnan Province | seeds, gamma rays (20 kR) + colchicine<br>[Taizhong No. 3] | disease resistant |
| Xiangfu 81-10<br>(=Xiangzaoluo 1) | China, 1984<br>Inst. Appl. Atomic Energy<br>Hunan Acad. Agric. Science | seeds, gamma rays 28 kR<br>[$F_2$ of IR 29 x Wenxuanqing] | glutinous, good grain quality for rice wine, matures in 6-6.75 t/ha; high resistant to bacterial blight and blast |
| Zhongtie | China, 1985<br>Guangdong Test<br>and Analysis Institute | 14 MeV (1.33-3.33) x $10^{11}$ n/cm$^2$<br>[Teiqiu 15] | high yield; good adaptation |
| 652 | China, 1979<br>Hubei Acad. of Agric. Science | seeds, gamma rays (30 kR)<br>[129 x Ewan No. 3] | resistant to blast, suitable for mountain areas |
| Panicum miliaceum L. (proso millet) | | | |
| Lipetskoe 19 | USSR, 1985<br>Y.S. Kolyagin<br>Agric. Inst. of the Central<br>Chernozem Zone | DMS 0.04% + NEH 0.01%<br>[$F_4$ line of cross Flavum 7 x Veselopodolyanskoe 38] | mid-season early, yield 4.29 t/ha (0.7 t higher than standard), drought and lodging resistant |
| Pennisetum americanum (L.) Leeke (pearl millet) | | | |
| ICMH 451 | India, 1986<br>ICRISAT<br>Hyderabad | gamma rays 30 krad<br>[Tift 23 DB] | hybrid variety produced by crossing with downy mildew resistant mutant 81 A/B |
| Phaseolus vulgaris (bean) | | | |
| Neptune | USA, 1986<br>M.W. Adams et al.<br>Michigan State Univ.<br>East Lansing | cross MSU 31906/ San Fernando//Seafarer | maintains plant architecture derived from Seafarer |

| Name of new cultivar | Place and date of release (or approval) and name of principal worker and institute | Kind and date of mutagenic treatment [parent variety] or mutant crosses (mutant underlined) | Main improved attribute of cultivar |
|---|---|---|---|
| Pisum sativum (pea) | | | |
| Heiga | Poland, 1986<br>J. Mikolajczyk, G. Wroblewska<br>ZD IHAR Przebedowo | Hamil x Delisa II | afila character, garden or canning pea |
| Jaran | Poland, 1986<br>J. Mikolajczyk, G. Wroblewska, S. Mikolajczyk<br>Plant Breeding Station Pasterzowice | Aschersleben x/Wasata x Wielkolistna/ | afila mutant, resistant to lodging, suitable for cultivation in mixtures with oat for green forage and dry seeds for fodder |
| Saccharum officinarum (sugar cane) | | | |
| Co 8153 | India, 1981<br>Sugar cane Breeding Inst.<br>Coimbatore 641007<br>(Tamil Nadu) | gamma rays 15 kR<br>seeds from cross<br>[Co 6304 x Co 6806] | similar in performance to Co C761; juice quality and yield superior to mid-late standard Co 6304 |
| Triticum aestivum (wheat) | | | |
| Longfumai No. 1 | China, 1984<br>Inst. Appl. Atomic Energy<br>Heilongjiang Acad. Agric. Sci.<br>Harbin | $1 \times 10^{11}$ $N/cm^2$<br>thermal neutrons, seeds<br>[$F_1$ Xinshuguang No. 1 x Lia No. 8] | super early maturity (75-80 d from emergence) good quality 15-18.2% protein) high yield 3-4.5 t/ha<br>1986: 13 000 ha |
| Tambo | Switzerland, 1985<br>A. Fossati<br>Fed.Agric. Res. Station<br>CH-1260 Nyon | gamma rays 25 krad<br>[line (Probus x Bankuti) x Hoeser 52] | short straw<br>1987: 4000 ha |
| Yuandong No. 3 | China, 1985<br>Inst.Appl. Atomic Energy<br>Chinese Acad.Agric. Sciences<br>Beijing | seeds, gamma rays 25 kR<br>[$F_3$ 12040 x Aurora] | with complex resistance to rusts and powdery mildew, tolerance to dry hot wind |

