Mutation Breeding Newsletter

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Report from the FAO/IAEA Plant Breeding and Genetics Section

Technology development is a pre-requisite for further success in practical applications of nuclear techniques in plant genetics and crop improvement. The Research Contract Programme of the IAEA is a good means to stimulate the needed technology development. Present FAO/IAEA Co-ordinated Research Programmes concentrate upon the incorporation of in-vitro culture techniques into mutation breeding projects: In cereals by doubled-haploids for accelerating mutation selection, in root and tuber crops by eliminating chimerism through somatic embryogenesis, in mutation breeding for disease resistance by attempting in-vitro selection using pathotoxins where applicable. The Plant Breeding Unit of the Agency's Seibersdorf Laboratory contributes particularly to the methodology of mutation induction by irradiation of plant material before or during in-vitro culture.

Whether the FAO/IAEA Plant Breeding and Genetics Section should include already molecular genetics in its research and training programmes was the main question addressed to a Consultants' Meeting in November. The answer was definitely positive regarding the use of Restriction Fragment Length Polymorphism, but deferred other more sophisticated work recognizing the limited resources. Another new subject matter seriously considered now is the development of tracer techniques for the diagnosis of viruses, viroids and similar causal agents of plant diseases, which eventually could lead to better ways of distinguishing between resistance and susceptibility, particularly in vegetatively propagated and perennial crops. The resources for such work still have to be found.

If resources become available, we would also like to start a co-ordinated research programme on domestication of plants for industrial purposes. Project proposals are welcome.

As far as assistance to Member States is concerned, in 1988 we began to pay more attention to plant breeding problems in Africa. There was interaction with oil seed breeders during an IDRC Workshop in Kenya, there was a regional seminar in Zambia, and there were missions of staff members to Burkina Faso, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Nigeria, Senegal, Sudan, Tanzania, Uganda and Zaire. With financial support by the Italian Government, we expect to start in 1989 a regional co-operative programme including research contracts, training and workshops. Regional co-operation with plant breeders in Latin America continues under ARCAL (Regional Co-operative Arrangements for the Promotion of Nuclear Science and Technology in Latin America). The 7th Interregional Training Course on the Induction and Use of Mutations in Plant Breeding at the Seibersdorf Laboratory again saw 20 participants from 20 countries, selected among 61 applicants. The Section was responsible for 45 Technical Co-operation Projects involving 70 institutions in 37 countries. 52 scientists completed their training under IAEA fellowships.

The staff situation at present is as follows:

At Headquarters:

Alexander Micke (FRG)	Head, Plant Breeding & Genetics Section
Miroslaw Maluszynski (POL)	Technical Officer
Nobuo Murata (JPN)	Technical Officer
Lhamo Halgand (FRA)	Secretary
Kathy Weindl (CAN)	Secretary

At the Laboratory:

Thorsten Hermelin (SWE)	Head, Agricultural Laboratory, Seibersdorf
Frantisek Novak (CSR)	Head, Plant Breeding Unit. Seibersorf Lab.
Helmut Brunner (AUS)	Technical Officer
R. Afza (BGD)	Lab. Technician
M. van Düren (NET)	Lab. Technician

Responsible for the Joint FAO/IAEA Division:

Björn Sigurbjörnsson (ICE)	Director
Leo LaChance (USA)	Deputy Director

RESEARCH NEWS

Induced genetic variation for aluminum and salt tolerance in rice

MNH applied to fertilized egg cells of "Taichung 65" led to an increase in genetic variation in the progenies. Of a M_2 population of 15 000 seedlings, 2.3 % were scored tolerant to salt. Tolerant plants showed less shoot and root growth inhibition. 50 variants expressed different degrees of tolerance to Al, even up to 30 ppm. The tolerance was related to longer root development.

From: CHAUDHRY, M.A., YOSHIDA, S. and VEGARA, B.S., (International Rice Research Institute, Los Baños, Philippines). Environmental and Experimental Botany 27 (1987) 29-35 and 37-43.

XA0201016

Genetics of induced mutant genes for resistance to aphids in cowpea

The cowpea aphid is a serious pest, particularly in Africa and Asia. Aphids damage the crop by sucking sap from the terminal shoot and from petioles of the young leaves. An indirect and often more serious damage is caused by the transmission of mosaic viruses. Several resistant lines have been identified at IITA and were used in breeding. More recently, two resistant varieties ICV11 and ICV12 were developed at ICIPE, which derive their aphid resistance from mutation induction by gamma irradiation [1]. Backcrossing the mutants with the susceptible original variety ICV1 indicated monogenic-dominant inheritance of the resistance. Other resistant cultivars included in the genetic study were ICV10, an improved breeding line from landraces in Kenya and Tvu 310, a breeding line from IITA. Crosses between these resistant cultivars led to conclude that ICV10 and Tvu 310 contain the same dominant gene for resistance and that ICV11 and ICV12 contain another dominant gene for resistance, which is non-allelic to the resistance gene in ICV10 and Tvu 310. The genes were designated as Rac1 (in ICV10 and Tvu 310) and Rac2 (in induced mutants).

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[1] PATHAK, R.S. and OLELLA, J.C., Mutation Breeding Newsletter No. 28, September 1986.

From: PATHAK, R.S., (International Centre of Insect Physiology and Ecology, ICIPE, POB 30772, Nairobi, Kenya). Crop Science 28 (1988) 474-476.

Increase of genetic variation in "Blue Daisy" (Brachycome multifida) by in-vitro mutagenesis and polyploidization

"Blue Daisy" was recently introduced from Australia and became a popular ornamental in Europe, but it lacks genetic variation and does not produce seeds under European environment conditions. Thus, the development of new cultivars is handicapped. "Blue Daisy" is vegetatively propagated by cuttings. Techniques were developed to increase genetic variation by in-vitro mutation induction and polyploidization.

For in-vitro propagation nodal segments with one pinnate leaf were placed on MS-medium containing 0.1 mg/l NAA and 2 mg/l BAP (medium "a") or 2 mg/l IAA and 0.2 mg/l BAP (medium "b") solidified by 0.6% Oxoid agar. $25^{o}C$ and 16 h illumination (800 lux) resulted in highest propagation rates. After 4 weeks on medium "b" large numbers of axillary shoots could be cut off and placed for rooting on 1/3 strength MS-medium supplemented with 2 mg/l IAA. Another 3 weeks later plantlets could be transferred into the greenhouse for further cultivation. The chromosome number of *B. multifida* is 2n=14. Polyploidy was obtained by placing in-vitro derived explants for about 3 weeks on solid MS-medium "a" containing 0.1% colchicine. The resulting axillary buds were transferred for 3-5 months to medium "b" for shoot development. After rooting and transfer into the greenhouse polyploidy was first determined by comparison of pollen grains from treated and untreated plants. For confirmation, the number of chromosomes was counted using the orcein-acetic squash method. Two different polyploid types were obtained: one more erect and one more hanging phenotype, both having enlarged leaves and flowers.

X-ray doses of 10-50 Gy were applied to freshly cut nodal segments. The explants were placed on solid medium "b" in petri dishes. Inhibition of shoot development was used as criterium of radiosensitivity.

X-ray dose	average no. of shoots/10 expl.	% of control
0 Gy	51	100
10 Gy	29	57
20 Gy	24	47
30 Gy	20	39
40 Gy	7	14
50 Gy	1	2

The described procedure of in-vitro propagation of Brachycome during 3 years did not give any somaclonal variant. The shoots developing after application of X-rays were rooted and all plants were searched for mutations. Variants found were recultered in-vitro several times and propagated by in-vivo cuttings to confirm its mutant character. Some mutants were treated with colchicine as decribed above. Examples of induced mutants are the following:

No.	dose	changed characteristics
6	20 Gy	temperature dependent chlorophyll-defect: visible only in sunshine; bolster-forming; dwarf type
5	30 Gy	rays tubular, showing the underside of the petals: almost white flowers
10	40 Gy	petals 50% shorter than in control, but the number of petal garlands is doubled
11	40 Gy	early, rich and extended flowering (semperflorens); graceful leaves; dwarf type
12	30 Gy	almost white flowers
11a	-	polyploid of mut. No.11 with enlarged flowers and leaves
12a	-	polyploid of mut. No.12, white tubular petals, enlarged flowers, hanging type

(Excerpts from a presentation during the XVIth Int. Congress of Genetics, Toronto, Canada, 20-27 August 1988 by WALTHER, F. and SAUER, A., Fed. Research Centre for Hort. Plant Breeding, D-2070 Ahrensburg).

Advances of mutation breeding in Heilongjiang Province, China

40 varieties, early maturing, high yielding and/or disease resistant have been developed between 1963 and 1979 in cereals, industrial crops and vegetables. They have been cultivated on 530.000 ha.

1. The following varieties were released after 1979:

Soybean: "Heilong No. 26" released in 1980 was bred through crossing mutant "Har63-2294" with "Xiaojinhuang". This variety possesses high yield, drought tolerance, cold tolerance during juvenile phase, disease resistance and good quality. The breeders have won a state prize. This variety yields 3-3.5 t/ha, and was cultivated so far on more than 270.000 ha [1].

