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Mutation Breeding Newsletter

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RESEARCH NEWS

Development of a high yielding chickpea mutant

Pulses occupy an important place in the diet of people of Bangladesh, their production however has shown little improvement over the last 15 years. Chickpea (Cicer arietinum) comes next to grasspea (Lathyrus sativus) and lentil (Lens culinaris) in importance. About 140,000 acres were planted with chickpea in 1976-77 producing around 40,000 tons of grain [1].

In 1971, the most important commercial variety, Faridpur-1 was irradiated with several doses of ^{60}Co gamma-rays. Mutants with various characters were selected in the M_2 generation. The mutant M-669 was selected out of the 20 kR treatment.

The various characteristics of the mutant are listed in Table 1. The plant is a bit shorter than the mother variety and it matures about 10 days earlier. It has a higher harvest index and significantly larger number of pods/plant. Due to less branching and smaller plant type, 10% more plants/acre is feasible, contributing to higher yield/unit area. Also higher protein yield/unit area is obtained. No significant difference in the amino acid pattern is noticed.

The mutant was subjected to a microplot yield trial along with other 10 elite lines in M_5 and to an advanced yield trial along with 4 elite lines in M_6 generation. In 1977-78, zonal and agronomic trials were conducted at two locations, Ishurdi and Jamalpur and in 1978-79 at three locations, Ishurdi, Jamalpur and Jessore. The mutant M-669 has consistently yielded higher than the mother variety, Faridpur-1, over different years of testing. Table 2 gives details of yield comparisons of the advanced yield trials and zonal-cum-agronomic trials conducted during 1976-77, 1977-78 and 1978-79, respectively. It is clear that M-669 produced higher seed yield than any other strain in these experiments.

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Table 1. Comparison of various characters of the mutant M-669 with the mother variety, Faridpur-1

Character	Faridpur-1	M-669
Height (cm)	50-55	45-50
No. of branches/plant	9 ±	7 ±
Maturity in days	155	145
No. of pods/plant	80 ±	92 ±
1000 seed weight (g)	85 ±	75 ±
Harvest index (%)	33	40
Colour of mature fruit	Dull	Shiny
Population (plants) possible/ acre	70000 ± 5000	80000 ± 5000
Protein yield (kg/ha)	355	515
Amino acids (g/16gN)		
(a) Lysine	8.05	7.44
(b) Methionine	1.60	1.56
(c) Cystein	1.61	1.61

Table 2. Mean grain yield (kg/ha) of chickpea strains

Strains	1976-77*	1977-78		1978-79		
	Ishurdi	Ishurdi	Jamalpur	Ishurdi	J.pur	Jessore
M-669	8.90	900	1161	2088	2992	1790
M-102	8.40	686	801	1937	2007	1278
M-29	7.85	536	767	1931	2696	1214
Faridpur-1	4.83	423	756	1914	2503	1349
M-55	8.53	401	522	1851	2427	978
Sabur-4**	-	-	-	1865	2457	1113

* Plot size = 27 m^2 ** Another commercial variety

The higher yield of the mutant appears to be due to an altered plant type enabling it to set larger number of pods, though with slightly smaller seeds. However, a higher harvest index and perhaps wider adaptibility to various environmental conditions, have favoured its superiority to Faridpur-1 over different locations and years. The mutant once released, should become soon popular in the pulse growing areas of Bangladesh. Application for registering it as a variety has been filed to the National Seed Board.

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Altimir 67 - a new mutant hybrid cv. in common wheat

Experiments carried out for many years on radiobiology and mutagenesis in wheat, led to important conclusions about radiosensitivity and mutability. By combining hybridization and mutation induction the new wheat cultivar Altimir 67 was obtained. It was developed following irradiation of F_2 seeds from the cross Skorespelka x Mexipak (1). The irradiation was carried out with 5 krad γ-rays, at the dose rate of 1250 r/min.

In 1979, the National Strain Testing Board approved the cultivar Altimir 67. The cultivar belongs to the var. erythrospermum. It is characterized by high productivity and complex resistance to rust and powdery mildew.

The cultivar possesses large spikes, about 9,5 - 11 cm long. Usually, 19 - 22 spikelets develop in one spike. The spikelets have 5 - 7 flowers, 4 - 6 form seeds.

During 4 years testing in the field of the Institute of Genetics 7580 kh/ha were obtained on the average from the cultivar Altimir 67, which is 20% more than from the popular cultivar Sadovo 1.

The results of the National Strain Testing in 1978-79 also proved the great productive ability of the new cultivar. In many experimental stations it ranked first in yield among the tested Bulgarian and foreign cultivars of wheat. The yield exceeds the standard in some stations by 23%. The cultivar's grain has very good technological and backing qualities.

The thousand grain weight of the cultivar Altimir 67 was 52,6 g, the hectoliter weight 80 kg and vitriousness 68%. The protein content of the grain is about 14%. The volume and porosity of the bread, made of this cultivar are also very good.

A unique combination of high productivity with resistance against the most important diseases - leaf and stem rust and powdery mildew, as well as a very good quality of the grain are accomplished in one genotype. This cultivar is valuable and useful for production and industry and is also an valuable initial material for wheat breeding in the future.

(Contributed by P. Savov, Bulgarian Academy of Sciences, Institute of Genetics, Sofia 1113, Bulgaria).

