Mutation Breeding Newsletter

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Mutant variety success in Burma

A mutant of the rice variety IR5, induced by gamma rays in 1971 and selected with the assistance of M.S. Haq while serving as expert under a IAEA Technical Assistance assignment, was approved for cultivation under the name "Shwe-war-Htun" in 1975. It is slightly taller than IR5, has a better looking, translucent kernel but retains the high amylose content. Its leaves are upright, the blades somewhat narrower and appressed in comparison to IR5. The variety "Shwe-war-Htun" became very popular. In 1976 it was cultivated on ca 34000 acres, 1981 on close to 2 million acres.

REFERENCE

Mutation Breeding Newsletter No. 12, 1978; No. 16, 1980.

(Contributed by A. Ashri, FAO-Expert at Yezin (Burma).

Mutation breeding in the People's Republic of China

Crop improvement by means of inducing mutations has been practiced in China since 1956. X-rays, gamma-rays, beta-rays, fast neutrons and thermal neutrons have been used, to some extent together with chemical mutagens. Different crop plant species including vegetables, fruit trees and medicinal herbs have received such mutagen treatments. Radiation has not only been used to induce mutations but also to promote genetic recombination. Hence, not only pure lines or varieties but also hybrid seeds, plants or tissue cultures were used as initial stocks. A large number of small study teams in communes also took part in mutation breeding. Through these teams large populations of progenies could be grown for screening desirable mutants. It has been reported that more than one hundred improved varieties and strains have been obtained through radiation breeding. The following ones are some examples:

1. Earliness is most desirable where double or triple cropping is practiced. "Yuanfeng Early" is an improved rice variety which matures fourty days earlier than the original variety "Kezi No. 6". Now it has been grown in the lower Yangtze River region on over 600,000 ha.

2. High yield is always wanted by farmers. "Emai No. 6" is an improved wheat variety which yields 20% higher than the original variety "Nanda 2419". It has been grown in Hubei province on over 330,000 ha. "Lumian No. 1" is a high yielding cotton variety which yields 48% higher than the original variety "Daizi No. 15" in lint and has as good a staple quality. It has been grown extensively in Shandong province.

3. Protein and oil content are important qualities of soybean and peanuts. "Tiefeng No. 18" is an improved soybean variety which yields 15% higher than the local variety. It has a protein content of 38% and an oil content of 22%. It has been grown in Liaoning province on over 260,000 ha. "Yeuyou No. 22" is an improved peanut variety of compact type. It yields 12% higher than the check variety, shows better resistance to pests and better tolerance against environmental stress. It has been grown in Guangdong province on over 240,000 ha.

4. Combining ability and disease resistance are very important for hybrid maize. "Yuanwu 02" is an improved inbred obtained through radiation breeding. It has a very good combining ability and is resistant to leaf spot. "Luyuandan No. 4" is a single-cross hybrid with "Yuanwu 02" as one of its parents. It has a growth period of around 80 days and has been grown in Shandong and other provinces on over 660,000 ha.

5. Cold resistance is of great importance in the in northern part of China. A bud mutation of pear has been obtained in Heilongjiang province, which could stand a temperature of $-33^{o}C$. After surviving several hard winters, now it began to set fruits. An improved fall-growing Chinese cabbage variety "Baicai No. 9" is cold tolerant. It has a growth period of 65 days, a higher yield and a better storage quality than local varieties.

6. As far as vegetatively propagated plants are concerned, useful mutants of mullberry, walnut, orange and apple were obtained. The mulberry mutant has bigger, thicker and more tender leaves, hence a higher yield. The walnut mutant has larger fruits of uniform shape. The orange mutant has fewer seeds, the apple mutant measures 145 cm in height and 120 cm in crown diameter, whereas the check variety at the same age measured 290 cm in height and 225 cm in crown diameter.

(Extracted from a paper "Application of Atomic Energy in Agriculture in China" by Guanren Zu, Director, The Institute for Application of Atomic Energy in Agriculture, Chinese Academy of Agricultural Sciences, Beijing, The People's Republic of China).

A compact mutant variety of olive induced by mutation

The large size of olive trees has become a limiting factor for economic cultivation because of the high costs of harvesting. If compact growth habit mutants could be induced in the outstanding commercial cultivars, these would be of immediate value for dense planting and easy fruit picking.

In order to tackle this problem, rooted cuttings of the olive cultivar "Ascolana" - a table olive - have been irradiated in the dormant stage of buds with gamma rays from a Co-60 source at a dose of 4 krad (exposure rate 250 rad/h). Somatic mutations (chlorophyll and morphological) were observed in MV_2 shoots originating from the MV_1 after cutting back. Some were isolated and multiplied by grafting.

Mutants with short internodes, loss of apical dominance or lateral shoot growth have received particular attention. A mutant clone which was agronomically evaluated for several years, is interesting for several characteristics. The plant height growth is reduced, height being only 50% of the original variety after 10 years. The plant habitus tends to be globous because of the reduced apical dominance. Flower initiation and fruit production start in the third year of plantation instead of the sixth year as for the original variety. The flowers of the mutant are completely male sterile and thus need to be pollinated by other cultivars. The clonal propagation of the mutant is easy, either by grafting or through root cuttings. The mutant clone proved to be uniform and stable, and the production constant. The olive mutant has been registered in Italy in 1981 under the name "Briscola".