Sorghum: "Longfuliang No. 1" released in 1979, was selected in M_3 of irradiated variety "Xinliang No. 7". This variety possesses 15 days earlier maturity, dwarf culm (90-100 cm), high yield and disease resistance. It is suitable for machine harvest, yields 5.2 - 8 t/ha and was cultivated so far on more than 20.000 ha [1].

Spring wheat: "Longfumei No. 1" released in 1983, derived from thermal neutron irradiated F_1 seeds of the cross "Xin No. 3" x "Lio No. 8". This variety possesses early maturity, high yield, good quality (protein 18.2%, lysine 0.40%) and disease resistance. It is suitable for multiple cropping: After harvest, chinese cabbage and radish can still be planted. It yields 3 - 4.5 t/ha and was cultivated so far on more than 13.000 ha [3].

Maize: "Longfuju No. 1" released in 1983 is a single-cross hybrid. One parent, the inbred line "fu746", was developed from irradiated material. This hybrid variety possesses early maturity, high yield, good quality (protein 12.0%, lysine 0.32%), leaf blight resistance. It yields about 7.5 t/ha (occasionally up to 10 t/ha) and was cultivated so far on more than 15.000 ha [4].

Chinese cabbage: "Beicai No. 9" released in 1979, has been bred from irradiated F_2 seeds of the cross "Ke No. 2" x "Feichenghuaxin". This variety possesses disease resistance, early maturity, a better cabbage head and storage tolerance. It yields about 45 t/ha (sometime 105 t/ha) and was cultivated so far on 13.000 ha [1].

Fibre flax: "Heiyi No. 4" released in 1979, was bred by crossing the induced mutant γ-67-1-681 with the line 6409-640. This variety possesses drought and salt tolerance, lodging resistance, high yield and good fibre quality. The fibre yield was 0.75 t/ha on light-salty soil, the highest yield 1.22 t/ha. The cultivated area so far amounts to 20.000 ha [2].

These mutant cultivars created an additional farmers income estimated at US$ 55 000 000.

2. The following mutant lines proved to be very valuable germplasm for cross breeding:

(a) early maturity
Soybean mutant Har 75-6222 requires only 80 days to maturity. It is 32 days earlier than the parent. Sorghum mutant Lifu 119-3 is 20 days earlier than the parent. Maize mutant Longfu 1747 is 15 days earlier than the parent.

(b) high yield
Soybean mutant Har 77-7594 yielded 4.45 t/ha, 48% more than the control. The hybrid sorghum 11A x fuxin 9-1 (the male parent is a radiation induced mutant) yielded 9.5 t/ha, 30% more than the control. The mutant of wheat Longfu 80-7006 yielded 5.2 t/ha, 40% more than the control.

(c) disease resistance
Wheat mutant Longfu 5009 resists root rot. Millet mutant Nan 72-4 resists mildew. Maize mutant Longfu 508 resists leaf blight. Maize

mutant Longfu 6227 resists head smut. The mutant of chinese cabbage 79-21-2 resists downy mildew.

(d) good quality
The oil content of several soybean mutants is 1-2% higher than the parents and ranges from 23.4% to 46.4%. The sugar content of the muskmelon mutant 407 is 10% higher than the parent. The fibre ratio of flax mutant γ-7015-4 was 22.8%, about 5% higher than the parent.

(e) tolerance to adverse environment
The soybean mutant Longfu 73-8955 possesses salt tolerance. The yield was 13.8% more than the control on salty soil. The soybean variety Heilong No. 16 has good shade tolerance. The leaves have more stomata, the grana are bigger. The mutant of fibre flax γ-67-681 possesses more tolerance to salt.

(f) dwarf type
The maize mutant 7147 has a short culm of only 150 cm.

(g) productive plant architecture
The mutants of maize 8005 and 8007 possess upward leaves and no ligula.

3. Irradiation is also used in connection with distant hybridization. Seeds from off-springs of crossing triticale with common wheat were treated with ^{60}Co-γ rays or neutrons. By means of induced translocation, some chromosome fragments or genes from genome of rye were introduced into the ABD genome of wheat. Translocation lines with good economic value were selected, such as Harshi 82-14, Harshi 82-1-1, Harshi 82-2-23-1 and Longfu 82nen389. These lines possess long spikes, multiple spikelets, drought tolerance, stem rust and leaf rust resistance, mildew resistance and high yield. Two of them already joined regional tests in Heilongjiang province. Also, the substitution line Longfu 92027 was selected which possesses good disease resistance and productive traits.

REFERENCES

[1] Mutation Breeding Newsletter No. 25.
[2] Mutation Breeding Newsletter No. 27.
[3] Mutation Breeding Newsletter No. 30.
[4] Mutation Breeding Newsletter No. 31.

(Contributed by Guangzu Sun, Institute for Application Atomic Energy, Heilongjiang Academy of Agricultural Sciences, Harbin, People's Republic of China).

Induced genetic variation for resistance to M-virus in potato

Seeds of the cross "Mariella" x "Xenia N" were treated with DMS, NEH or NMH at the Institute of Chemical Physics, USSR Academy of Sciences, Moscow. The parent varieties are moderately resistant to potato virus M, the resistance is probably under polygenic control. The mutagen treated progenies were subjected to artificial infection and subsequently tested for two years serologically. This screening was performed three times. It was found that the mutagen treatments increased resistance as well as susceptibility to the M-virus.

From: TELLHEIM, E., KLEINHEMPEL, R., OERTEL, H. and SPRINGMANN, B. (Institute for Potato Research, Gross-Lüsewitz, DDR-2551). Archiv für Züchtungsforschung 17 (1987) 101-105.

Induced marker gene mutations in soybean

Non-fluorescent root mutants in soybean are useful as markers in genetic studies. 13 such mutants were detected among more than 150 000 seedlings derived from soybean lines treated with 6 mutagens [1]. One of them, derived from variety "Williams" treated with 20 kR gamma rays, did not correspond to the already known spontaneous non-fluorescent mutants. It was assigned the identification no. T285 and the gene symbol fr5. The other mutants corresponded with known loci fr1, fr2 or fr4.

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[1] PALMER, R.G., SCHILLINGER, J.D. and HOWSON, T., Soybean Genetics Newsletter 12 (1985) 77-81.

From: SAWADA, S. and PALMER, R.G., (Dept. of Agronomy and Genetics, Iowa State University, Ames IA 50011, USA). Crop Science 27 (1987) 62-65.

Increased genetic variability for symbiotic nitrogen fixation in green gram (Vigna radiata L.)

When green gram is planted after rice in Andhra Pradesh, its nitrogen fixation relies upon local rhizobia that have been able to survive the stress of 5-6 months submergence. No rhizobia strain isolated elsewhere was found superior to native rhizobia. Thus improvement of the host may be the only practicable way to improve nitrogen fixation. 15 mutants obtained from gamma irradiated green gram variety "LGG 127" were tested along with the parent and the cultivar "Pant Mung 2". Nodule no. per plant was higher in the mutants. There was also considerable variation in dry weight of nodules per plant and in seed yield. However the number of nodules per plant showed no correlation with seed yield, nodule size may be more relevant. The N content of the shoots at anthesis was positively correlated with dry weight of nodules, seed protein % and seed yield per plant.

From: ROSAIAH, G., KUMARI, D.S., SATYANARAYANA, A. and SEENAIAH, P., (Nagarjuna University, Nagarjunanagar, Guntur, Andhra Pradesh 522 510, India). Indian Journal of Agricultural Sciences 57 (1987) 271-273.

Dwarf mutant of rice variety "Seratus Malam"

Seeds of "Seratus Malam", a local tall upland variety with long panicles and high yield potential were irradiated with 10-50 krad gamma rays in 1983. From 50 000 M_2 plants, 130 semidwarf mutants and 1 dwarf mutant were selected. The dwarf mutant M-362 was obtained from the 10 krad treatment. The mutant shows about 50 % reduction in plant height, but also in number of productive tillers. Thus the yield per plant is also significantly less. However, the mutant gene is not allelic to DGWG and therefore may be useful in cross breeding.

From: MUGIONO, P.S. and SOEMANGGONO, A.M.R., (BATAN, Jakarta, Indonesia). International Rice Research Newsletter 13 No.1 (Feb. 1988) 5.

Seed protein and nitrogen fixation in chickpea mutant variety "Hyprosola"

"Hyprosola" is a high yielding, high protein mutant cultivar obtained after gamma irradiation from the variety "Faridpur-1" [1]. The mutant yields 45 % more protein per unit area. The essential amino acid index is unchanged. It is likely that the high nutritional value in "Hyprosola" seed protein arises from an increase in the albumin:globulin ratio. Nitrogen fixation rates of the mutant during the first 7 weeks of growth were found to be similar to "Faridpur-1". Under field conditions, the mutant may be able to nodulate more rapidly and more extensively than the parent variety.

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[1] SHAIKH, M.A.Q., AHMED, Z.U., MAJID, M.A., WADUD, M.A., Environmental and Experimental Botany 22 (1982) 483-489.

From: SCHROEDER, H.E., GIBSON, A.H., ORAM, R.N., (CSIRO, Division of Plant Industry, Canberra ACT 2601, Australia) and SHAIKH, M.A.Q. (Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh). J. Sci. Food Agric. 44 (1988) 31-41.