Martonvásári 8 - mutant variety in Hungary

On 14 December 1978 the wheat variety Martonvásári 8 was registered by the Hungarian National Variety Council. The variety has been developed by cross breeding between induced mutants of the varieties Bezostaya I and Ranka, and was tested under the identification number Mv-103 (see MBNL No. 12, p.1, 1978).

Seed production begun in 1977. Seed production area is now ca. 15,000 ha and expected area of cultivation during 1980 is 100 - 120,000 ha. According to the interest by farmers, a further sharp increase in the sowing area is likely. The license for the variety has been purchased by the Italian seed company Helizea s.p.a. Ferrara and the variety will be marketed in Italy under the name "Claudia". Seeds for official testing were sent in autumn 1979 to Austria, Bulgaria, CSSR, France, GDR, Holland, USA and USSR.

In the official Hungarian state variety trials Mv 8 has produced the following yields during 3 years on an average of 15 experimental sites:

Variety	Yield t/ha			Mean	%
	1977	1978	1979*		
Jubileinaya 50 (standard Var.)	5.67	5.65	4.70	5.34	100
Martonvásári 8	6.04	6.43	5.06	5.84	109.3

* 1979, there was a severe drought in Hungary

The variety has good baking quality with a cruide protein content of 14-16%. Thousand-grain-weight is 42-44 g, test weight 80-82 kg. The variety has good winter hardiness and excellent resistance to lodging. It has a good resistance to powdery mildew and stem rust, fair resistance to leaf rust, tolerance to foot and root rot disease.

(Contributed by G. Szilági, Agricultural Research Institute, Hungarian Academy of Sciences, Martonvásár, Hungary).

Wheat mutation breeding programme in Chile faces disease problems

In 1971, the Catholic University of Chile with support of the International Atomic Energy Agency, started a project to develop wheat mutants, through gamma irradiation, of improved protein content, disease resistant and high yielding.

We made progress fairly rapidly, and after five to six generations of selection and testing were able to identify several mutants with the required characters, which were rapidly increased for eventual release. (See MBNL No. 13 p.9-10, 1979).

Four mutants, designated as UC-3, UC-4, UC-5 and UC-6 were selected to be included in the National Cooperative Yield Experiment, in which they were studied at several locations through the country's spring cereals growing area. In the four years in which these mutants were studied in the NCYE, they yielded equal or better than the rest of the commercial cultivars or best breeding lines with which they were compared, simultaneously producing a higher protein content with acceptable milling and baking quality.

Two disease problems that were not present in 1971, when this Project was initiated, became serious in the area. First, in 1975, barley yellow dwarf virus severely attacked cereals, wiping out several cultivars, and forcing us to discard a large number of mutants that showed to be susceptible to the virus. Since we had large populations, we were still able to continue the Project with adequate numbers of individuals so as to ensure appropriate variability in our experiments. The most severe problem, however, first became apparent in the late spring of 1978. Race 15 B of Puccinia graminis f.sp. tritici, absent from Chile for over 20 years, was identified in the north end of the spring cereals area. Its attack, characterized by fairly small, narrow pustules, began fairly late, and did not cause severe yield reductions. In 1979 the attack was highly severe, and above that, showed that the national germ plasm possessed no genes for resistance, as shown by the fact that all the material included in the NCYE, formed by the registered cultivars and the best lines of the various national wheat breeders were susceptible. In addition, race 15 B started moving south, and is expected to be present in the entire North Central and Central Regions, within the next two to three years.

Our material was not exempted from this problem: Mutants UC-3, UC-4 and UC-5, are lost for all practical purposes, as commercial cultivars. It is still feasible to use mutant UC-6 as a commercial cultivar, because its susceptibility is equal or less than that of other commercial cultivars available and its yield potential has not been drastically impaired, even under the worst conditions of artificial stem rust inoculation.

Mutants UC-3, UC-4, UC-5, UC-6 will be included in a backcross programme with four sources of resistance to race 15 B which were identified in 1979. This programme, already initiated, will be conducted in an accelerated manner under greenhouse conditions, aiming at producing two and a half to three generations per year, so as to recover their genotypes with added resistance to stem rust in approximately two years.

(Contributed by P.C. Parodi and Isabel M. Nebreda, Department of Plant Science, School of Agriculture, Catholic University of Chile, Santiago, Chile).

Albena - an anthocyaninless mutant cultivar in sweet pepper (Capsicum annuum L.)

After irradiation of dry seeds of the cultivar Zlaten medal (golden medal) in 1970 with 13,5 krad gamma rays two anthocyaninless mutant plants were discovered in M_2 generation.

The mutant plants are characterized by lack of anthocyanin (purple) spots on the hypocotyl, node, stem, and non-mature fruits. The anthers are yellow instead of purple. Similar spontaneous mutants were described by Deshpande 1933 and Odland 1960.

The mutant character is designated with the symbol al (anthocyaninless) in the gene list for the pepper (Lippert, Borgh and Smith 1965).

Field trials have shown that the mutant line exceeds the standard cultivar in early as well as in total yield and in addition the fruits are commercially more attractive and have an improved flavour due to the lack of anthocyanin spots.

In 1974 the mutant line was released by the National Strain Testing Board as a cultivar under the name Albena (the first two letters indicate the al - gene).

At present the mutant cultivar is widely distributed in Bulgaria for early field production of "Kapia" (long, conic, flat, two lobbed) type of sweet pepper.