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(Contributed by B. Donini and P. Mannino. Lab. Promozione e Sviluppo in Agricoltura, CNEN, C.S.N., Casaccia, Roma, and by G. Roselli, Centro di Studio sulla propagazione delle specie legnose, C.N.R., Piazza Puccini 4, Firenze, Italia).

Mutant variety of tobacco

Delhi 76 is a new bright tobacco developed in the breeding and genetics program at the Agriculture Canada Research Station Delhi (Ontario), tested before release under the number M15. In comparison to Delhi 34, Delhi 76 produced a much higher yield of better quality tobacco and shows higher tolerance to both common diseases black root rot and weather fleck. License No. 1704 was issued for cv. Delhi 76 on Nov. 1976 by the Production and Marketing Branch of Agriculture Canada.

Delhi 76 originated from a mutagenic study initiated in 1970 by Dr. B. Povilaitis. Dry seeds of Delhi 34 were irradiated with gamma rays, in the Gamacell 200 of the Atomic Energy of Canada Limited, Chalk River Nuclear Laboratories with 6 kR. This dose was optimal in inducing desirable variability in the progeny with a 53% survival rate. During 1971, a population of 100 plants was grown and 10 near normal plants were selected for seed production and subsequent progeny testing. Individual plants were evaluated for yield, leaf number, total alkaloids and ground sucker development in 1971 and 1972.

Replicated evaluation tests were conducted with 25 M_4-generation lines in 1973 and 3 M_5- and M_6-generation lines in 1974 and 1975, respectively. Mutant line M15 was evaluated for 3 years, 1973-75, in a total of five tests and was designated as Delhi 76.

Table 1. Mean values of agronomic data of five tests during 1973-1975

	Cultivar	
Character	Delhi 76	Delhi 34
Grade index ($/kg)	1.66	1.68
Yield (kg/ha)	2862.00	2613.00
Returns ($/ha)	4749.00	4381.00
Leaf no./plant	19.70	19.40
Av. leaf width (cm)+	29.90	29.70
Av. leaf length (cm)+	59.70	60.00
Three top leaf width (cm)	21.50	21.90
Three top leaf length (cm)	51.60	52.20
Topping ht. (cm)	133.00	134.00
Days to topping	70.90	68.90
Ground suckers (no./plant)	2.20	2.80
Ground suckers wt. (kg/ha)	47.40	74.40
Black root rot index++	106.00	100.00
Weatherfleck index*	1.20	2.30

+Measurement based on 5th, 10th and 15th leaf average.
++Higher rating indicates better black root rot tolerance.
*Lower rating indicate better weatherfleck tolerance.

Table 2. Mean values of chemical and physical data of five tests during 1973-1975

	Cultivar	
Character	Delhi 76	Delhi 34
Leaf total alkaloids (% TA)	2.60	2.80
Leaf reducing sugars (% RS)	15.89	13.31
Ratio (RS:TA)	6.10	4.70
Lamina (%)	72.10	72.80
Lamina wt (g/1000 cm^2)	6.69	6.51
Filling value (cc/g)	4.00	4.20
Equilibrium moisture (%)	14.00	13.70
Shatter (%)	8.92	9.30

The agronomic, chemical and quality performance are summarized in Tables 1-3. The color, texture and body of the cured leaves were rated equal to Delhi 34, but the overall quality index was slightly higher. Ground sucker number and weight were about 30% less than Delhi 34.

Table 3. Mean values of quality evaluation data for five tests during 1973-1975

Character	Cultivar Delhi 76	Delhi 34
Leaf color+	75.70	74.00
Leaf texture	64.30	64.70
Leaf body	64.10	61.00
Quality index	68.30	67.00
Avg 5-company rating	67.90	65.80
Leaf grade composition (%)++		
Sands	7.80	5.40
CL	28.80	22.70
CF	3.80	1.70
BL	28.50	46.80
BF	26.50	11.50
ND	1.00	2.00

+Values for first five characters are out of 100.
++Description of grade composition can be obtained from the Ontario Farm Products Grades and Sales Act and Regulations respecting flue-cured tobacco, 1965, Toronto, Ontario pp. 10-25.

The chemical constituents reducing sugars and total alkaloids of Delhi 76 were similar to Delhi 34. On an average, Delhi 76 exceeded the yield of Delhi 34 by 250 kg/ha with additional returns of $367/ha over the five tests.

The percentage grade composition showed the marked increase in the BF orange-colored leaf grades associated with better smoking quality. Smoke quality tests were conducted by manufacturers' smore panels and found to be satisfactory. Registration was recommended by the Ontario Tobacco Crop Committee.

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WHITE, F.H. and PANDEYA, R.S., Research Station, Agriculture Canada Box 186, Delhi, Ontario N4B 2W9). Delhi 76 bright tobacco. Can. J. Plant, Science 61, 791-793, 1981.

Breeding for high protein content and photosynthetic efficiency through induced mutations

In 1977 we treated dry seeds of the wheat cultivar "Selection No. 7" with gamma rays (30 krR), gamma rays (30 kR) + microwave (lmw) and gamma rays (30 kR) + EMS (0.3%) separately. The high-protein lines were selected in subsequent generations and the protein content of these lines was determined by the Kjeldahl method. The different physico-chemical mutagens used in treating "Selection No. 7" could induce high-protein mutants. A total of 123 mutants obtained were analysed for protein content. The results show that the protein content of some selected mutants increased 2% over the parent variety "Selection No. 7". High-protein characteristic of mutants obtained from M_2 generation was confirmed in M_3 generation.