XA0201024

Vine type mutant induced in Vigna mungo L.

Dry seeds of the black gram variety T_9 were irradiated with 10-30 kR gamma rays followed by treatment with 0.25 % EMS. Several vine type mutants were obtained, showing 2.5 times increase in final plant height. Pollen fertility was normal, maturity period unaffected. Segregation ratio suggests monogenic recessive inheritance of the vine type.

From: SINGH, R.K., RAGHUVANSHI, S.S. and PRAKASH, D., (Plant Genetics Unit, Department of Botany, University of Lucknow, India). Plant Breeding 99 (1987) 27-29.

Chromosomal location of gamma ray induced dwarfing gene Rht12 in wheat

A dwarfing gene mutation was induced by gamma rays in the winter wheat cultivar "Karcagi 522" [1]. Segregation ratios suggest dominant inheritance [2]. By F_2 monosomic analysis it was found that the gene called Rht12 is located on chromosome 5A.

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[1] VIGLASI, P., Acta Agronomica Hung. 17 (1968) 205-214.
[2] KONZAK, C.F., WILSON, M.R. and FRANKS, P.A., IAEA TECDOC-307 (1984) 39-50.

From: SUTKA, J. and KOVACS, G., (Agric. Res. Institute, Hung. Acad. of Sciences, 2462 Martonvasar, Hungary) Euphytica 36 (1987) 521-523.

Radiation-induced mutations in sweet cherry (Prunus avium L.)

Dormant scions of "Bing" were exposed to 1 - 2.5 kR gamma radiation. The main buds were excised and the scions grafted to allow the growth of accessory buds into primary shoots. The frequency and types of mutations were described in a population of 3307 M_1V_2 shoot. The overall mutation frequency was 2.7% incl. 0.15% growth-reduced mutants. The experiment was repeated using 3kR and 4kR fractionated doses in water. Differences in mutation frequency at 3kR and 4kR were not significant. Of 2765 surviving M_1V_2 shoots derived from irradiation of accessory buds of both standard and V_1 shoots, the overall mutation frequency was

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3.3% incl. 1.7% partial leaf mutants, 1.0% leaf mutants, and 0.54% growth-reduced mutants. For maximum mutation rate with adequate survival we suggest acute irradiation of accessory buds in air at dosages approximating LD50. Mutant sectors in M_1V_1 shoots derived from accessory buds are larger than those from main buds, as revealed by the higher number of mutant repeats.

From: SAAMIN, S. (Cocoa and Coconut Research Division, Malaysian Agricultural Research and Development Institute) and THOMPSON, M.M. (Department of Horticulture, Oregon State University, Corvallis, OR 97331, USA). Abstract of poster presented at SABRAO International Symposium and Workshop on Gene Manipulation for Plant Improvement in Developing Countries, 30 November – 3 December 1987, Kuala Lumpur, Malaysia.

Mutation induction in Lathyrus sativus L.

Seeds of the grass pea varieties "LSD 6" and "S 220" were treated with 10 - 25 kR gamma rays, 0.1 - 0.4% EMS or 0.01 - 0.04% NMH. DMSO in 1% solution applied together with 10 kR gamma rays, 0.1% EMS or 0.01% NMH increased the effects of the mutagens. M_2 progenies were checked for morphological and leaf color mutations. From data obtained the following treatments appear appropriate: 15kR gamma rays; 10 kR gamma rays + DMSO; 0.1% EMS; 0.01% NMH.

From: SINGH, M. and CHATURVEDI, S.N., (Raja Balwant Singh College, Agra U.P. 282002, India). Ind. J. Agric. Sciences 57 (1987) 503-507.

Arachin polymorphism in groundnut following mutation induction

Gel electrophoresis showed 3 major arachin components of Mr 70.7, 63.8 and 60.9 kD in the variety "Spanish Improved". "TG 1" (a x-ray induced mutant from "Spanish Improved") showed components of 70.7, 63.8 and 59.5 kD. "TG 18" a derivative of a cross between the two showed only two components of 70.7 and 63.8 kD.

From: KRISHNA, T.G. and MITRA, R. (Nuclear Agric. Div., BARC, Trombay, Bombay 400085, India). Phytochemistry 26 (1987) 897-902.

Resistance to brown-spot disease in rice improved by mutation induction

The high yielding rice cultivar "Pusa 33" suffers considerable losses due to "brown-spot" disease caused by Helminthosporium oryzae Breda de Haan. Seeds were treated with 0.15 - 0.6% EMS (6h 24°C, pH 5-9). Germinating M_2 seeds were sprayed with the toxin extracted from the fungus. Toxin tolerant seedlings were grown to maturity, M_3 offsprings were retested for toxin resistance. Resistant mutant lines showed an increase in grain yield from 8.8 to 10.9 g per plant.

From: BORAH, S.P. and GOSWAMI, B.C., (Dept. of Botany, Gauhati University, Gauhati, India). Z. Pflanzenzüchtg. 96 (1986) 185-188.

Alternaria resistance of Brassicae campestris L. improved by induced mutations

Seeds of "YS 52", a cultivar susceptible to Alternaria brassicae (Berk.) Sacc., were exposed to gamma rays (30 - 90 kR). Eight more resistant mutants were selected in M3 and subjected to further field evaluation. The best mutant "17-5-83" appeared resistant and gave 44% higher yield than the parent, mutant "70-7-82" was found to be moderately resistant and gave a yield 21% higher than the parent. The yield increases seem to be connected with plant architecture changes.

(Contributed by M.L. Das and A. Rahman, Bangladesh Institute of Nuclear Agriculture, Mymensingh).

Mutation spectrum in peas following treatment with fast neutrons and NEH

Seeds of Pisum lines "Wt 3527" and "Wt 4042" were treated with 200 and 500 rad of N_f or 0.014 % NEH (8h, pH 4,5-5) or the combination of the two (irradiation followed by NEH treatment). Among 30 000 M_2 plants 1314 mutants were identified. N_f were the least effective in terms of number of mutants, but induced the widest spectrum, alone as well as in combination with NEH. A number of hitherto unknown mutant genes were identified after the combined treatment of the line "Wt 3527".

From: SWIECICKI, W.K. (Poznan Plant Breeders, Plant Experiment Station, Wiatrowo, Poland), Plant Breeding 98 (1987).

Induction of mutations in Japanese millet, Echinochloa furmentacea (Roxb.) Link

Seeds of cultivars "VL8" and "VL11" were treated with EMS, gamma rays and a combination of both mutagens. Chlorophyll mutation frequencies were as follows:

Treatment	VL 8	VL 11
15kR	6.0	9.6
15kR + 0.1% EMS	8.5	10.5
30kR	10.1	10.5
30kR + 0.1% EMS	9.8	9.0
0.1% EMS	6.6	8.6

From: MEHRA, H.S., JOSHI, H.C., CHIKARA, J., (Vivekananda Parvatiya Krishi Anusandhan Shala, Almora, Uttar Pradesh 263 601), Ind. J. Agric. Sci. 55 (1985) 294-295.

Use of induced chlorophyll deficient mutants to identify "heterotic blocks" in pearl millet chromosomes

Chlorophyll deficient mutant stocks induced in "Tift 23" of pearl millet (Pennisetum americanum L. Leeke) were crossed with "Tift 23" and 5 other normal inbreds to study the effect of these deleterious recessive genes on yield. The difference between near-isogenic S_1 (F_2) populations homozygous or heterozygous for the chlorophyll deficiency was not significant. However among 69 S_1 progenies from crosses with other inbreds the heterozygotes were higher yielding than the homozygotes in 53 cases, 15 of which were significant. A mutant like "M5" identified a high yield "heterotic block" in "Inbred 104" and a very low yield "heterotic block" in "Inbred 186".

From: BURTON, G.W., (University of Georgia, College of Agriculture, Agronomy Department, Tifton, GA 31793). Crop Science 26 (1986) 537.

Mutation induction for domestication of Cuphea: Effects of gamma rays

Oils of the socalled lauric acid group plants are very interesting for industries commercially because of their relatively high content of saturated medium chain triglycerides (MCT), in particular lauric acid ($C_{12:0}$). Steep melting point curves and low melting points make these oils particularly suitable as fats for synthetic creams, hard butters and similar products; sodium soaps of MCT's are hard, stable to oxidation, and free lathering. Palm kernel oil from *Elaeis guineensis* Jacq. and coconut oil from *Cocos nucifera* L. are the two most important commercial source of MCT's for the chemical industry. However, because of large variation in production and price, industries became interested in a continous supply of MCT's from other species.

The genus *Cuphea* (*Lythraceae*) contains a large number of herbaceous annuals adapted to temperate climate whose seed oil contains high levels of MCT's. Unfortunately, a common characteristic of the wild species is seed shattering during ripening. Seed shattering could be due to floral zygomorphy which causes the placenta to rupture the ovary wall during development, exposing the seeds; exposed seeds dry and are quickly shed. Seed dormancy is another major deterrent to the agronomic use of *Cuphea*. It appears to result from hard seed coats as well as from physiological factors and can be effectively broken only by prolonged after-ripening (up to a year).