To our knowledge this is the first use of al - gene in plant breeding. The al - gene represents also a very good gene marker that could be used in the hybrid seed production as well as in mutation breeding for genetic labelling of the material in order to eliminate any contamination from cross-pollinations.

(Contributed by Stefan Daskalov, Institute of Genetics, Sofia 113, Bulgaria).

Two mutants of cotton with wide adaptability suitable for cultivation in different cotton zones of India

Cultivation of the superior quality cotton variety (*G. hirsutum*) MCU-5 developed in Tamil Nadu was restricted to Southern India because of its sensitivity to day length conditions. A photoperiod insensitive mutant induced by 30 kR gamma rays treatment now named 'Rasmi' flowers in about 50 days and matures in 150 days irrespective of location and season. The mutant has retained all agronomical and fibre quality properties of the parent variety and spins to 60 counts. It has been recommended for commercial cultivation in Orissa where no cotton was grown earlier and has already covered an area of over 2 thousand hectares. The mutant has also become suitable for cultivation in other zones like north and north-west India where it was not possible to grow the original variety.

Another mutant of cotton having high yield potential and medium maturity was evolved from the variety Stoneville 213, a direct introduction from U.S.A. The cultivar was extremely susceptible to jassids a major insect pest limiting cotton production in India, mainly because of its smooth plant parts. By 25 kR gamma irradiation hairiness could be induced and the mutant showed fair degree of tolerance to jassids. After extensive testing it is being distributed to farmers under the name 'Pusa Ageti' in Haryana, Maharashtra and Orissa. It is a medium staple (25 mm) cotton with high ginning percent (38%) and early maturity (145 days). The variety is ideally suited for cotton/wheat rotation.

(Contributed by R.N. Raut and R.S. Panwar, Division of Genetics, Indian Agricultural Research Institute, New Delhi - 110012, India).

Short day insensitive jute mutant

Jute (*Corchorus capsularis* and *C. olitorius*) as a fibre crop can be grown only during the months of long photoperiods (sowings from mid Feb. to May and harvest in Aug. - Sept.). With the onset of short days in September flowering sets in, and the vegetative growth is terminated. Being a bast fibre crop, the fibre yield is positively correlated with plant height. The time of flowering, which determines plant height, thus is a major factor affecting yield. Genotypes insensitive to short days were not known in either species. Now a mutant which has a minimum vegetative growth period of 120 days irrespective of the growing season was isolated.

Induced mutation research in C. capsularis var. JRC 412 at this Centre resulted in the isolation of 109 mutants. These were sown in the off-season (November) 1977 with a view to identify late flowering, tall mutants. While all the mutants flowered in 45-50 days, like the parent, four plants in the population of a tall mutant, T-93 (1 krad fast neutron) flowered only after 120 days. Seeds of these were sown in the following crop season (May 1978). As the progenies of the four plants were identical, their seeds were bulked and planted along with the parent in November 1978, 1979 and in May 1979.

The parent flowered in 45-55 days after sowing in November and 87-90 days after sowing in May, the mutant flowered after 120 days during both the seasons (Table). This has been observed for three years in the November, and two years in the May sowings. The extended period of vegetative growth lead to considerable increase in plant height during both the seasons. Thus the mutant could be grown for fibre during short day periods also. The mutant (designated TCJ-5 = Trombay Capsularis Jute No. 5) is being tested for fibre yield under the All India Coordinated Research Project in the jute growing areas. Hybridization to transfer this trait to other high yielding strains and to study the genetics is underway.

Duration till flowering and plant height
following different sowing dates

Date of sowing	Number of days to 50% flowering		Plant height (cm)	
	Parent	Mutant	Parent	Mutant
16 Nov. 1977	47	120	113 ± 1	191 ± 11
8 Nov. 1978	47	130	80 ± 2	183 ± 5
11 Nov. 1979	55	123	115 ± 1	199 ± 4
25 May 1978	90	120	240 ± 5	331 ± 7
25 May 1979	87	123	227 ± 3	345 ± 2

(Contributed by D.C. Joshua and R.G. Thakare, Biology and Agriculture Division, Bhabha Atomic Research Centre, Trombay, Bombay, India).

Screening for TMV and Peronospora tabacina resistant mutants in haploid and dihaploid plants of Nicotiana tabacum

Irradiated anthers of the two Nicotiana varieties Bright and Xanthi Yaka have been cultured "in vitro" for haploid plants regeneration. The suitable doses to be applied at the floral bud stage have been determined before (Table 1). The haploid plantlets, after transferring to pots, were inoculated with TMV and Peronospora tabacina for screening any resistant mutants.

Table 1. Haploid plantlets of N. tabacum cv. Bright regenerated from anthers cultured "in vitro" after floral bud gamma irradiation

Gamma rays (rad)	Anthers cultured no.	Haploid plants no.	No. of plant/No. of anthers ratio
0	300	1115	3.71
100	135	162	1.20
300	120	204	1.70
600	130	116	0.89
900	115	92	0.80
1800	495	360	0.74

A progressive reduction of haploid plant regeneration has been observed with increasing dose. A value of about 50% was obtained at about 300 rad.

The dose of 1000 rad has been chosen for the cv. Bright, 500 and 1000 rad for Xanthi Yaka.

The percentage of chlorophyll and morphological mutants induced are reported in Table 2.