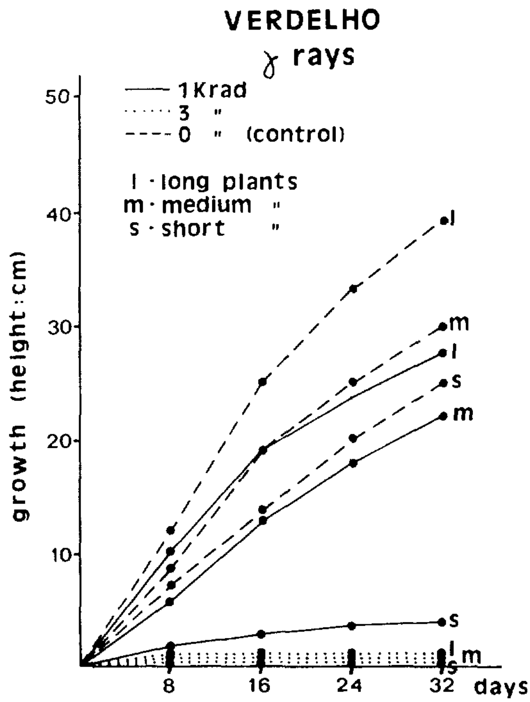
In order to increase the frequency of mutants with high photosynthetic efficiency, seeds were treated with gamma rays (30 kR) and screened by the C_3-C_4 plant roomette. Up to now 14 outstanding mutants were selected from 1800000 M_1 seedlings of the ten rice cultivars. Most of these mutants show short culm, more tillering, straight leaves with dark green colour, lust growth and lower fertility. Since 1976, we evaluated the photosynthetic characteristics of some selected strains by measuring the P_n of flag leaves and showed that the mutants 603-1, 608-1, 612-2 have higher P_n values than the parent "Jibang" rice by about 55%, 64% 72%, 63%, respectively. The results show that when seedlings obtained from seeds treated with gamma rays were screened with the C_3-C_4 plant roomette, the unadapted, lower photosynthetic efficiency type was eliminated under lower concentration of CO_2, but the higher photosynthetic efficiency type remained. The selected mutants from M_1 seedlings were unstable, most of them segregated in subsequent generations when further screened in the C_3-C_4 plant roomette, but higher photosynthetic efficiency could be confirmed in selected lines in later generations.

(Abstract No. IAEA-SM-251/29 submitted for the FAO/IAEA Symposium on Induced Mutations as a Tool for Crop Plant Improvement, Vienna, 9-13 March 1981 by Liu Xueyu, Nie Yuqi, Zheng Qiuying, Ni Wenqin, Dai Qiujie, Jiangsu Academy of Agricultural Sciences, Nanking, People's Republic of China).

Use of radiation in vine breeding

The Agricultural Service of Madeira Island is interested in recovering old grape varieties because of their potential for breeding. However, only very few plants of these varieties are left and one has to search for them in order to establish a germ plasm collection. (We found, for example, in the island Porto Santo one plant of the old variety "Verdelho roxo", that was thought to have disappeared completely from Madeira). For this viticultural revitalization programme, it is essential to use virus-free plants. As many of the plants of the old varieties are infected by virus, we use *in vitro* culture with "Rose-Galzy" medium. Such *in vitro* cultivated plants are used also for the irradiation with γ rays.

Resistance to diseases is a very important objective of vine breeding. In Madeira, losses due to mildew can be high. Up to the present, different pathogenic races of the parasite have not been observed. At least some resistant clones, obtained near Lisbon by intra-specific hybridization with varieties of *Vitis vinifera*, maintained the character on Madeira Island under favourable conditions for the parasite. The known resistance to *Plasmopara viticola* is polygenically controlled. Selection is based on leaf tissue reaction to the fungus (quantitative differences in the density of conidia on the leaf spots). Since among the popular varieties of European vines, sources of *Plasmopara* resistance are unknown, we use two ways to reach an economically satisfactory level of resistance in Madeira vines:



1) Mutation induction by irradiation with γ rays of plants of the old varieties cultivated in vitro was carried out at the Physical and Nuclear Engineering Laboratory. The ^{60}Co source had a strength of about 10,000 Ci and the size of the irradiation chamber is 65 x 50 x 20 cm. We tried two doses (1 and 3 krad) and 3 different growth stages of plants in the two varieties "Bastardo" and "Verdelho". The 3 growth stages were:

- Short: up to 5 cm; 2 or 3 leaves
- Medium: from 5 to 7 cm; 4 or 5 leaves
- Long: more than 7 cm, and more than 5 leaves

The growth inhibition by gamma rays is illustrated in the figure for the variety "Verdelho". "Bastardo" is slightly more radio-resistant, otherwise the results are similar. For the transplantation after irradiation one needs plants with sufficient growth capacity; so, for mutagenic purpose, the dose of 1 krad on medium or long plants is used.

2) The old varieties Boal, Malvasia Candida, Sercial and Verdelho were crossed with our clone C.27, obtained from "Jaen x Azal branco". However, we cross also with resistant plants obtained previously by mutagenesis (Coutinho, 1977). Examples of resistant clones obtained in this way are given in the table.