Natural genetic variation in *Cuphea* does not appear to be suitable for the development of non-shattering types. Therefore, the potential of broadening genetic variation through mutagenesis (using EMS) was investigated, first in the autogamous species *C. aperta* and in the allogamous species *C. lanceolata*, and *C. procumbens*. Mutants having somewheat improved seed retention were selected from all three species, however, expressivity was complete only in *C. aperta*. According to HIRSINGER and RÖBBELEN, the autogamous species *C. tolucana* Peyr. (n=12) and *C. wrightii* A. Gray (n=22) would be more promising candidates than *C. aperta* for domestication: Both are characterized by erect growth, a high number of fruits which are generally borne on the upper portion of the plant, surplus space in the fruits (enhancing the chances of developing a non-shattering type), and lauric acid yields (as a percentage of total seed fatty acids) of 63.3 and 53.9%, respectively. *C. tolucana* is a diploid whereas *C. wrightii* may be an allopolyploid.

Therefore, in a new series of experiments, dry seeds (2% moisture) of *Cuphea tolucana* and *C. wrightii* were exposed to 0 to 30 kR of gamma radiation. After irradiation the seeds were hydrated in oxygenated water. Responses of both species were curvilinear but *C. tolucana* was considerably more sensitive to gamma radiation than *C. wrightii*. The range of exposure causing 40 to 60% plant height reduction was approximately 5 to 8 kR in *C. tolucana* and 9 to 17 kR in *C. wrightii*. In a second experiment under the same conditions, *C. tolucana* was exposed to levels of 0 to 12.8 kR and *C. wrightii* to levels of 0 to 60 kR. A 50% plant height reduction was caused by 10-12 kR in *C. tolucana*, and between 11 to 18 kR in *C. wrightii*. Results of both experiments are consistent with the experience that chromosome number and tolerance to radiation are positively correlated. For large scale mutation breeding work, the appropriate gamma ray doses should be 8-12 kR for *C. tolucana*, and between 11 to 18 kR for *C. wrightii*.

(Contributed by T.A. Campbell, Plant Sciences Institute, Beltsville Agricultural Research Center, United States Department of Agriculture, Agricultural Research Service, Beltsville, MD 20705, USA).

Barley mutant line with high protein yield

Mutation breeding was initiated in 1969 at the Agricultural Research Institute, Nicosia, aiming at developing high yielding barley lines having also high protein or lysine content. The final results were reported at the FAO/IAEA Research Co-ordination Meeting at Nicosia in 1980 [1]. At that time some lines were superior to their mother line in grain yield, protein content or protein yield. However, high yield is essential for feed-barley as there is no premium price for protein content or quality.

In the experiments reported earlier, the mean grain yield of mutant M-Att-73-337-1 was 3202 kg/ha, 9.9% higher than the mother variety "Attiki". The Kjeldahl protein content was 12.7% for the mutant line and 13.4% for the mother variety. The mutant line was further evaluated in field trials (11 m^2 plots and 6 replications) during 1983-88, along with other promising material from the breeding programme.

The performance of the mutant line and its mother variety "Attiki" is summarized as follows:

Variety/ line	Grain yield kg/ha	1000-grain weight(g)	Straw (kg/ha)	Number of spikes per m^2	Kjeldahl protein (%)	Protein yield kg/ha
M-Att-73-337-1	4631	41	6277	425	11.9	503
Attiki	4220	35	5390	382	12.5	477

The mutant line outyielded its mother variety by 9.7% in grain yield and 16% in straw yield. These increases are apparently the result of increased 1000-grain weight and a higher number of culms per m^2. Protein content of the mutant line was slightly lower, but its protein yield was 5.5% higher.

The yield of the mutant line over 16 trials during 1983-88 was also 4% higher than the yield of the main commercially grown variety "Athenais".

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(Contributed by A. Hadjichristodoulou, Field Crops Section, Agricultural Research Institute, Nicosia, Cyprus).

In vitro mutation breeding for salinity tolerance in Citrus

Mutation breeding began in the 1970's, concentrating on early ripening and high quality spontaneous mutants, subsequently on the induction of seedless mutants by gamma radiation and other mutagens. Extremely early cultivars "Guoqing 1 to 5" have been obtained from bud mutations in satsuma mandarin and are grown commercially. Other desirable mutants have been found in progenies from gamma ray treated budwood. Recently we introduced plant tissue and cell culture techniques hoping to avoid chimerism and diplontic selection and to obtain solid mutants in a shorter time, resistant to salt, herbicides, low temperature and diseases.

I. Methods for cell and protoplast culture

Ovules from fruitlets 1 - 6 weeks after flowering, cultured in MT supplemented with IAA 0.1 mg/l and KT 1.0 mg/l, gradually produce callus from nucelli. After several passages, habituated callus lines are obtained, which grow very well in MT medium without any growth substances. These callus lines, regardless of the species and cultivars, are white, friable, composed of cell clumps of various size and highly embryogenic. When transferred to MT medium containing 2% glycerol and caseinhydrolysat 400 mg/l, they become green and form numerous green globular embryoids within one month. Most of the embryoids derive from single cells. The embryoids could develop roots and shoots forming large numbers of plantlets in a fresh medium. Habituated callus lines have been established in 5 cultivars. Their high embryogenic capacity of single cell origin provides good material for mutation induction.

For obtaining protoplasts, the habituated calluses were transferred into liquid MT medium and cultured for two passages on a shaker, then they were macerated with enzyme solution containing 0.3% - 0.5% pectinase, 0.3% - 0.5% cellulase, MT macroelements and 0.7 M mannitol, at 5.7 pH. After incubation at 25°C for 12 - 16 hrs., a large number of viable protoplasts could be collected. They were resuspended to a density of 80 000 - 100 000 protoplasts/ml and kept in liquid MT containing 0.14 M sucrose and 0.46 M mannitol. After 4 days, a few protoplasts resumed division, 2 weeks later, about 15% of the protoplasts have divided once to three times, looking like proembryos. After 2 months, they formed visible globular embryoids, which would develop plantlets after transfer. For plant proliferation, the appropriate media were MT supplemented with BR (Brassinolide) 0.001 mg/ml - 0.02 mg/l and 6BA 3 mg/l - 5 mg/l or 6BA 1 mg/l - 5 mg/l and NAA 0.25 mg/l - 1.0 mg/l. With the combinations of BR and 6BA, even root segments could develop adventitious buds.

II. Mutagenic treatment

The mutagens used include gamma radiation, EMS, SA and PYM (Penyanmycin). PYM, a kind of antibiotic, was discovered by the Genetics Research Institute of the Chinese Academy of Science. It is a stronger mutagen than EMS and can induce a large amount of chromosome aberrations. But application of gamma radiation to cells and protoplasts seems to operate more easily, since chemical mutagens usually give rise to breaks in protoplast membrane and loss of protoplasts.

The LD50 of gamma radiation, EMS, PYM and SA for Citrus callus cells were 5 - 7 Krad, 0.3% (25°C, 12 - 24 hrs.), 0.5 - 2.5 µg/ml (25°C, 8 hrs.) and 0.01 M - 0.05 M (25°C, 8 hrs.), respectively. Protoplasts were much more sensitive. Decrease of cell and protoplast viability, delay in cell wall regeneration of protoplasts and the first division of cells derived from protoplasts, and reduction in colony formation were effects of mutagenic treatments.

Gamma radiation of 7 krad and EMS at 0.2% - 0.5% produced 6.50% and 5.98% chromosome aberrations, respectively, but SA very few. Among the aberrations were lagging chromosomes, fragments, bridges, unequal divisions and micronucleates, some of which could lead to sterility and seedless fruit mutants.

III. Selection for salt tolerance

The habituated callus cells, having recovered after treatment with mutagens, were exposed to NaCl. Through continuous selection for 5 - 7 passages, mutant cell lines able to stand 0.8% NaCl were obtained in 4 rootstock varieties and 4 scion cultivars. They still possess embryogenic capacity and have regenerated many plantlets.

Growth curve analysis indicated that these NaCl tolerant cell lines, after 3 passages in non-selective medium, kept similar growth increment and cell viability when placed again in NaCl medium. Under salt stress, the soluble protein content decreased significantly in the original cell lines but not in the mutant cell lines. The accumulation of proline in the mutant lines was 30% - 70% higher. Peroxidase activity of the mutant lines was lower and had an additional band compared with the original forms. Also Na^{+} and Cl^{-} absorption of the mutant lines was different indicating that the mutant lines could avoid NaCl.

At present, protoplasts isolated from these mutant cell lines are being cultured to obtain salt tolerant plants from protoplasts and embryoids have already been formed. Next we intend to fuse protoplasts of salt tolerant and non-tolerant lines for complementation test to further clarify the genetic nature of salt-tolerance and to use it perhaps as a genetic marker. Salt-tolerant scion and rootstock plants will be grafted together and checked for their performance under such circumstances.

(Contributed by Deng Zhanao, Zhang Wencai, Wan Shuyan, Citrus Research Institute, Huazhong Agricultural University, Wuhan, China).