Table 2. Haploid chlorophyll and morphological mutants induced after floral bud irradiation

N. tabacum cv.	Dose (rad)	No. plants observed	Mutants Morphological %	Mutants Chlorophyll %
Bright	1000	666	2.10	3.30
Xanthi Y.	500	272	5.14	2.20
	1000	88	10.00	10.00

At a comparable dose a higher frequency of mutants has been observed in the cv. Xanthi Yaka.

Artificial inoculation has been carried out on a population of 666 haploid plants of the cv. Bright and of 260 of the cv. Xanthi Yaka. The disease symptoms were scored on the leaves for TMV and on the whole plant for the *P. tabacina*.

Among the plants inoculated 17 in the cv. Bright and 16 in the cv. Xanthi Yaka respectively showed signs of resistance to TMV.

After inoculation with P. tabacina 9 plants of the cv. Bright were not infected while all the plants of Xanthi Yaka were infected.

From those haploid plants which were selected as potentially resistant, by "in vitro" culture of stem internode dihaploid plants were obtained. These have been again inoculated with TMV and P. tabacina. The test for confirmation of induced resistance is still underway.

At present a large number of new haploids of the cv. Bright, regenerated from irradiated floral buds are available and will be screened for resistance to TMV.

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(Contributed by S. Lucretti, G. Ancora and F. Saccardo, Divisione Applicazioni Radiazioni CNEN, C.S.N., Casaccia, Rome, Italy).

In vitro culture as a rapid tool of isolation and propagation for somatic mutation

Mutagenic treatments are now widely used to induce useful mutations in vegetatively propagated plants. The starting material generally consists of a multicellular structure such as buds. Therefore mutations induced by X- or gamma rays will create a chimeric shoot.

A major difficulty is the isolation of a somatic mutation in a periclinal chimera. The usual method of V_1 growth, cutting back and grafting till the appearance of the mutated shoot in V_2 and V_3 generations requires a rather long time [1].

The *in vitro* culture of shoot apices allows continuous vegetative growth and is being regarded as a tool for the rapid isolation of the induced somatic mutations.

Research in our Laboratory intends to establish suitable doses for bud irradiation, conditions and techniques of shoot apex propagation *in vitro*, rooting and plant establishment in soil.

The results already achieved in artichoke [2,3], apple [4], cherry and fig indicate the possibility for large scale vegetative propagation (e.g., in artichoke with a rate of 4.5 plants from each shoot after three weeks, one can obtain millions of plants per year).

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(Contributed by B. Donini and G. Ancora., Divisione Applicazioni delle Radiazioni, CSN Casaccia, CNEN, S. Maria di Galeria, Rome, Italy).

Improving N_2-fixation by optimal rice-diazotrophs associations - potential use of induced mutations

Nitrogen fixation in the rhizosphere of grasses is unevenly distributed and seems to depend much upon ecological conditions.

Several laboratories have started research programmes aimed at improving this biological nitrogen input in rice cultivation by inoculation with Azolla or cyano-bacteria, or by use of them as green manure.

Another research trend has started in France, in the Philippines and in Japan; its aim is a better matching of the plant and the bacterial partners in order to establish more efficient associations.

But comparing nitrogen fixing systems is not that easy; it is possible to make this comparison in the field with the acetylene reduction technique but its use in the case of rice is difficult and subject to artifacts. Comparison in green houses or growth cabinets is handicapped by the need for a large number of plants to compensate for variations between individual plants; even so, such comparisons have been made:

- F. Hamad in our laboratory compared cultivars of rice. The best cultivar (Cristal) was 2.5 times more efficient than IR8, the worst [1].

- At the GERDAT laboratories in Southern France, Mr. Beunard also compared different cultivars and found the best 13 times more efficient than the worst [2].

- At IRRI, the best variety fixed about 5 times more nitrogen than the worst [3].

- In Trinidad, B. Boddey compared in the field 4 cultivars but could not evidence significant differences between them.

In all those instances the method used to compare cultivars is expensive, time consuming and not very precise. Nevertheless, these works show that genetic variability in respect to nitrogen fixation does exist.

Recently we began a project in cooperation with Prof. Marie (INRA). His laboratory has selected most of the rice cultivars grown in France, some of them obtained by mutagenesis. Two series of such mutants obtained from "Cigalon" and "Cesariot" cultivars have been compared by Y. Dommergues and co-workers in Dakar; they could evidence a very large variation in N_2 fixing potential of different mutants. The best one being 60 times higher than the worst one (Table) from the same original variety. This work has been done in growth cabinet, where the plant to plant variability is high and the study very expensive. Thus, it is possible, by mutation induction, to generate a higher genetic variability for nitrogen fixation. But an important limiting factor in respect to a rice mutation breeding programme with this objective was the lack of a good method for screening the mutants. This method must be easy to use even for large numbers of plants, and show only a low variability. It appears that we have found such a method.