Table: Resistance to Plasmopara selected after seed irradiation

Varieties	Doses (rad)	Clone No.	1971	1973	1975	1976	1978
Vital	1000	4	R	M	M	R	M
		6	R	M	M	R	
		8	M	R	R	R	R
		57	M	R	M	M	
Fernao	500	703	R	M	M	R	M
Pires	1000	777	R	R	R	R	R

R = highly resistant M = medium resistant

In vine improvement, results must be confirmed on a large scale during various years before releasing a clone, but the results are sufficiently promising to be of interest in a vine breeding programme for resistance to downy mildew.

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(Extracted from paper presented at the ESNA Meeting, Aberdeen, UK, 1981 by M.P. Coutinho, Technical University of Lisbon and G. Corte, Agricultural Service of Madeira, Portugal).

Mutation breeding of pea and soybean

The best proof for the value of mutants will be cultivars bred by using such mutants. Three pea mutant cultivars have been officially approved in Poland and five more are currently in the last cycle of official variety testing. All the varieties have a common feature, the change of leaflets into tendrils. This characteristic recombines excellently with other genes responsible for leaf structure, earliness, height, plant morphotype, etc. It is not a yield improving factor in itself but it facilitates the effective use of herbicides, improves the exposure of the plants to light, provides uniform maturity and, most of all, resistance to lodging. Consequently, it has positive effects on cultivation as such and improves crop quality. In combine harvesting the losses are reduced from 30-50% in traditional forms, to 5% in the new types. And this is the essential factor for improving the economic yield.

Recently, we have begun a new cycle of genotype and morphotype formation by crossing tendril lines with lines of hybrid origin *Pisum* x *Vicia faba minor*. In this way, we expect to improve especially seed size, as some hybrid lines are characterized by a seed size of 30 to 50 g per 100 seeds.

Work on the utilization of soybean mutants in breeding is not as advanced. In 1974, seeds of 20 soybean varieties were treated with gamma rays and mutagenic chemicals, separate or in combination. In the subsequent generations we have selected approximately 130 mutants, several of which have value for breeding purposes. Worth mentioning are mutants from the variety Fiskeby having an improved morphotype; mutants of the variety Woronezska, determined and of reduced height, about two weeks earlier than the control; mutants of the variety Altona approximately 10 days earlier. These lines are being tested as to yield potential and suitability for combine harvesting.

In these investigations we have observed a phenomenon that is worth mentioning from the methodological point of view. Among seven mutant lines from the variety Fiskeby we observed in 1979, (M_6 generation), that three lines lost the "uniformity" present in previous years. Seeds of these plants also showed substantial changes concerning colour of the hilum and the seed coat (brown spots, patches and full brown colouring of various shades). The offspring of 1400 plants sown in 1980 showed an unusually strong segregation for seven characteristics investigated (earliness, height, height of first pod setting, hilum and seed coat colour, kind of determining, weight of 100 seeds). The variability ranges were so pronounced that environment random influences had to be excluded. These variabilities occured even more strongly in 1981. Approximately 30 000 plants of this population undergo at present a detailed biometric study. They represent an enormous genetic, developmental and morphological variation.

The interpretation of this phenomenon is rather difficult. Why does this segregational explosion occur as late as in M_6-M_7 generation and why are so many characteristics involved? The probability of outcrosses must be excluded as a number of features go even beyond the variability present in our nurseries and we have not observed this scale of segregation in any cross combination before.

A new cycle of mutation induction in soybean uses a somewhat different methodological approach. Pods were collected when the water content in the seeds was approximately 45 to 50%. Seeds in ripening pods were treated with 3.6 or 9 kR of gamma rays. After treatment, pods and seeds were dried at room temperature and stored for sowing in the following year. Germination in all combinations exceeded 90% but the irradiation after-effect in M_1 generation was very strong. M_2 and M_3 generations are being tested at present to determine the mutagenic effectiveness of this treatment method.

(Extracted from paper presented at the 12th ESNA Meeting Aberdeen UK, 1981. Author: J.K. Jaranowski, Institute of Genetics and Plant Breeding, Academy of Agriculture, Poznan, Poland)

Nitrogen fertilizer response of a new mutant variety of chickpea in Bangladesh

The experiment was conducted during the Rabi season of 1979-80 at the Regional Agricultural Research Station of the B.A.R.I. at Jamalpur. The soil type is Brahmaputra Grey Floodplain. The varieties of chickpea under study were Faridpur-1 and Sabur-4 and a mutant strain M-669. The mutant was developed at INA and in the meantime, has been recommended by the National Seed Board under the name "Hyprosola" (H=high, Y=yield, PRO=protein and SOLA=Bengali name of chickpea) (Shaikh et al. 1980).

The experiment followed a randomized block design with four replications. Nitrogenous fertilizer was applied as urea at doses 0, 10, 20, 30 kg N/ha. One-half of the dose was added to the soil during land preparation, the other half just before flowering. Triple superphosphate and muriate of potash were added to the soil at the standard rate of 50 kg P_2O_5/ha and 35 kg K_2O/ha, respectively, at the time of land preparation. Plot size was 6m x 4m with a buffer zone of 1m betwen the replications. Seeds were sown at a rate of 31 kg/ha on 8 November 1979. The experimental field was irrigated once only to maintain optimum moisture level. The crop was harvested on 26th March 1980.

The variety Hyprosola produced 21.5, 26.1 and 30.5 % more grain when 10, 20 and 30 kg N/ha were applied, respectively. In Faridpur-1, seed yield increased by 17.3, 26.7 and 41.5 percent. So the fertilizer response was similar or even better in Faridpur-1. However, Hyprosola yielded much higher than Faridpur-1 and Sabur-4 at all doses of nitrogen added.