Screening for spontaneous virulent mutants of barley powdery mildew (Erysiphe graminis DC)

Seedlings of 4 barley lines possessing resistance genes Ml-a6, Ml-a12 or Ml-g were inoculated with powdery mildew culture CR3, which is a-virulent to the 4 host lines. In total, 50 million conidia were screened for the occurrence of virulent mutants, 43 putative virulent mutants were found. They could be grouped into 5 genotypes according to the virulence spectrum. They might have originated by one of the following events: 1. admixture, 2. physiological events that allow a few conidia to establish colonies in spite of the presence of a functional gene for resistance, 3. mutation in a gene for specificity, 4. deletion or mutation in some kind of suppressing element in which case more than one virulence may be affected.

Based upon the virulence spectra, mating type, biochemical tests and analysis of test crosses, 3 of the genotypes were clearly classified as not being of mutational origin. Of the two remaining genotypes one differed in 4 virulences, the other by two virulences and one avirulence. Based upon expectations from the gene-for-gene concept, it is concluded that both were not of mutational origin. If in fact there are derived from a mutation, the concept of gene-for-gene interactions would have to be revised.

Assuming that no mutations for virulence were found in this experiment, the spontaneous mutation frequency from avirulence to virulence would be below $2x10^{-8}$.

From: TORP, J. and JENSEN, H.P., (Agric. Res. Dept., Risö National Laboratory, DK-4000 Roskilde, Denmark). Phytopath.Z. 112 (1985) 17-27.

Spontaneous mutation frequencies in barley

Estimation of the spontaneous mutation frequency requires screening of very large populations and has therefore rarely been carried out in higher plants. A study on inter-allelic recombination in the ml-o locus allowed to collect some data on spontaneous chlorophyll mutants. 1866 barley plants were progeny tested in the greenhouse. 25 plants segregated for newly arisen, spontaneous chlorophyll mutant genes. Among a total of 470129 seedlings screened there were 79 mutants ($1.7 \pm 0.6 \times 10^{-4}$). If these data are pooled with others from similar materials the resulting estimate is 1.6×10^{-4} in about 1,43 million seedlings. The estimate of the chlorophyll mutation rate per generation is close to 6.3×10^{-4} per diploid genome. Assuming that the number of loci that can give rise to chlorophyll mutants is in the order of 500, the spontaneous mutation rate would be in the order of 6×10^{-7} per locus and haploid genome per generation.

From: JÖRGENSEN, J.H. and JENSEN, H.P. (Agric. Res. Dept., Risö National Laboratory, D-4000 Roskilde, Denmark). Hereditas 105 (1986) 71-72.

Application of mutagenesis for improvement of grapevines

The objectives of our mutation breeding programme are to improve good clones in a limited number of characteristics. One year old grafted vines were treated with x-rays during dormancy just before bud burst. Root stocks and base of the grafted vines were shielded. Among varieties irradiated with 2-6 kR were the following: "White Riesling" clone 239-25 Gm, "White Riesling" clone 110-18 Gm, "Müller-Thurgau" clone 6-8 Gm, "Ruländer (Pinot gris)" clone 2 Gm, "Blauer Spätburgunder (Pinot noir)" clone 20 Gm and "Trollinger". Grafted and rooted vines were found to tolerate higher doses of radiation than unrooted cuttings. In M_1V_2 many chimeric and non-chimeric variant shoots could be observed.

Two stable periclinal chimeras were obtained in "White Riesling" and "Trollinger" after irradiation. Out of irradiated "Ruländer", mutants of "Weisser Burgunder (Pinot blanc)" type were selected. In another experiment using 1500 rad of fast neutrons mutants with the characteristics of "Blauer Spät-Burgunder (Pinot noir)" were found. Within progenies of irradiated "Blauer Spätburgunder" early ripening types with dark skin berries were discovered.

New mutant clones under evaluation show interesting properties with regard to stem rot, *Botrytis*, yield and quality.

From: BECKER, H., (Institute of Grape Breeding, D-6222 Geisenheim, FRG). Schweizerische landw. Forschung 26 (1987) 3.

Improvement of soybean variety "Bragg" through mutagenesis

Variety "Bragg" (Jackson x D49-2491) of soybean (*Glycine max*. (L.) Merrill) was found to be high yielding and widely adaptable throughout India. Its yield stability, however, is unsatisfactory, probably due to low germinability necessitating use of higher seed rate. With the main objective to rectify this defect, mutagenesis involving chemical as well as physical mutagens was used. Dry seeds were treated with EMS or MMS (0.2, 0.4 and 0.6%), or gamma rays (15, 20 and 25 kR) with and without additional exposure to UV (2 hrs at 260 nm) in 1982 [1]. In M_2, a mutation frequency ranging from 2.24 to 22.85% was observed. Screening of M_2 and of subsequent generations yielded a broad spectrum of mutations. Some of the mutants are agronomically useful. Among them, mutant "$T_2$14" resulting from 25 kR gamma rays + UV, was found to possess better germinability (+15%), earliness (5 days) and high yield during both rainy and post-rainy seasons in 1986 and 1987, when compared with the parent variety "Bragg". The mutant has smaller seed-size (TGW 125 g) than the parent (145 g). In soybean, large-seeded varieties were reported to have poorer seed germinability [2]. Thus, the better germinability of the mutant might be related to its reduced seed size. Seeds of the mutant show a light brown colour of the hilum in contrast to the black hilum of "Bragg". In other characters the mutant is similar to "Bragg".

The mutant should have potential for commercial cultivation in India. For confirmation of its agronomically superior performance, it is undergoing national evaluation in multilocational trials under "All India Co-ordinated Research Project on Soybean (ICAR)". The strain has been named "NRC-2".

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(Contributed by P.S. Bhatnagar, Prabhakar, S.P. Tiwari and J.s. Sandhu, National Research Centre for Soybean, Indore, 452 001, M.P., India).

XA0201041

Induced mutation altering flower colour in Chrysanthemum

"Flirt" is a double Korean type, small flowered *Chrysanthemum* of red colour. Rooted cuttings were treated with 1.5 - 2.5 krad gamma rays. A chimeral flower colour mutant was detected after 1.5 krad treatment. After purification through repeated cuttings a mutant clone was developed and released as commercial cultivar "Man Bhawan". It produces bi-coloured flower-heads: yellow and red at full bloom stage becoming completely yellow later on. By chromatography, 6 pigment spots could be identified in the variety "Flirt" but only 5 in the mutant, violet (hRf 69.83) being absent. Spectrophotometric analysis of petal extracts showed presence of three peaks in both "Flirt" and "Man Bhawan" at full bloom stage but only two in "Man Bhawan" at fading stage.

From: DATTA, S.K., (National Botanical Research Institute, Lucknow 226001, India). J. Nucl. Agric. Biol. 16 (1987) 217-218.

"Hari" a mutant cross derived rice variety released in India

TR-RNR-21 is a derivative from a cross between "IR-8" and "TR-5", the latter being a N_f-induced dwarf mutant of the salt tolerant variety SR-26-B. In initial yield evaluations at BARC during 1972-78 it gave higher yields of 54% in monsoon season and 19% in dry season over "Jaya" and compared favourably with "IR-8" and "Sona".

XA0201042

During 1975-80, trials were conducted by the Andhra Pradesh Agricultural University (APAU), Rajendranagar and the All India Co-ordinated Rice Improvement Project (AICRIP), at Rajendranagar, Hyderabad. In these trials TR-RNR-21 was compared with "Pankaj", "Jaya", RP-4-14, "Sona", "Surekha", RNR-323341 and "Prabhat". Compared with the highest yielding check and all the seven checks combined, overall average yields of TR-RNR-21 were higher by 10.1 and 19.8% respectively.

Since 1981, TR-RNR-21 was included in minikit trials of Andhra Pradesh State. Results from over 90 locations of the Telangana region show that mean grain yield of 3843 kg/ha was 19% more than the yield of the local checks. In view of its consistantly superior performance, TR-RNR-21 was released as 'Hari' in 1987 for general cultivation in the irrigated transplanted conditions of the Telangana region of Andhra Pradesh, excepting the endemic gall midge prone areas.

'Hari' is a medium duration variety maturing within 135-140 days. It is a semi-dwarf (93 cm), erect, compact and non-lodging type with dark green foliage; anthocyanin pigment absent; grain long (10.1 mm), slender with kernel length/breadth ratio of 3.54; kernel flinty, white, translucent and non-glutinous; white belly absent; TGW 25.2 g; protein content 7.1%; bulling, milling and head recovery - 80, 74.5 and 68% respectively; cooking quality good. It is not affected seriously by blast, tungro virus, sheath blight and brown leaf spot diseases and green leaf hopper, leaf folder and stem borer insect pests. A characteristic of this variety is that the flag leaf is long, stays far above the panicle and remains green till maturity.

(Contributed by P. Narahari, Nuclear Agriculture Division, Bhabha Atomic Research Centre (BARC), Trombay, Bombay 400 085, India).

Multifoliate leaf mutants of mungbean and urdbean

Both mungbean (*Vigna radiata* (L.) Wilczek) and urdbean (*Vigna mungo* (L.) Hepper) are characterized by trifoliate leaves.

In the M_2 of mungbean cultivar "Pant Mung-2" after treatment with 40 kR gamma rays a mutant was identified in which each leaflet is substituted by a trifoliate leaf, giving 9 or even more leaflets. The mutant was established as a true breeding line. The character is controlled by a single recessive gene which was designated *mfl*.