Table: Potential of nitrogen fixation in the rhizosphere of different induced mutants, originating from the same cultivar "Cesariot" (after Dommergues 1978)

Genotypes of Rice	$10^{-9} C_2H_4/hr^{-1}/g\ root^{-1} \pm$ S.D.
Rampant 2	5,320 ± 5,010
Criblé glumelles bicolores	4,890 ± 2,770
Grain tres long, non perlé	3,310 ± 2,190
Rampant 1	2,890 ± 1,670
Original Césariot cv.	2,120 ± 1,470
Petit pois	2,020 ± 1,800
Raide 1	1,560 ± 1,250
Criblé	1,550 ± 860
Glumelles chamois	1,270 ± 580
Rachis noir	860 ± 470
Piment	690 ± 580
Glumelles chocolat	500 ± 310
Court à grain grossi	80 ± 40

It is based on an idea which we have called the "spermosphere model". In this system, young plant seedlings are growing in test tubes in the dark, using the seed reserves as an energy supply. The possibility of using this system as a tool to screen rice mutants depends upon the assumption that the partition of assimilates in a plant is the same during the heterotrophic and the autotrophic stages of its life. The spermosphere model appears very promising in respect of reducing variability due to variable energy supply, because the amount of energy supplied can be controlled simply by using seeds of known weights. The spermosphere model could definitely be used to compare bacterial species inoculated to the same rice.

A particular advantage of the spermosphere model is its small size which makes it feasible to evaluate nitrogen fixation directly from a measurement of gaseous nitrogen with the ultrasensitive detectors available now. The use of gaseous ^{15}N will enable us to follow the transfer of fixed nitrogen to the plant and to determine the percentage of plant nitrogen derived from the bacteria.

In conclusion, we shall have an experimental system which is independent of photosynthesis, highly reproducible (S.D. ≃ 7% of means), inexpensive (no growth cabinet required), and very handy. This system will allow (a) to compare the associations of one cultivar of rice with several different strains (b) to compare association of bacterial strain with several rice genotypes (mutants) faciliating plant breeding for N_2-fixation (c) to measure efficiency: N fixed per g of available carbon of the seed or N fixed per g of exudate (d) to study the fate of fixed nitrogen (^{15}N).

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(Contributed by J. Balandreau, CNRS, Centre de Pedologie Biologique, B.P.5, 54500 Vandoeuvre, France).

Mutation induction in breeding new varieties of Chrysanthemum morifolium Ram

Chrysanthemum is a short day plant. All year round production of flowers in Northern Europe therefore requires artificial short day conditions, usually with 10 h daily illumination of ca. 10.000 lux and 14 h darkness for 8-14 weeks depending upon the temperature. With increasing energy costs, this cultivation procedure became very costly and the idea was created to breed varieties which would be satisfied with a light intensity of ca. 3000 lux, which is equivalent to natural light prevailing during winter months in Northern Germany. Such genotypes were selected in F_1-populations after crossing various Chrysanthemum lines differing in their photoperiodic sensitivity.

The breeder of ornamental plants must aim at producing as many colour variants as possible before releasing a new variety, if he wants to prevent a competitor to draw commercial benefits from easy obtainable mutants. With this aim a mutation breeding programme was started. 12-25 unrooted cuttings each of four differently coloured, low light intensity requiring genotypes were irradiated with 1750 rad gamma rays (dose rate of 36000 rad/h) at the Institute of Biophysics, Technical University, Hannover. Terminal and axillary shoots were cut 4-6 times and propagated to obtain up to 500 plants per irradiated genotype. At flowering time a number of valuable colour mutations were detected, the spectrum depending upon the original genotype. Those appearing only in sectors were discarded, periclinal chimeras were further propagated. Besides changes in flower colour and certain morphological changes, also alterations of the photoperiodic reaction were noticed in some of the mutants, in the sense that some required less, others more than the standard illumination time of 9 weeks.

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(Contributed by M. Satory, Federal Research Centre of Horticultural Plant Breeding, D-2070 Ahrensburg, FRG).

Mutation breeding in Burma for improving grain quality, maturity time and plant height of high yielding rice varieties

In the late sixties and early seventies, Burma introduced a number of high yielding rice varieties from abroad to boost up rice production (IR5, IR20, IR22, IR24, C4-63). In some selected localities under a high level of management, the highest yield potential (5-6 t/ha) has been obtained from these varieties. However, when they were released to farmers and grown under different conditions with the farmer's cultural practices, most of the varieties showed a yield potential at par with or even lower than the local commercial varieties. Their acreage therefore reached only about 10% of the total rice area, and with this their contribution to the country's rice production was rather small. Only IR5 and C4-63 were found to be somewhat adaptable to Burmese conditions, but either too early (C4-63) or of poor grain quality (IR5). All of these introduced varieties were considered to be too short in plant height. To improve undesirable traits in these cultivars of high yield potential a mutation breeding programme was initiated in 1971. Out of IR5 irradiated with 25 kR gamma rays a mutant was selected which had higher yield, better grain quality, longer straw, higher milling outturn with equal or earlier maturity time. In 1975 the mutant was released by the Agricultural Corporation as variety under the name "Shwe-war-tun" (see MBNL No.12, 1978). In 1975 it was grown on more than 25000 acres yielding on the average 2531 lbs/acre (against a national average of 1500 lbs). In 1976 (wet season) the mutant variety was cultivated on ca 34000 acres, yielding 2675 lbs/acre.

From irradiated IR24 and C4-63 in total 31 promising mutant strains were put in trials in 1975. Of particular interest is a mutant strain 325/M4 from IR24, which requires a longer time to mature (160 days) and suits the rice growing period of ca 12 million acres or 50% of the total rice area in Burma (Kauklat Tract). Due to the rainfall pattern in this area, varieties are required which can be sown in June, transplanted in July and harvested in late November or early December. Floods occur in this area three times a year. In spite of the flood, the mutant (being about 4 feet tall) yielded in trials 4000 lbs/acre against only 2000 lbs from the local check variety C46-15). Seeds of the variety were distributed to farmers in 1978.