Table. Seed yield (kg/ha) response to different levels of nitrogen fertilization

Rates of N(kg/ha)	Varieties: Hyprosola	Faridpur-1	Sabur-4	Mean
0	1994	1590	1626	1737[d]
10	2423	1865	1926	2071[bc]
20	2515	2015	2165	2232[ab]
30	2602	2250	2360	2404[a]
Mean	2384[a]	11930[b]	2019[b]	

*Means followed by letters in common are not significant at 1% level of probability.

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SHAIKH, M.A.Q., et al., Mutation Breeding Newsletter No. 16, 1980.

Altered plant architecture in a blackgram mutant

Blackgram (*Vigna mungo*) is an important legume crop of Bangladesh, grown on ca. 52000 ha with an annual production of ca 38000 t. The cultivars grown have a low yield potential and are characterized by excessive vegetative growth with commensurate poor harvest index, spreading habit and asynchronous pod maturity. Even the two recommended varieties are not much different. Limited genetic variability thus reduces hope for improvement through hybridization.

Attempts, therefore, appeared justified to create genetic variability by mutation induction. Dry seeds of two accessions of blackgram were treated with ^{60}Co gamma rays. An erect, synchronous and determinate type mutant, No. B-10(23), was selected from an M_2 progeny following 50 kR treatment. The mutant bred true in the M_3 generation. It bears upright pods compared to downward/horizontally borne pods of the mother variety. It also possesses an increased number of pods/plant resulting in higher harvest index and seed yield/plant. In the table, the characteristics of the mutant are compared with those of the mother variety. It is evident that the mutant has improvements in agronomic characters over the mother variety but a reduction in plant height. The mutant line is now under intensive trials and eventually will qualify for release as a commercial variety.

Table 1. Characteristics of a blackgram mutant and its mother variety.

	Mutant No. B-10(23)	Mother variety (Acc. B-10)
1. Petiole length (cm)	6.1	6.6
2. Length of leaf (cm)	6.5	5.9
3. Breadth of leaf (cm)	2.7	3.1
4. Plant height (cm)	22.1	24.8
5. No. of primary branches	2.9	2.5
6. No. of inflorescences/plant	12.7	12.3
7. No. of Pods/plant	29.8	20.5
8. Pod length (cm)	4.8	4.2
9. No. of seeds/pod	6.1	6.0
10. Yield/plant (gm)	5.6	3.8
11. Harvest index (%)	28	19

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(Contributed by M.A.Q. Shaikh and M.A. Majid, Plant Genetics Division, Institute of Nuclear Agriculture, P.O. Box 4, Mymensingh, Bangladesh).

Treatment of developing embryos for inducing mutations in rice.

Seed is the preferred material for mutagen treatments due to ease in handling. However, the formation of chimeras (mutated sectors) from a differentiated embryo following mutagen treatment limits the chances for recovery of induced mutations. A few hours after fertilization there will be only the zygote or the developing embryo consisting of a few cells. By mutagen treatment at this stage, one can avoid the formation of a chimera or have large size mutated sectors thereby recovering mutants in higher frequencies as has been shown by Ashri and Levy, 1974, for peanuts.

Mature seeds (MS) were presoaked for 10 hrs before treatment with sodium azide (pH 3, 8 hrs) or EMS (pH 7, 12 hrs). Treatment of developing embryos 48 - 72 hrs after fertilization (DE) was performed by soaking the panicles of potted plants in different concentrations of EMS (pH 7, 5 hrs) or sodium azide (pH 3, 4 hrs) followed by rinsing in water. To treat developing embryos of rel. uniform age, over- and under- aged florets were clipped off from the rachis prior to exposure.

The results indicate that treatment of developing rice embryos in the described way was effective and that an increased frequency of mutations could be recovered.

Number and frequency of chlorophyll mutations induced by treatments of developing embryos (DE) and mature seeds (MS) of rice

Treatments	Number studied		No. of M_1 panicles segregating	in %	No. of M_2 mutant seedlings	in %
	M_1 panicles	M_2 seedlings				
Control						
Buffer, pH 3, DE	247	6115	-	-	-	-
EMS						
0.1%, DE	261	5924	3	1.1	15	0.25
0.2%, DE	261	6566	91	34.9	428	6.52
0.5%, MS	231	6020	29	12.6	189	3.14
Sodium azide						
1 x 10^{-4}M, DE	221	5780	26	11.8	73	1.26
5 x 10^{-4}M, DE	213	5847	46	21.6	211	3.61
1 x 10^{-3}M, MS	254	6218	38	14.9	140	2.25

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(Contributed by Dr. B.B. Mandal and Dr. N.P. Sarma, Division of Genetics and Plant Breeding, Central Rice Research Institute, Cuttack-753 006, (Orissa), India).

Blast resistance of rice mutants in West Africa and Colombia

An analysis of 67 rice varieties for resistance against 15 pathotypes of *Pyricularia oryzae* by Notteghem[1] showed that a number of varieties from West Africa and Brazil possess horizontal resistance. Among the varieties released by IRAT, Ivory Coast, are some mutants and mutant-cross derived varieties. The blast resistance spectrum of these varieties in comparison with some others is illustrated in the table. It is obvious and worth noting that the valuable horizontal resistance of IRAT 2 has been maintained unharmed, while short culm and better lodging resistance were obtained through mutation induction.