In urdbean, the same type of mutation was detected in the M_2 of the cultivar "Netiminumu" after treatment with 50 kR gamma rays. Also this mutant character (designated *mfl*) shows monogenetic recessive inheritance.

(Contributed by A, Satyanarayana, Y, Koteswara Rao, P, Seenaiah and D, Kodandaramaiah, All India Co-ordinated Pulses Improvement Project, Regional Agricultural Research Station, Lam, Guntur 522 034, India).

Gamma ray induced somatic mutations in rose

Budwood of 32 rose cultivars (*Rosa* spp.) was exposed to 3-4 krad of gamma rays and eyes were grafted on *Rosa indica* var. *odorata* root stock. Radiosensitivity with respect to sprouting, survival and plant height, and mutation frequency varied with the cultivar and dose of gamma rays. Somatic mutations in flower colour/shape were detected as chimera in 21 cultivars. The size of the mutant sector varied from a narrow streak on a petal to a whole flower and from a portion of a branch to an entire branch. 14 mutants were detected in M_1V_1, four in M_1V_2 and three in M_1V_3. Maximum number of mutations was detected following 3 krad treatment. Eyes from mutant branches were grafted again on root stock and non-chimeric mutants were aimed at by vegetative propagation. Mutants from 11 cultivars only could be isolated in pure form. Isolation of non-chimeric mutants sometimes is difficult due to weak growth of a mutant branch. In such a case, all normal looking branches are removed to force a better growth of the mutant branch. It is advisable to maintain irradiated plants at least for four years with drastic pruning in each year.

Nine mutants viz. "Sharada", "Sukumari", "Tangerine Contempo", "Yellow Contempo", "Pink Contempo", "Striped Contempo", "Twinkle", "Curio" and "Light Pink Prize" have already been released as new cultivars for commercialization [ref. MBNL No. 23 and 31] and others are being multiplied and assessed. The original and mutant colours are shown in the Table. The mutation spectrum appears to be wider for the cultivars "Contempo" and "Imperator". Pigment composition of the original variety is relevant for the kind of flower colour mutations that can be induced.

Table. Gamma ray induced somatic mutations commercialized in rose

Original cultivar and colour	Mutant cultivar and colour/shape
America's Junior Miss (Coral pink)	Sukumari (light pink)
Contempo (Copper orange with yellow eye)	Yellow Contempo (Empire yellow)
	Tangerine Contempo (Tangerine orange)
	Pink Contempo (pink)
	Striped Contempo (yellow stripe on orange background)
First Prize (Blend of light red and deep pink)	Light Pink Prize (light pink)
Imperator (Cherry red)	Twinkle (pink stripe on cherry red background)
	Curio (small group of flowers at the centre of flower)
Queen Elizabeth (Carmine)	Sharada (Blossom pink)

(Communicated by Dr. S.K. Datta, Mutation Breeding Lab., National Botanical Research Institute, Lucknow 226001, India).

XA0201045

Sodium azide mutagenesis in wheat: mutants with golden glumes

In bread wheat, Triticum aestivum L. (2n=6x=42, AABBDD), detection of induced mutations is hampered by the presence of duplicate and triplicate genes [1]. Induced changes in spike characteristics are known, but mutants with changed glume colour do not seem to have been reported. Physical mutagens such as gamma rays, thermal neutrons and fast neutrons, and chemical mutagens like EMS, EI, dES and NEH have been extensively used for induction of mutations in bread wheat but it seems as if these mutagens did not induce mutants with changed glume colour.

We used sodium azide for inducing mutations in the widely adapted cultivar "Sonalika", which is characterized by brown glume colour. Presoaked seeds were treated with 0.2M sodium azide for 3 hours. Three spikes were harvested from each M_1 plant. M_2 generation was space-planted as spike progeny. We were successful in identifying 3 mutants with golden glumes. The mutants resemble "Sonalika" in other spike characteristics. The mutants glume colour was confirmed in M_3.

The mutants were also evaluated for agronomically important characteristics. Some characters were significantly different from the parent.

Character	Sonalika (parent)	Mutant a	Mutant b	Mutant c
Plant height (cm)	98.8	90.8	91.2	95.0
Number of productive tillers	14.8	27.8*	19.6	25.6*
Number of spikelets per spike	17.8	19.8	19.2	20.2
Number of grains per spike	48.6	61.8*	50.8	60.4*
Grain yield per plant (g)	22.2	45.8*	34.3*	50.4*
1000 grain weight (g)	45.4	46.8	50.8*	55.2*
Glume colour	Brown	Golden	Golden	Golden

* Significantly different from the mother cultivar "Sonalika"

Glume colours may be useful as genetic markers since such characters are less influenced by the environment. Our investigation confirms that also agronomically useful genetic variation may be readily induced in bread wheat through sodium azide.

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(Contributed by K.A. Siddiqui, K.A. Jafri and M.A. Arain, Division of Plant Genetics, Atomic Energy Agricultural Research Centre, Tandojam, Pakistan).

XA0201046

Mutation induction in grasspea (Lathyrus sativus L.)

Grasspea is a widely grown food legume in Bangladesh, suited particularly for marginal conditions. Its yields are low, its main drawback, however, is that the seeds contain a neurotoxin BOAA, which requires heat degradation before consumption. The genetic base of local varieties is rather narrow. Introduced varieties are even lower yielding than the local ones or fail to flower and produce seeds. Thus, mutation induction of local cultivars should be regarded as a means for creating useful genetic variation.

Seeds of the grasspea cultivar "BINA Acc. No.1" collected from Jessore were treated with 2-5 mM solutions of sodium azide. A wide range of genetic variation was obtained regarding plant height, number of pods per plant, days to maturity.

From: ALI, M.S., SHAIKH, M.A.Q., ISLAM, M.S. and SAHA, C.S., (Plant Genetics Division, B.I.N.A., POB 4, Mymensingh, Bangladesh). Bangladesh J. Nucl. Agric. 2 (1986) 41-49.

Radiosensitivity of cotton

Seeds of three varieties of Gossypium arboreum L.(2n=2x=26) and two varieties of G. hirsutum L. (2n=4x=52) were gamma irradiated. Seedling growth and seedling survival were recorded 15 and 30 days after planting, respectively. The following results were observed:

Variety	Radiation doses in Gy for	
	50% growth reduction	50% of lethality
Brown lint (2n=26)	180	224
White lint (yellow flower) (2n=26)	285	272
White lint (white flower) (2n=26)	255	362
Si Sumrong 2 (2n=52)	470	508
Si Sumrong 3 (2n=52)	520	1408

(work supported by IDRC)

From: WONGPIYASATID, A., (Dept. of Appl. Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand). Bangladesh J. Nucl. Agric. (1986) 18-26.

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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
Abelmoschus esculentus (L.) Moench (= Hibiscus esculentus L.) (okra)			
MDU 2	India, 1978 Sree Rangasamy Tamil Nadu University Coimbatore 641003	DES 0.04% seeds [Pusa Sawani]	Attractive light-green long fruits; increased yield (12.3%), less crude fibre
Arctium lappa L. (burdock)			
Tsuneyutaka	Japan, 1986 Y. Yanagisawa, Y. Saishu Kenkyuukai Co. Hatori, Minori-machi Ibaraki-ken	Gamma rays seeds, 1969 [Yanagawa-risou]	Thick root, good growth of the root, high quality
Bougainvillea sp. (bougainvillea)			
Poultoni Variegata	India, 1981 V. Abraham, B.M. Desai Nuclear Agric. Div. BARC, Bombay 400 085	Chronic gamma rays 1.5 krad rooted cuttings, 1987 [Poultoni]	Variegated 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
Suvarna	India, 1981 B.M. Desai, V. Abraham Nuclear Agric. Div. BARC, Bombay 400 085	Colchicin 0.05% Gamma rays 1 kR rooted cuttings [Lady Hudson of Ceylon]	Young bracts golden colour turning to pinkish lemon when older
Brassica napus L. (rape)			
Stellar	Canada, 1987 R. Scarth, P.B.E. McVetty, S.R. Rimmer, B.R. Stefansson Plant Science Dept. University of Manitoba Winnipeg R3T 2N	(<u>M11</u> x Regent) x Regent M11 = EMS-induced mutant [Oro]	3% linolenic acid, 28% linoleic acid; low erucic acid and low glucosinolate from "Oro"
Capsicum annuum L. (pepper)			
Horgoska slatka-X-3 (H.S-X-3)	Yugoslavia, 1974 I. Karasz	Gamma rays	Spice pepper, resistant to CMV
Corchorus olitorius L. (tossa jute)			
JRO 3690 (Savitri)	India, 1985 D.P. Singh Dept.of Plant Breeding College of Agric. Pantnagar	Cross mutants "tobacco leaf" x "long internode" both from X-ray treatment 50 kR, dry seeds	Average 300-350 cm, yield increased by 0.2 t/ha, less damaged by *Apion* and yellow mite

Cynodon dactylon x C. transvaalensis (sterile triploid bermuda grass)

Tifgreen II	USA, 1983 G.W. Burton USDA Univ. of Georgia Tifton GA 31793	Gamma rays 7 krad dormant rhizomes, 1971 [Tifgreen]	Compared with "Tifgreen" under minimal management, more vigorous, denser turf, more resistant to root knot, stubby and sting nematodes, better spring recovery