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| Triticum aestivum (wheat) contd. | | | |
| 62-8 | China, 1985<br>Inst. of Crop Breeding and Cultivation<br>Qinghai Acad. of Agric. and Forestry<br>Xineng | fast neutron<br>[Abbodanza] | resistant to stripe rust, 6-8 days earlier than Abbodanza<br>1986: ca. 600 ha |
| 62-10 | China, 1985<br>Inst. of Crop Breeding and Cultivation<br>Qinghai Academy of Agric. and Forestry<br>Xineng | fast neutrons<br>[Abbodanza] | resistant to stripe rust, 20 cm shorter culm than Abbodanza<br>1986: ca. 600 ha |
| Henong 1 | China, 1985<br>Inst. of Nucl. Agriculture<br>Zhejiang Agric. Univ<br>Hangzhou | gamma rays seed, 1979<br>[Yangmai 1] | 12-18% higher yield than predom. cultivar Zhemai 1; lodging resistant due to short thick culms |
| Yuandong 94 | China, 1984<br>Inst.f.Appl. Atomic Energy<br>Chinese Acad. Agric. Sciences<br>Beijing | seeds, gamma rays 25 kR<br>[12040 x Aurora] | medium early, good quality resistant to rust |
| Triticum turgidum (durum wheat) | | | |
| Arpad | Austria, 1987<br>Landwirtschaftsbetrieb<br>Neuhof-Rohrau | cross Attila x mutant of Capelli | rel. short culm, lodging resistant; high yield; resistant to yellow rust |
| Vicia faba (faba bean) | | | |
| Ti-Nova | GDR, 1986<br>R. Steuckardt<br>M. Dietrich<br>H. Griem<br>VEG Pflanzenproduktion<br>Gotha-Friedrichswerth | cross with x-ray induced ti mutant | terminal inflorescence 70-90 cm, improved lodging resistance; earlier and more uniform maturity; suitable for combine harvest |

| Name of new cultivar | Place and date of release (or approval) and name of principal worker and institute | Kind and date of mutagenic treatment [parent variety] or mutant crosses (mutant underlined) | Main improved attribute of cultivar |
|---|---|---|---|
| Vigna radiata (mungbean) | | | |
| NIAB Mung 19-19 (NM 19-19) | Pakistan, 1985<br>I.A. Malik, G. Sarwar, Y. Ali<br>NIAB<br>Faisalabad | gamma rays 40 kR<br>[Pak 22] | takes 60-65 d instead of 90-95 d to harvest; determinate type, yields 35% more than standard variety 6601; recommended for spring and summer crop |
| NIAB Mung 121-25 (NM 121-25) | Pakistan, 1985<br>I.A. Malik, G. Sarwar, Y. Ali<br>NIAB<br>Faisalabad | gamma rays 20 kR<br>[RC 71-27] | takes 60-65 d instead of 90-95 d to harvest; determinate type, yields 44% more than standard variety 6601; recommended for spring and summer crop |
| Zea mays (maize) | | | |
| Kollektivnyi 210 ATV | USSR, 1984<br>V.V. Morgun<br>Sel'skokhozyaistvennaya Opytnaya Stantsiya<br>Cherkany<br>Ukrainian SSR | Druzhba x DevizTV<br>(= chemical induced mutant of ChK208TV x DBe42TV) | high yield hybrid |

## New Publications

Gene Structure and Mutation
Gamma Field Symposia No. 24, 1985
Institute of Radiation Breeding Ohmiya-machi, Naka-gun, Ibaraki-ken, Japan.
Contents:

T. Kato: Inducible mutagenic repair processes in *E. coli*
H. Satoh: Genic mutations affecting endosperm properties in rice
K. Okuno: Expression of mutant genes specifying starch synthesis in cereal grains
Y. Sano: Gene regulation at the waxy locus of rice
E. Amano: Genetic fine structure of induced mutant genes in cereals

Improvement of Root and Tuber Crops by Induced Mutations
Conclusions and Recommendations of research co-ordination meetings 1984 and 1986, IAEA-TECDOC-411 (IAEA Vienna 1987)

## BOOK REVIEW

Biotechnology in Agriculture and Forestry Vol. 2
Crops I

Editor: Y.P.S. Bajaj
Springer Verlag Berlin, Heidelberg, New York, Tokyo
625 pp. 144 figs. DM 348.-

"Biotechnology" - a catchword of scientific journalism - is a rather ambiguous term. The book's content may be better described by "In-vitro culture for plant improvement". 33 chapters provide a wealth of technical information and related references of in-vitro culture work. More than half of the 608 pages deal with cereals. Wheat and rice are treated in great detail, but maize, sorghum, millet, barley, triticale and hordicale are discussed as well. The other crop species dealt with are soybean, Phaseolus bean, winged bean, potato, tomato, eggplant, cucurbits, onion, garlic, celery, amaranth and buckwheat. Dependent upon the amount of research results and the style of the authors the chapters differ in value. Some are almost monographs of the species (incl. taxonomy, production figures, lists of diseases and pests) others provide a straight account on in-vitro techniques, results and problems. Some chapters reflect utilitarian optimism, others are more critical in evaluating present status and future prospects. There is some overlap and duplication of presentation, but this may be difficult to avoid with 66 authors from 15 countries.

The authors put much emphasis on anther culture and the doubled-haploid technique and this is one area, in which "mutation breeders" are certainly interested. Unfortunately, the number of crop species where regeneration of haploid plants exceeds 1% is still very small. Thus there is the risk of loosing most of the segregants or mutants. Apparently the amenability for successful anther culture depends also upon the genotype used, and this is another severe restriction. However, the book provides good information on culture conditions. It may not have to be stressed that plant breeders in general, but particularly mutation breeders, can derive economic benefit from the possibility of quick clonal "micro-propagation". The book contains information on such possibilities.