The good resistance of IRAT 13 was confirmed in Togo[2] and Mali. Sang-Won Ahn of CIAT explored the possibility of "slow-blasting" as a way to keep blast damage below the economic threshold level. He found IRAT 13 and IRAT 133 among the group of "slow-blasting" varieties under Columbian conditions[4].

		Pathotypes of *P. oryzae**														
	Rice varieties	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
IRAT 2	560A x var.from Zaire	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
IRAT 13	Mutant of IRAT 2	2	2	2	2	2	2	2	2	3	2	2	2	1	2	2
IRAT 78	" "	3	2	1	1	3	2	2	1	2	3	2	2	1	2	3
IRAT 79	" "	3	3	2	2	[4]	2	2	2	2	3	2	2	1	2	3
IRAT 10	Lung sheng 1 x 63104	3	2	2	1	3	2	3	2	3	3	2	[4]	1	3	3
IRAT 109	IRAT 13 x IRAT 10	2	2	1	2	3	2	2	1	2	2	2	2	1	2	2
IRAT 133	" "	2	2	2	2	1	2	2	2	3	2	2	3	1	2	2
IRAT 141	" "	2	3	1	1	3	2	2	[4]	[4]	2	2	[5]	1	2	3
IRAT 114	Mutant of Moroberekan	2	2	1	2	3	2	2	1	2	2	2	2	1	2	2
IR5	Peta x TR	3	3	[5]	3	[4]	3	[5]	[5]	[4]	[5]	[5]	[5]	1	[4]	[4]
IR8	Peta x Deo Geo Woo Gen	1	3	1	2	2	[5]	[5]	[4]	2	[5]	2	1	[5]	2	2
Peta	Indonesian variety	1	1	1	1	1	[5]	[5]	[4]	2	[5]	2	1	[5]	2	3
Dourado Precoce	Brazilian upland rice	2	2	2	2	3	3	2	3	3	2	2	2	1	2	2

*)Pathotypes a = MAD 3, b = MAD 4, c = MAL 7, d = CI 2, e = CAM 1, f = CAM 2, g = BE 2, h = GUY 12, i = GUY 13, j = CO 1, k = SU 1, l = BRE 6, m = PH 1, n = FR 1, o = IND 1.

REFERENCES

(1) NOTTEGHEM, J.L., Analyse des resultats d'inoculation de 67 varietes de riz par 15 souches de *Pyricularia oryzae*.

(2) AKATOR, S.K., Methods de lutte contre la pyriculariose du riz au Togo.

(3) DIALLO BU, D., Comportement de quelques varietes de riz selectionnes au Mali vis a vis de la pyriculariose.

(4) AHN, S.W., The slow-blasting resistance.

(Papers presented at the Symposium on Rice Resistance to Blast, 1981, Montpellier, France).

LIST OF VARIETIES

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 varieties 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 variety does not imply its recommendation by FAO/IAEA.

Name of new variety	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 attributes of variety
Cicer arietinum			
Hyprosola	1981 Bangladesh M.A.Q. Shaikh, Institute of Nuclear Agric. Mymensingh	gamma rays, 20 kR 1971 [Faridpur-1]	matures 10 days earlier, more pods, higher harvest index, higher planting density, feasible ca. 19% higher variety
Cynodon sp. (Bermuda grass)			
Tifway II	1981 USA G. Burton, USDA, Coastal Plain Station Tifton, GA 31793	gamma rays, 9 krad, dormant rhizomes 1970 [Tifway]	better nematode resistance, more frost, better spring growth, denser and more weed-free turf
Glycine max			
Universal I	1965 USSR Tedoradze S.G. Georgian Plant Breeding Station	gamma rays [Imeretinskaya]	surpasses initial variety by 500 kg/ha in grain yield, is lodging resistant, can be used as grain crop and as green fodder

Gossypium sp.			
Lumian No. 1	1976 P.R. of China Institute of Atomic Energy Appl. in Agric., Shantung Prov., Acad. of Agric. Sciences	40-45 kR gamma rays, 1971 [F9 from Zhong No. 2 x 1195]	good vigor and plant architecture, higher boll production, 1981 cultivated on 1238000 ha.
Hordeum vulgare			
Pernilla	1979 Sweden Svalöf AB	(Birgitta x Mari) x/ (Opal x Vega) x Bladaggig ur Gull/x Birgitta	earliness, yield
Jenny	1980 Sweden Svalöf AB	Kristina x/Hellas^2 x (Pallas^5 x Rupee)/	yield, mildew resistance
Kustaa (Sv 71297)	1980? Finland Svalöf AB	/(Mari^5 x Monte Christo) x Impala/x Kristina	earliness
DL-253	1981 India R.P. Sharma Genetics Division, IARI New Delhi	sequential treatment of seeds with 20 kR + 0.30% EMS [Ratna]	higher tiller number, higher yield, field resistance to covered and loose smut and to yellow rust
Lupinus luteus			
Aga	1981 Poland J. Mikolajczyk E. Peikow, Plant Breeding Station, Przebedowo	Seeds X-rays 1956 [mutant population x Afus]	early maturing, resistant to Fusarium, high yield potential
Lycopersicon esculentum			
Luch 1	1965 USSR Kulik M.I., Shkvarnikov P.K. Inst. of Cytology and Genetics, Novosibrisk	gamma rays [Pushkinsky]	early, high yielding, yield per ha. of red fruit 3-5400 kg higher than initial variety