Another IR24 mutant, M4-17, is recommended for release as variety. It shows translucent kernels, grain type A, a plant height of ca.4 feet, a maturity period of about 145 days during the wet season and moderate resistance to stem borer and bacterial leaf blight.

REFERENCE

TIN MYINT, U., (Agricultural Research Institute, Gyogon). Report presented at the Annual Research Congress held at A.R.I. Gyogon, Rangoon, Burma, December 1977.

High yielding mutants in mung bean

Seeds of mung bean cultivar S-8 were exposed to gamma rays and fast neutrons with the aim to isolate mutants for the various morphological yield components. Seventy three mutants for different characters were isolated in the M_2 generation. Among these, twenty three had more pods per plant. These were grown for three successive generations during which further selections were made for increased number of pods per plant. This resulted in the selection of two mutants which gave 25 - 30% more yield than the parent cultivar S-8 in preliminary trials.

These were further tested at four locations, along with the best local variety under Punjabrao Krishi Vidyapeeth for two years. The mean yields of the mutants TP-6 and TP-7 (Trombay Phaseolus No. 6 and 7) were 47 and 49% more than the check variety (Table). In view of this significant increase in yield these have been recommended for mutilocation trials in farmer's fields. These and other mutants for different yield components have been utilized in inter-mutant and cultivar x mutant crosses.

Yield (kg/ha) of TP-6 and TP-7 during two years of multilocation trials

Variety	Mean of four locations 1978-79	1979-80	Mean for two years	Percent increase over check
TP-6	964	1181	1073	47
TP-7	1064	1109	1087	49
Kopergaon (Check)	650	948	728	

(Contributed by R.G. Thakare, S.E. Pawar and D.C. Joshua, Biology and Agriculture Division, Bhabha Atomic Research Centre, Trombay, Bombay, India).

Promising sesame mutants

Twenty true breeding morphological mutants were isolated in the M_2 generation in 1977, following exposure of sesame (*Sesamum indicum* L.) variety N-62-32 seed to gamma rays. In the M_4 and subsequent generations, mutant lines were screened for yield and oil content. Some of these lines have consistently given significantly higher yields for the last 2-3 seasons, while others have maintained higher oil percentage over the parent variety for three seasons (Tables). Five cultures are being tested in Punjabrao Krishi Vidyapeeth, Akola (Maharashtra State) against the other improved varieties.

Yield in kg/ha

Progeny No.	Rabi 1978-1979	Kharif 1979	Rabi 1979 - 1980 I	Rabi 1979 - 1980 II
Parent (N-62-32)	589	650	595	382
36-10	701	978	727	596
27-6	692	521	605	
22-5	520	810	426	
S-337	-	948	779	
R-149	-	888	773	

Oil (%) of mutant lines

Progeny No.	Kharif 1978	Rabi 1978-1979	Rabi 1979 - 1980
Parent (N-62-32)	51.9	46.4	47.13 ± 0.19
1-7	-	50.2	49.97 ± 0.03
1-8	57.6	49.2	49.20 ± 0.46
1-9	56.8	49.3	45.73 ± 1.60
2-2	56.1	48.5	48.37 ± 0.12
3-1	55.0	49.0	47.13 ± 0.15
22-2	54.4	50.0	49.34 ± 0.18
30-3	54.0	47.0	45.07 ± 0.06
31-1	53.9	48.7	46.17 ± 0.56
34-3	55.3	49.5	49.87 ± 0.26
43	55.5	50.3	47.37 ± 0.52

(Contributed by G.S.S. Murthy, Biology and Agriculture Division, Bhabha Atomic Research Centre, Bombay 400 085).

EMS induced dominant mutations in *Phaseolus vulgaris* L.

The present communication is meant as a response to the FORUM question raised in MBNL No. 13, 1979 whether "mutation induction mostly leads to mutant characters behaving as single gene recessives against the original genotype (parent)".

Two varieties of dry bean "Porrillo Sintético" and "Carioca" were utilised in the study. Hundred seeds each of these varieties were pre-soaked in distilled water for 24 hrs and were treated with 0,7% EMS solution (pH 6,8) for 6 hrs at 25°C. After a thorough washing in distilled water, the seed was allowed a period of 17 hrs recovery on moist filter paper and later planted in greenhouse pots.

In the M_1 generation of Cariocoa, a plant with dark green, rough textured leaves with small epidermal projections was observed. The mutant exhibited brittleness of stem and leaf petioles and showed on an average 70% pollen sterility. The very few seeds obtained from the mutant when planted in M_2, segregated for normal and mutant phenotypes, thus showing the heterozysity of the mutant phenotype. The inheritance studies indicate a simple Mendelian inheritance, the mutant type behaving dominant.

The field planted M_2 population of the variety "Porrillo Sintetico" exhibited several chlorophyll and morphological mutants, two of them being dominant to the normal type. One is a chlorophyll mutant, with distinct yellowish green leaves visible in 3-4 weeks old plants. The mutant segregated in M_3 generation for normal and mutant types and the character is controlled by 1 or 2 dominant genes. The inheritance of this characters is under study. The other mutant observed is characterized by dwarf plant type with a overall reduction in plant height and other plant parts including pods. The character as reported earlier (Tara Mohan, 1979) is governed by a dominant gene. The mutant in certain morphological respects resembles the compact mutant of bean induced by γ-radiation (Moh and Allan, 1971), which is governed by a recessive gene.