Dianthus caryophyllus L. (carnation)

Maiella-lonchabi	France, 1982 Y. Mitteau Lab. Phys. Veget. S.N.C. Barberet & Ducloux La Londe-Les-Maures; A. Silvy Lab. d'Amél. Plantes CEN Cadarache	Gamma rays 50 Gy 1980 [Pallas-londorga]	More resistant to Fusarium oxysporum; unicoloured pale-yellow
Galatee-lonvego	France, 1982 Y. Mitteau Lab. Phys. Veget. S.N.C. Barberet & Ducloux La Londe-Les-Maures; A. Silvy Lab. d'Amél. Plantes CEN Cadarache	Gamma rays 50 Gy 1980 [Pallas-londorga]	More resistant to Fusarium oxysporum; unicoloured yellow-bronze
Loncerda	France, 1983 Y. Mitteau Lab. Phys. Veget. S.N.C. Barberet & Ducloux La Londe-Les-Maures; A. Silvy Lab. d'Amél. Plantes CEN Cadarache	Chronic gamma irrad. and in-vitro culture [Elsy-londonie]	Very resistant to Fusarium oxysporum; unicoloured cherry-red

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
Glycine max L. (soybean)			
Doi kham	Thailand, 1986 S. Smutkupt, A. Wongpiyasatid, S. Lamsejan, K. Naritoom Dept. Appl. Rad. and Isotopes Kasetsart University Bangkok 10900	Gamma rays 15 krad seeds [S.J.4]	High resistance to rust (Phakopsora pachyrrhizi) 15% higher yield than SJ4 in rainy season with rust incidence, larger seed
Hibiscus moscheutos (ornamental hibiscus)			
Shirasagi-no-yume	Japan, 1987 H. Toratani, H. Hasegawa, M. Maeda Radiation Centre of Osaka Pref. Shinke-cho Sakai, Osaka	Gamma rays 30 krad seeds [Sakai-no-hana]	Reddish purple stripes on flower petals
Hordeum vulgare L. (barley)			
Amalia	Austria, 1988 Probsdorfer Saatzucht GmbH A-1011 Wien	Cross Trumpf/Ho 465/CF 25	High yield, good lodging resistance, tolerant to powdery mildew; high TGW
Comtesse	Austria, FRG, 1988 Nordsaat GmbH D-2322 Waterneversdorf	Cross 74195/Trumpf/ 5238-8-74/Aramir	High yield, good lodging resistance, tolerant against mildew and rust
Gunnar	Denmark, 1982 B. Nilsson Svalöf AB S-26800 Svalöv Sweden	Kristina x (Mari^6 x 57510-44) x A61718	Early maturing

Tyra	Norway, 1988 A. Heen Dept. of Crop Science Agric. University N-1432 As-NLH	Sold x SVA 71164 (both derivatives of Mari)	High yield, short straw, earliness
Ipomoea batatas (L.) Poir. (sweet potato)			
Yan-shu 759	China, 1986 Cui Guangqin Inst. Agric. Sci. Yan-tai County	Fast neutrons $4 \times 10^{11}/cm^2$ seeds [F_1 (Yan-shu 3 x Xu-shu 18)]	High starch content, resistant to black spot, short internodes, erect trailing plant type
Yan-shu 781	China, 1986 Cui Guangqin Inst. Agric. Sci. Yan-tai County	Fast neutrons $1 \times 10^{12}/cm^2$ seeds [F_1 (Feng Shou-huang x Hong-hong 1)]	High starch content, high yield
Morus alba L. (mulberry)			
7681	China, 1988 (Sichuan Prov.) Z. Ren, D. He, M. Wen Sericultural Res. Inst. Sichuan Acad. Agric. Sci.	N_2 laser 6 min, 345 joule seed, 1987 [F_1 (Cangxi 49 x Yu 2)]	Leaf yield ca. 20% over standard cultivar He-ye-bai. Tolerant to drought, resistant to mulberry blight; cultivated so far on 14 000 ha
S54	India, 1974 C.R. Sastry Central Sericult. Res. and Training Unit Mysore	EMS 0.1-0.6%, 6-24 h, 5-25°C seeds [Berhampore]	Improved leaf yield and leaf quality; better than "Kanva 2"

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
Orysa sativa L. (rice)			
Fu-no 101	China (Sichuan), 1987 D. Deng, W. Wu Sichuan Prov. Inst. of Appl. Nucl. Technology Chengdu	Gamma rays seeds, 1979 [Guichao No. 2 (indica)]	Glutinous rice, 5 days earlier heading, yield 6.5-7.5 t/ha = 6-7% higher than check; cultivation on 80.000 ha
IRAT 4 (= IRAT 51)	Senegal, 1968 M. Couey IRAT/ISRA	Chronic gamma rays 25-30 krad seeds, 1963 [Sintane Diofor]	
IRAT 5 (= IRAT 52)	Senegal, 1968 M. Couey IRAT/ISRA	Chronic gamma rays 25-30 krad seeds, 1963 [Sintane Diofor]	
IRAT 78 (= M18)	Côte d'Ivoire & Cameroon, 1976 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1970 [63-83 (Senegal)] = IRAT 2	More pubescent leaf blades, slightly shorter culm, more erect flag leaf, slightly later maturing, softer grain, horizontal resistance to Pyricularia oryzae from IRAT 2 but altered reaction to specific pathotypes
IRAT 79 (= M45)	Côte d'Ivoire & Cameroon, 1976 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1970 [63-83 (Senegal)] = IRAT 2	Higher tillering, narrow and shorter leaves, less awned, better specific adaptation to certain environments, horizontal resistance to Pyricularia oryzae from IRAT 2, but altered reaction to specific pathotypes

Oryza sativa L. (rice) contd.

IRAT 101 (= M55)	Côte d'Ivoire, 1976 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1970 [63-83 (Senegal)] = IRAT 2	Greater adaptability, higher TGW, shorter culm, shorter leaves
IRAT 113	Côte d'Ivoire, Guinea Bissau, 1979 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1974 [Morobérékan (Côte d'Ivoire)]	shorter plant height (120 cm), rel. late (130d), very little shattering
IRAT 114	Côte d'Ivoire & Cameroon, 1979 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1974 [Morobérékan (Côte d'Ivoire)]	Plant height reduced from 130-150 cm to 100-120 cm, rel. late, very little shattering
IRAT 115	Côte d'Ivoire, 1979 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1974 [Morobérékan (Côte d'Ivoire)]	Single recessive gene mutation for short culm, different from IRAT 13, very little shattering, rel. late (129d)
IRAT 116	Côte d'Ivoire, 1979 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1974 [Morobérékan (Côte d'Ivoire)]	Reduced plant height, very little shattering, erect flag leaf
IRAT 117	Côte d'Ivoire, 1979 M. Jacquot IRAT/IDESSA	Chronic gamma rays 25-30 krad seeds, 1974 [Morobérékan (Côte d'Ivoire)]	Reduced plant height, good tillering, rel. late

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 L. (rice) contd.			
IRAT 191 (= IREM 191)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974) [IAC 25 (Brazil)]	Tall, low tillering, early maturity
IRAT 192 (= IREM 192)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974) [IAC 25 (Brazil)]	Relatively tall, early maturity
IRAT 193 (= IREM 193)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974 [IAC 25 (Brazil)]	Tall, low tillering, early maturity
IRAT 194 (=IREM 194)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974 [IAC 25 (Brazil)]	Height reduced from 130-150 cm to 100-120 cm; single semi-dominant gene for short culm, different from IRAT 13; WARDA-recommended upland variety for Nigeria; good lodging resistance
IRAT 195 (= IREM 195)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974 [IAC 25 (Brazil)]	Relatively tall, med. tillering, early, soft grain

<u>**Oryza sativa L.**</u> (rice) contd.

IRAT 196 (= IREM 196)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974 [IAC 25 (Brazil)]	Tall, low tillering, early
IRAT 239 (= IREM 779)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974 [IAC 25 (Brazil)]	Tall, low tillering, early
IRAT 240 (= IREM 950)	Guyana & Brazil, 1980 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1974 [IAC 25 (Brazil)]	Tall, low tillering, early
IRAT 241 (= IREM 73-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Tall, med. tillering, hard grain
IRAT 242 (= IREM 575-1)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Height reduced from 130-150 cm to 100-120 cm; high TGW (43g)
IRAT 243 (= IREM 15-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Tall, low shattering, hard grain
IRAT 244 (= IREM 12-5)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Relatively tall, med. tillering, 118d till maturity, hard grain

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
<u>*Oryza sativa* L.</u> (rice) contd.			
IRAT 245 (= IREM 431-1-1)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Tall, med. tillering, 118d till maturity, hard grain
IRAT 246 (= IREM 346-3)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Tall, med. tillering, 118d till maturity
IRAT 247 (= IREM 75-1)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Tall, med. tillering, 118d till maturity, hard grain
IRAT 248 (= IREM 2-1)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Med. plant height, low tillering, 119d till maturity
IRAT 249 (= IREM 123-2-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [IAC 5100 (Brazil)]	Tall, med. tillering, 118d till maturity
IRAT 250 (= IREM 52-1)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Relatively tall, low tillering, 117d till maturity, hard grain

Oryza sativa L. (rice) contd.