Name of new variety	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 attributes of variety
Nicotiana tabacum			
Delhi 76	1976 Canada F.H. White, R.S. Pandeya, B. Povilaitis, Agriculture Canada Research Station Delhi (Ontario)	dry seed, gamma rays, 6 kR, 1970 [Delhi 34]	similar in plant type to parent but slightly darker green, leaf cures easily with a more desirable orange color particularly in the upper half of the plant, superior yield, reduced ground sucker development, higher disease tolerance
Oryza sativa			
M 401	1981 USA H.L. Carnahan, C.W. Johnson, S.T. Tseng Calif. Coop. Rice Research Foundation, Biggs, Ca. 95917	gamma rays, seed, 1974, [Terso]	semi-dwarf height, consequently higher yield, premium quality, medium grain size
Nanjing No. 34	1976 P.R. of China Jiangsu Academy of Agricultural Sciences, Nanjing	30 kR gamma rays and microwave, 1971 [Zhaofong]	short stature, high yield 1981 cultivated on ca 220000 ha. in Jiangsu province and lower reaches of the Yangtze river
Yuan Feng Zao	1975 P.R. of China Wang Tinghua, Wang Yanyu, Song Yonggui, Sun Shuxiong Inst. of Appl. of Atomic Energy, Zhejiang Acad. of Sciences, Hangzhou	35 kR gamma rays, 1971 dry seeds [Kezi No. 6]	45 days earlier than Kezi No. 6, 10% higher yield than local commercial variety, 8-14% higher lysine content than other main commercial varieties, in 1980 cultivated on 1.07 million ha.

<u>Olea europaea</u> (olive)			
Briscola	1981 Italy B. Donini, G. Roselli CNEN Lab. Agricoltura CSN Casaccia; CNR Centro di Studio Propagazione Specie Legnose, Firence	gamma rays 4 krad rooted cuttings, 1968 [Ascolana tenera]	<u>plant height reduced by 50%</u> early entering production, easy harvest, male sterile
<u>Pisum sativum</u>			
Esedra	1980 Italy F. Saccardo, L.M. Monti, P. Vitale, CNEN Lab. Agricoltura, CSN Casaccia	X-rays, 750 rad, pollen 1971 [Sprinter]	4 days later flowering, increased yield, more contemporary pod setting, better suitable for mechanical harvesting
Navona	1980 Italy F. Saccardo, C.M. Monti, P. Vitale CNEN Lab. Agricoltura CSN Casaccia	X-rays, 750 rad, pollen 1971 [Sprinter]	one week later flowering, reduced plant height, more contemporary pod setting, longer period for canning
<u>Prunus cerasus</u>			
Plodorodnaya michurina (Michurin's prolific)	1977 USSR Tsentral'naya Geneticheskaya Laboratoria Michurinsky	X-rays [Prunus maackii]	seed set without pollination
<u>Saccharum officinarum</u>			
Nanei	1981? Japan M. Ikeda, Tropic Crops Lab., Agric. Fac., University of Kajoshima	growing cane, chronic gamma rays, 1976 [Ni 1]	longer, thicker stalk, better tillering than Ni 1, higher yield of cane and sugar than NCo 310

Name of new variety	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 attributes of variety
Triticum aestivum			
IAS 63	1974 Brazil E. Peixoto Gomes, J. Carlos Ignaczak, Instituto de Pesquisas Agropecuarias do Sul, Pelotas R.S. Brazil	Pel 19906-62 x Pel 18102-62, 1963, gamma rays, seeds, 1960 [IAS 20 - Jassul]	higher yield, less grain shedding, more resistant to stem rust (races 11/65, 17/61, 17/63)
Carolina	1981 Chile P.C. Parodi, I.M. Nebreda Dept. of Plant Science Catholic Univ. of Chile Santiago	gamma rays 10 krad, seeds 1972 [Collafen]	yield, grain protein content, disease resistance, slightly delayed maturity
NI - 5643	1975 India Agric. Res. Station, Niphad, Dist. Nasik (Maharashtra)	New Thatch x NI-284-S (irradiated) 1972	maturity in 120 days, amber colored, bold lustrous grain, 3500 kg/ha, res. to stem rust, suitable for irrigated conditions in Maharashtra State
Payne	1981 USA E.L. Smith, E.E. Sebesta, H.C. Young, H. Pass, D.C. Abbott, Oklahoma Agric. University, Stillwater Ok. 74078	Triumph 64/Teewon Sib/ Sturdy	Teewon Sib is a translocation line from X-rayed Wichita 2 x TAP48 carrying Lr24 gene for leaf rust resistance

Triticum aestivum (Contd)			
Shan Nong Radio-63	1980 P.R. of China Inst. of Genetics and Breeding, Shandong Agric. College	30 kR gamma rays [F4 of You-bao x Ou-rou]	quick grain filling, good photosynthetic ability, efficient use of fertilizers, high and stable grain weight, 1981 cultivated on 130000 ha.
Nanjing No. 3	1976 P.R. of China Jiangsu Academy of Agric. Sciences, Nanjing	25 kR gamma rays 1968 [St. 1472/506]	short culm, strong straw, lodging resistance, high yield, 1981 cultivated in ca. 140000 ha. in Jiangsu province
Zea mays			
Lu-Yuan SC No. 4	1976 P.R. of China Inst. of Atomic Energy Appl. in Agriculture, Shantung Prov., Academy of Agric. Sciences, Jinan	30 kR gamma rays, 1971 [Wu SC Early] selected mutant used in cross Yuan Wu No. 2 x Wei Feng	single cross hybrid, 15-20% higher yield, maturation 80 days, 180 cm height, resistant to lodging, leaf spot, drought, water logging, 198? cultivated, on 660000 ha.