These results indicate that induced mutagenesis can lead to mutants with the mutant character exhibiting dominant inheritance, though the more common phenomenon is the occurrence of mutants behaving as single gene recessives.

REFERENCES

MOH, C.C. and ALAN, J.J., Bean mutant induced by ionizing radiation VII. Compact Mutant. Turrialba 21 (1971) 478-480.

TARA MOHAN, S., EMS-induced dwarf mutant of dry beans (*Phaseolus vulgaris* L.). Turrialba (in press).

(Contributed by S. Tara Mohan, Instituto Agronomico de Paraná, Caixa Postal 1331, 86.100 Londrina, Paraná, Brasil).

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
Triticum aestivum			
Mv 8	1978 Hungary G. Szilagyi, D. Szalay Agric. Res. Inst. Hung. Acad. Sciences Martonvásár	1965 cross Bezostaya 1 mutant x Ranka III mutant 1500 r gamma rays 1962 soaked and vernalized seed [Bezostaya I, Ranka III]	short culm, strong straw lodging resistant 1980 cultivated on ca. 120,000 ha in Hungary
Claudia (identical with Mv 8)	1979 Italy	1965 cross Bezostaya 1 mutant x Ranka III mutant 1500 r gamma rays 1962 soaked and vernalized seed [Bezostaya I, Ranka III]	
Altimir 67	1979 Bulgaria P. Savov, Inst. of Genetics Bulgarian Acad. of Sciences Sofia	5 krad gamma rays F_2 seeds from cross Skorospelka x Mexipak	productive spikes resistant to stem and leaf rust and to powdery mildew

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 turgidum ssp. durum			
G-0367	1970 Greece Cereal Research Institute Thessaloniki	neutron [YG-3688]	
Attila	1980 Austria J. Adam Plant Breeding Station Neuhof A-2471 Rohrau	cross Adur x mutant of Capelli	short culm, lodging resistant, high yield, high TKW and yellow pigment
Grandur	1980 Austria H. Hänsel Probstdorfer Saatzucht GmbH Vienna	cross Adur x Castelporziano (CP 132, mutant of Capelli)	short culm, lodging resistant, high TKW, high yield
Ricinus communis			
RC8	1978 India S.S. Sindagi, M.R. Rao, T.S. Rao Univ. Agric. Sciences Bangalore, Karnataka	40 kR gamma rays [Rc 1188-54]	in comparison to "Aruna" castor taller, longer growth period, higher TKW, higher yield
Gossypium hirsutum			
Rasmi	1976 Orissa(India) R.N. Raut, R.S. Panwar and H.K. Jain Ind. Agric. Res. Inst. New Delhi	30 kR gamma rays 1969 [M.C.U.5]	daylength tolerant therefore suitable for cultivation throughout India during main Kharif season and also off-season, high yield, superior quality

Pusa Ageti	1978 New Delhi (India) R.N. Raut, R.S. Panwar and A.K. Basu Indian Agric. Res. Inst. New Delhi	25 kR gamma rays 1969 [Stoneville 213]	high ginning (GP 38) short duration (150 days) Jassid tolerant (hairy) fits well for cotton/wheat rotation in Northern India
Lespedeza cuneata Dumont			
Interstate 76	1979 USA E.D. Donnelly Dept. Agron. and Soils Auburn Univ. N.A. Minton USDA, Georgia Coastal Plain Exp. Station Tifton	cross Interstate x Ala L11	resistance to Meloidogyne incognita et al. higher yielding than Interstate
Capsicum annuum L.			
Albena	1976 Bulgaria S. Daskalov Inst. Genetics and Plant Breeding Sofia	13.5 krad gamma rays dry seeds 1970 [Zlaten medal]	more attractive fruits, better flavour because of lack of anthozyanine
Chrysanthemum			
Blue Star	1977 The Netherlands Fides, De Lier*	1.75 krad X-rays 1976 [Pink Star]	darker pink flower colour
Bright Star	1977 The Netherlands Fides, De Lier*	1.75 krad X-rays 1976 [Pink Star]	bright pink flower colour
Morning sun	1978 The Netherlands C.B.S.H., De Lier*	1.75 kR X-rays; rooted cuttings 1976 [Evening sun]	pure yellow flower colour

* In cooperation with the Association Euratom-ITAL, Wageningen.

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
Chrysanthemum			
Amber Boston	1978 The Netherlands C.B.S.H., De Lier in co-op. with Pan Amer. Pl. Co.*	? [Pink Boston]	bronze flower colour, better grower than existing sport
Miros	1978 The Netherlands Chryveco, 's-Gravezande	1750 rad X-rays; rooted cuttings 1976 [Mikrop]	darker pink flower colour, 10 cm longer crop in winter
Dark Miros	1979 The Netherlands Chryveco, 's-Gravenzande*	1750 rad X-rays 1977 rooted cuttings [Miros]	darker pink flower colour rest of genotype unchanged
Bronze Miros	"	"	bronze flower colour rest of genotype unchanged
Orange Miros	"	"	orange flower colour rest of genotype unchanged
Rohit	1979 Lucknow (India) M.N. Gupta and S.K. Datta National Botanical Res. Institute Lucknow	Gamma rays - 2 krad 1977 (Kingsford Smith)	rhodonite red flower heads
Bronze Star	1977 The Netherlands Fides, De Lier*	1.75 krad X-rays 1976 [Pink Star]	bronze flower colour