IRAT 251 (= IREM 297-3)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Relatively tall, med. tillering, 123d till maturity
IRAT 252 (= IREM 46-4)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Relatively tall, med. tillering, 120d till maturity; higher TGW (41g), hard grain
IRAT 253 (= IREM 50-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Relatively tall, low tillering, 125d till maturity; higher TGW (43g), hard grain
IRAT 254 (= IREM 53-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Relatively tall, med. tillering, 125d till maturity, hard grain
IRAT 255 (= IREM 35-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Med. plant height, med. tillering, 125d till maturity, higher TGW (42g), hard grain
IRAT 256 (= IREM 46-2)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Pratao Precoce (Brazil)]	Med. plant height, med. tillering, 124d till maturity, less lodging, higher TGW (43g)
IRAT 257 (= IREM 41-1-3)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Makouta (Côte d'Ivoire)]	Relatively short culm, lodging resistant, 117d till maturity, low tillering

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 L. (rice) contd.			
IRAT 258 (= IREM 41-1-4)	Guyana & Brazil, 1983 R. Dechanet, IRAT Guyana M. Chatel, IRAT/CNPAF Brazil	Chronic gamma rays 25-30 krad seeds, 1978 [Makouta (Côte d'Ivoire)]	Relatively short culm, lodging resistant, low shattering, higher TGW (41g), hard grain
Kunihikari	Japan, 1987 H. Uchiyamada, Y. Koga, S. Samoto Hokuriku Agric. Exp. Station Inade, Jonetsu-shi Niigata-Ken	(Shu-2800 x Hokuriku 100) x Nagoyutaka	Lodging resistant, good eating quality
Setaria italica (L.) Beauv. (foxtail millet)			
Lugu No. 7	China, 1987 J. Zhong Inst. of Crop Research Shandong Academy of Agric. Sciences	Gamma rays 40 kR seeds [Lugu No. 2]	10-15 cm shorter, lodging resistant; 6-8 days later 1987: 18.000 ha
Triticum turgidum ssp. durum Desf. (durum wheat)			
Sredetz (720-C)	Bulgaria, 1988 K. Filev et al. Institute of Genetics Sofia	(No. 788 x Castelporziano) x Mexipak First parents were gametophyte irradiated before crossing with 2 krad gamma rays in 1976. For cross with Mexipak in 1977 pollen irradiated with 1.5 krad was used.	Good yield, lodging resistant, cold tolerant, more resistant to stem rust

Zeveryana	Bulgaria, 1986 K. Filev Institute of Genetics Sofia	(no. 788 x Creso) x Castelporziano First parents were gametophyte irradiated before crossing with 2 krad gamma rays in 1975. For cross with Castelporziano in 1976 pollen irradiated with 1.5 krad was used.	Short culm, but taller than "Creso", early, productive, highcontent of beta carotene
Vigna radiata L. (mungbean, green gram)			
ML 26-10-3	India, 1983 D.P. Singh Dept. of Plant Breeding College of Agriculture Pantnagar	Gamma rays seeds [ML-26]	Tolerant to yellow mosaic virus, high yield
Zea mays Mill. (maize)			
Luyu No. 5 (hybrid)	China, 1984 S. Hu et al. Inst. Appl. Atomic Energy Shandong Acad. Agric. Sciences	Yuanqi 123 x Huangzao 4	Early maturity, high yield, wide adaptability, good quality, good disease resistance 1985-87: 280.000 ha
Luyuan S.C.9 (hybrid)	China, 1987 S. Hu et al. Inst. Appl. Atomic Energy Shandong Acad. Agric. Sciences	Yuanqi 722 x Huangzao 4	Medium maturity, high yield, compact stature 1985-87: 53.300 ha
Yuanqi 123	China, 1978 S. Hu et al. Inst. Appl. Atomic Energy Shandong Acad. Agric. Sciences	Yuanwu 02 x Qi 31 (mutant derived from 25 kR gamma ray treatment)	Early maturity, disease resistance, flint kernel, good combining ability
Yuanqi 722	China, 1978 S. Hu et al. Inst. Appl. Atomic Energy Shandong Acad. Agric. Sciences	Yuanwu 02 x Qi 31 (mutant derived from 25 kR gamma ray treatment)	Medium maturity, disease resistance, semi-dent kernel type, good combining ability

NEW PUBLICATIONS

The Origin and Domestication of Cultivated Plants
(Proc. of symposium Rome 1985) Edit. C. Barigozzi
224p. Dfl. 160.- ISBN 0-444-42703-1
Elsevier, Amsterdam 1986

World Crops: Cool Season Food Legumes
(Proc. of Conference Spokane Wash. 1986) Edit. R.J. Summerfield
ISBN 90-247-3641-2
Kluwer Academic Publ. Dordrecht 1988

Mechanisms for Gene Transfer in Plant Improvement
(1987 Plant Science Lectures Series at Iowa State University)
US$ 8.- Prepaid orders to D. Fleig, Agronomy Dept., Iowa State Univ. Ames IA 50011
(Cheques payable to Iowa State University; from outside USA international money order).

Applied Mutation Breeding for Vegetatively Propagated Crops
C. Broertjes and A.M. van Harten
350p. Dfl. 350.- ISBN 0-444-42786-4
Elsevier, Amsterdam 1988

This book is an update of the earlier one "Application of Mutation Breeding Methods in the Improvement of Vegetatively Propagated Crops" by the same authors (Elsevier, 1978). It is a most useful source of information on the methodology of mutation breeding for all kinds of vegetatively propagated crops. All relevant species are covered in particular chapters including root and tuber crops, ornamentals, woody perennials and forest trees, fruit crops, fibre crops as well as "industrial crops", such as rubber, hops, mint. Many economically relevant results are mentioned (for update see the Mutation Breeding Newsletter). The book should be a standard text book for horticultural students and indispensable source of information for breeders working with vegetatively propagated plants.

Current Options for Cereal Improvement: Doubled Haploids, Mutants and Heterosis
(Proc. of FAO/IAEA Research Co-ordination Meeting, Guelph, Canada, 1986)
Edit. M. Maluszynski
Kluwer Acad. Publishers, Dordrecht 1989
ISBN 0-7923-0064-5 214p. price ca. Dfl. 30.-

FUTURE EVENTS

1989

26 Feb.-1 Mar Dutch-German Workshop "Secondary Plant Products from In-Vitro Cultures"
Contact: H. Breteler
Research Institute ITAL
P.O. Box 48, 6700 AA Wageningen, The Netherlands

5-9 Mar World Soybean Conference IV Buenos Aires, Argentina
Contact: J. Ramon Saez Garcia
Edificio Bolsa de Cereales
Avenida Corrientes 127
1043 Buenos Aires, Argentina
Telex: 21423 33572 BOCER AR

3-7 Jul — European Association for Potato Research
Pathology Section Meeting
Baden, Austria
Contact: E. Schiessendoppler
Bundesanstalt für Pflanzenschutz
Trunnerstr. 5, A-1020 Vienna, Austria

1-5 Oct — 9th Latin-American Congress of Genetics and
2nd Peruvian Congress of Genetics
Lima, Peru (official languages: Spanish and Portugese)
Contact: Comite Organizador C.P. 14-0010
Lima, Peru

21-23 Nov — 2nd Scientific Conference of Iraqi Atomic Energy Commission
Baghdad, Iraq
Topics incl. plant breeding, plant pathology, molecular biology
Contact: G.H. Al-Khateeb
Nucl. Research Centre P.O. Box 765
Baghdad, Iraq

1990

18–22 Jun — **FAO/IAEA International Symposium on the Contribution of Plant Mutation Breeding to Crop Improvement**
Vienna, Austria
Contact: A. Sokol, IAEA Conference Section
P. O. Box 100, Vienna, Austria

This symposium intends to discuss

(a) the economic benefits derived from mutant cultivars;
(b) the experiences in reaching particular breeding objectives by induced mutations;
(c) the restrictions for efficient mutation breeding in certain groups of plants like polyploids, cross-pollinators, apomicts;
(d) ways to improve the efficiency of mutation breeding, e.g. by optimal mutagen treatments, by choosing the appropriate material for treatment, by using in-vitro culture, by better selection methods;
(e) the potential use of computer simulation for optimizing mutation breeding projects;
(f) economic prospects of site specific mutagenesis, insertion mutagenesis and other kinds of gene engineering for crop improvement.

We would invite "posters" on all these topics. Submitted posters would be summarized and reviewed by invited speakers whether the authors attend the Symposium or not. Participation will require governmental nomination. A number of travel grants will be available.

25-30 Jun — 7th Int. Congress on Plant Tissue and Cell Culture
Amsterdam, The Netherlands
Contact: RAI Organizatie Bureau Amsterdam b.v.
Europaplein 12, 1078 GZ Amsterdam

NOTE

We do have a few spare copies of some older issues of the Mutation Breeding Newsletter. If you are interested in completing your library's set, please let me know which issues are missing and we will see whether we can help you.

Alexander MICKE

LAST BUT NOT LEAST

Please submit your contribution 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

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