Of course, all chapters refer to observations on genetic variability derived from in-vitro culture, some in rather detail and with critical evaluation of the kind of genetic (or epigenetic) changes, some rather superficially and in this case usually with unjustified enthusiasm. For someone who worked for many years on the use of induced mutations as a supplement to other plant breeding tools it is astounding to note the naivity with which certain "in-vitro culturists" pretend that the success of future plant breeding depends upon the creation of genetic variability by in-vitro culture. The referee regrets that he feels compelled to disagree with the Editor of this book stating that "genetic manipulation in test tubes has with speed and certainty astronomically increased the available genetic resources". Classic hybridization is still the main source of new genetic variability. In addition, plant breeders have by now a wide arsenal of physical and chemical means to induce mutations. Their usefulness is proven by the hundreds of mutant cultivars passed on to farmers. Somaclonal variation can likewise be useful, following strong selection for the rare positive variants. For many crop species, however, plant regeneration from callus cultures and thus selection of mutants is not practical yet. Details can be found in the book.

There are a few other points, which deserve a critical remark, e.g. that one author used $H_1$, $H_2$, etc. for plants derived from anther culture, another one used $R_0$, $R_1$, etc. That "cell and tissue cultures are known to undergo genetic erosions" can probably not be the reason, to become "a rich source of genetic variability". The difference between "genetic engineering" and "biogenetic engineering" remains obscure. "Cryopreservation" certainly has more value for germplasm banks to store clones of vegetatively propagated crops, rather than "somaclonal variants" of cereals and one would expect attention to be called to the need to avoid "somaclonal variation" in germplasm storage of in-vitro cultured plant material.

In spite of these critical remarks, it is obvious that the book contains rich and useful information also for plant breeders. In modifying a statement (Chase, 1974) cited in the book one might conclude that plant biotechnology methods will be successful in practice if those who are masters in biotechnology are also masters of plant breeding.

A. Micke

## FUTURE EVENTS

### 1987

30 Nov.-3 December — SABRAO International Symposium on "Gene Manipulation for Plant Improvement in Developing Countries", Kuala Lumpur (Malaysia)
Contact: A.H. Zakri, Dept. of Genetics
University Kebangsaan Malaysia
43600 UKM, Bangi

### 1988

8-13 February — International Congress of Plant Physiology, New Delhi (India)
Contact: S.K. Sinha, Water Technology Centre
IARI, New Delhi 110012

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|---|---|
| 24-26 February | EUCARPIA Cereal Section Meeting (topics: Integrated agriculture, physiological limitations, soil borne pathogens, introduction of new gene material, cereals for industrial use), Wageningen (The Netherlands).<br>Contact: L.A.J. Slootmaker<br>Stichting Nederlands Graan-Centrum<br>Hamelakkerlaan 40<br>6703 EK Wageningen |
| 5 April-13 May | 7th FAO/IAEA International Training Course on the Induction and Use of Mutations in Plant Breeding, Seibersdorf (Austria)<br>Contact: P. Schultze-Kraft<br>Head, IAEA Training Course Section<br>P.O. Box 100<br>A-1400 Vienna |
| 3-9 July | 5th International Lupine Conference, Poznan (Poland)<br>Contact: Institute of Bioorganic Chemistry<br>Polish Academy of Sciences<br>Noskowski 12<br>61-704 Poznan |
| 13-19 July | 7th International Wheat Genetics Symposium, Cambridge (U.K)<br>Contact: C.N. Law<br>Plant Breeding Institute Trumpington<br>Cambridge CB2 2LQ |
| 20-27 August | 16th International Congress of Genetics, Toronto (Canada)<br>Contact: L. Forget<br>Office of Conference Services<br>Ottawa, Ontario K1A 0R6 |
| 28 Aug.-2 Sept. | EUCARPIA International Symposium on Genetic Manipulation in Plant Breeding, Arhus (Denmark)<br>Contact: C.J. Jensen<br>Risö National Laboratory<br>Agric. Department<br>P.O. Box 49<br>4000 Roskilde |
| 5-9 September | 7th European and Mediterranean Cereal Rusts Conference, Vienna (Austria)<br>Contact: B. Zwatz<br>Federal Institute for Plant Protection<br>Trunnerstr. 5<br>1020 Vienna |

## LAST BUT NOT LEAST

Please submit your contributions to the Newsletter by 1 June and 1 December of each year.

Authors are kindly requested to take into account that the readers want to learn about new findings and new methods but would also like to see the most relevant data on which statements and conclusions are based. Conclusions should be precise and distinguish facts from speculation. The length of contributions should not exceed 2-3 typewritten pages including tables. We regret that photographs cannot be accepted for technical reasons. References to publications containing a more detailed description of methods or evaluation of findings are welcome but should generally be limited to one or two.

Alexander MICKE

Mutation Breeding Newsletter
Joint FAO/IAEA Division of Isotope and Radiation Applications
of Atomic Energy for Food and Agricultural Development
International Atomic Energy Agency
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A-1400 Vienna, Austria

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