PUBLICATIONS

Induced Mutations - A Tool in Plant Research: Proceedings of a FAO/IAEA symposium in Vienna 9 - 13 March 1981.

Topics: Induced mutations and the advancement of genetics
Induced mutations and plant evolution
Induced mutations and plant physiology
Induced mutations and plant parasites
Induced mutations and plant symbioses
Induced mutations and in vitro culture
Induced mutations and gene ecology
Induced mutations and plant breeding

Annex: Report of Consultants Meeting on the Induction of Mutations in Extranuclear Hereditary Cell Elements.

34 papers, 18 abstracts of posters, 541 pages, 840 - Austrian Schillings, Vienna 1981.

Induced Mutants for Cereal Grain Protein Improvement: Proceedings of a research coordination meeting held at Nicosia (Cyprus) 21-25 April 1980. IAEA-TECDOC. No. 259, 1982.

Induced Mutations for Improvement of Grain Legume Production II: Proceedings of research coordination meeting held at Chiang Mai (Thailand) 27 April - 1 May 1981. IAEA - TECDOC No. 260, 1982.

Proceedings of the 1st Mediterranean Conference of Genetics, Cairo, March 1979. Includes 50 papers on medical, agricultural and microbiological aspects of genetics and 4 introductory lectures. US$25.-. Orders: Egyptian Society of Genetics, c/o Department of Genetics, Faculty of Agriculture, University of Cairo, Giza, Egypt.

EXPERTS AND CONSULTANTS 1981

Bhatia, C.R. (India)	IAEA, Vienna (Austria)
Black, C.C. (USA)	Lima (Peru)
Constantin, M.J. (USA)	IAEA, Vienna (Austria)
Cornu, A. (France)	"
Davis, D.R. (UK)	"
Donini, B. (IAEA)	Khartoum, (Sudan)
Dellaert, L. (Netherlands)	IAEA, Vienna (Austria)
Favret, E.A. (Argentina)	"
Gaul, H. (FRG)	Kuala Lumpur (Malaysia)
Hanna, W.W. (USA)	IAEA, Vienna (Austria)
Hermelin, T. (IAEA)	Khartoum, (Sudan)
Levy, A. (Israel)	IAEA, Vienna (Austria)
Maliga, P. (Hungary)	"
Mikaelsen, K. (Norway)	Lima (Peru)
Mikaelsen, K. (Norway)	Bangkok (Thailand)
Murty, B.R. (India)	Maracaibo (Venezuela)
Patil, S. H. (India)	Mymensingh (Bangladesh)
Pohlheim, F. (GDR)	IAEA, Vienna (Austria)
Poulsen, C. (Denmark)	"
Saccardo, F. (Italy)	"
Walther, F. (FRG)	Khartoum (Sudan)

FELLOWSHIP TRAINING 1981

Bhagwat, S.G. (India)	Cambridge (UK)
Khalifa, M. (Sudan)	Arizona, New Mexico, Texas, Mississippi (USA)
Klu, G.Y.P. (Ghana)	Casaccia (Italy)
Loekman, I. (Indonesia)	Seibersdorf Laboratory (Austria)
Majid, R. (India)	Nottingham (UK)
Menten, J.O.M. (Brazil)	Wageningen (Netherlands)
Nimako, A. (Ghana)	Knoxville (Tennessee USA)
Pawlak, J.A. (Poland)	Wageningen (Netherlands)
Sarigabutr, A. (Thailand)	Davis, CA. (USA)
Shaikh, M.A.Q. (Bangladesh)	Canberra (Australia)
Shaikh, M.A.Q. (Bangladesh)	Jakarta/Bandung (Indonesia)

FUTURE EVENTS

1982

FAO/IAEA International Training Course on the Induction and Use of Mutations in Plant Breeding, IAEA Laboratory, Seibersdorf/Austria, 24 May - 2 July.

FAO/IAEA Consultants Meeting on Selection Methods Applied in Mutation Breeding, Vienna (Austria), 21 - 25 June.

International Symposium on the past, present and future of genetics, Brno, CSSR, 26 August - 1 September. (Contact: V. Orel Mendelianum of the Moravian Museum, 65937 Brno CSSR).

FAO/IAEA Research Coordination Meeting on Evaluation of Semi-dwarf Cereal Mutants for Cross-breeding, 30 August - 3 September, Davis (California) USA.

FAO/IAEA Regional Seminar on the Utilization of Induced Mutations for Crop Improvement in Latin-America, Lima (Peru) 17 - 23 October.

Research Coordination Meeting on the Use of Nuclear Techniques for Cereal Grain Protein Improvement, 13 - 17 December, Vienna (Austria).

1983

10th International Congress of EUCARPIA, "Efficiency in Plant Breeding", 14 - 21 June, Wageningen (The Netherlands).

XV International Congress of Genetics, New Delhi (India), (Contact: Secretary, Congress of Genetics, P.O. Box 2841, New Delhi 110060).

6th International Wheat Genetics Symposium, Kyoto, Japan, 28 November - 3 December, (Contact: S. Sakamoto, Plant Germ Plasm Institute, Kyoto University, Kozume Muko, Kyoto 617, Japan).

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
Lhamo WAHL

Mutation Breeding Newsletter
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Applications of Atomic Energy for Food
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