<u>Chrysanthemum</u>			
Yellow Westland	1978 The Netherlands C.B.S.H., De Lier*	1.75 krad X-rays 1975 [Westland]	yellow flower colour
White Westland	1978 The Netherlands C.B.S.H., De Lier*	1.75 krad X-rays 1975 [Westland]	white flower colour
Besanti	1979 Lucknow (India) M.N. Gupta and H.M. Jugran National Botanical Res. Institute Lucknow	Gamma rays - 1.5 krad + 1.5 krad (after 1 day) 1976 (E-13)	yellow flower-heads
Hemanti	1979 Lucknow (India) M.N. Gupta and R. Shukla National Botanical Res. Institute Lucknow	Gamma rays - 1.5 krad 1977 (Megami)	Chinese yellow flower-heads
<u>Streptocarpus</u>			
Nicky	1979 FRG Gerhard Fleischle Vaihingen/E. Ensingen In co-operation with the Foundation ITAL Wageningen	3 krad X-rays 1977 [Neptun]	darker blue flower colour, free-flowering, compact growth habit and shorter leaves

* In cooperation with the Association Euratom-ITAL, Wageningen.

FUTURE EVENTS

1980

FAO/IAEA Advisory Group on the Use of Induced Mutations for Improving Oil Seed and Other Industrial Crops, Vienna, Austria, 17 - 21 November.

Fourth International Symposium on Nitrogen Fixation, Canberra, Australia, 1 - 5 December.
Contact: A.H. Gibson, Division of Plant Industry CSIRO, P.O. Box 1600, Canberra City ACT 2601, Australia.

1981

Second International Seminar on Winged Bean, Colombo, Sri Lanka, 19 - 23 January.
Contact: W. Herath, Faculty of Agriculture, Peradeniya, Sri Lanka.

Conference on Soybean Seed Quality and Stand Establishment, Colombo, Sri Lanka, 25 - 31 January.
Contact: INTSOY, University of Illinois, 113 Mumford Hall, Urbana, Illinois 61801, USA.

FAO/IAEA Symposium on Induced Mutations as a Tool for Crop Plant Improvement, Vienna, Austria, 9 - 13 March.

World Sweet Potato Conference, AVRDC, 23 - 27 March.
Contact: R.L. Villareal, AVRDC.

Fourth International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO), Bangi, Selangor, Malaysia, 2 - 6 May.
Contact: MARDI, P.O. Box 202, Serdang Selangor, Malaysia.

Third Seminar of FAO/SAREC Project on Improvement in Nutritional Quality of Barley and Spring Wheat, Ankara, Turkey, 10 - 21 May.

First International Safflower Conference, Davis California, USA, 12 - 17 July.
Contact: P.F. Knowles, Agron. and Range Science Department, Univ. of California, Davis CA 95616, USA.

Fourth International Barley Genetics Symposium, Edinburgh, UK, 22 - 29 July.
Contact: W. Campbell, University of Edinburgh, 16 George Square, Edinburgh, Scotland, UK.

EUCARPIA, Section Mutation and Polyploidy, Wageningen, The Netherlands, August.
Contact: W. Odenbach, Institut f. Angewandte Genetik, Freie Universität, 1000 Berlin 33, Albrecht-Thaer-Weg 6.

13th International Botanical Congress, Sydney, Australia, 21 - 28 August.
Contact: W.J. Cram, University of Sydney, N.S.W. 2006, Australia.

RECENT PUBLICATIONS

Crop Improvement by Induced Mutation: Proceedings of Gamma Field Symposium No. 18. Institute of Radiation Breeding, NIAS, Ohmiya, Ibaraki-ken, Japan 1979.
Content:

Use of mutation induction to alter the ontogenetic pattern of crop plants
A. Micke (FAO/IAEA)

Modification of resistance to Puccinia recondita tritici in wheat populations after mutagenic treatment
K. Borojevic (Yogoslavia)

Wheat improvement by induced mutation
K.A. Siddique, M.A. Rajput, M.A. Arain, A.G. Arain, K.A. Jafri (Pakistan)

Mutation breeding in Brazil
A. Tulmann Neto, A. Ando, J.O.M. Menten (Brazil)

Studies on some agronomic and quality characteristics of 271 induced early mutants of rice (Oryza sativa L. cv. Nizersail)
M. Rahman, A.J. Miah, M.A. Mansur, A.K. Kaul (Bangladesh)

Breeding of new rice varieties by gamma rays
M. Toda (Japan)

Screening for protein quantity and quality and for other nutritional factors in breeding programmes
E.G. Niemann (FRG)

Studies on the improvement of the components of essential oil of genus Mentha by radiation
S. Ono (Japan)

Effect of irradiation upon essential oil content of peppermint (Mentha piperita L.) and its composition
A. Sadowska (Poland)

Effect of gamma-ray irradiation on hybridization between Chamaecyparis obtusa S. et Z. and C. pisifera S. et Z.
T. Maeta (Japan)

Potential use of heavy-ion radiation in crop improvement
T.C. Yang, C.A. Tobias (USA)

Advances in Legume Science. Proceedings of International Legume Conference, Kew 1978. Royal Botanical Gardens, Kew (UK) 1980 - £15.

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
Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development

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