Mutation Breeding Newsletter

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News from the FAO/IAEA Plant Breeding and Genetics Section

At a Regional Seminar on Improving Rice Production through Research using Nuclear Techniques, held at Jakarta (Indonesia) 10 - 14 October 1977, plant breeders, agronomists, plant pathologists and entomologists from 10 countries gathered to discuss achievements, current problems and plans for interdisciplinary research.

Plant breeders and entomologists from 9 countries met 17 - 21 October at Dakar (Senegal) to review prospects, desirability and feasibility of using mutation induction for improving resistance of crop plants to insect pests.

The Second Interregional Training Course on Plant Breeding for Disease Resistance including the Utilization of Induced Mutations was organized 14 November - 12 December 1977 at the Indian Agricultural Research Institute in New Delhi with 20 trainees from 14 countries. The Course included a field trip to Hyderabad (ICRISAT, All India Coordinated Rice Improvement Programme and IARI Regional Research Station) as well as to the Bhabha Atomic Research Centre at Bombay.

In the meantime preparations for the FAO/IAEA/GSF International Symposium on Seed Protein Improvement in Cereals and Grain Legumes (to be held 4 - 8 September 1978 at Neuherberg, FRG) are progressing well. From the papers submitted for presentation it appears that the symposium will have a very ambitious programme and a large international audience.

Regarding our future activities you may be aware that FAO is giving priority during the next biennium to reduction of crop losses pre-and post-harvest. This is a challenge to plant breeders in terms of resistance to diseases and insect pests attacking crop plants at pre-harvest stages. Also the problem of mycotoxin development in fungus infected grain should receive plant breeder's attention. We will therefore continue to have strong interest in all aspects of crop plant disease resistance, and resistance against disease transmitting vectors, placing more emphasis than in the past on leguminous and other dicotyledonous plants. We would appreciate to learn about ongoing research projects in these fields and would make all efforts within our capabilities to support worthwhile projects.

As physiological aspects are of increasing concern to plant breeders particular in the context of efficient use of fertilizer and water, of salinity tolerance and drought resistance, but also in regard of photosynthesis, respiration, and source-sink relationships, we will also pay increasingly attention to the potential of tracer techniques to help the plant breeder in identification of superior crop genotypes.

RESEARCH NEWS

Early mutations in pearl millet

A number of early mutants that flower 35 - 50 days after planting (as compared to 80 - 90 days for normal types) have been recovered from mutagen treated pearl millet 'Tift 23B' and 'Tift 239DB' seeds. The mutants were isolated while screening large populations for induced protein mutants. The mutagens used were thermal neutrons, ethyl methane sulfonate, and diethyl sulfate alone and in various dual treatments.

We believe that the mutants have tremendous potential for grain production in areas of limited rainfall. The short-season millets may not yield as much as regular season pearl millets but should give more reliability to grain production because grain can be produced with less water and in a shorter period of time. They should also fit well into multi-cropping systems.

The early genes are being used to develop early cytoplasmic male sterile and are being transferred to other inbreds so that early experimental hybrids can be developed.

(Contributed by W.W. Hanna and G.W. Burton, USDA-ARS, Coastal Plain Station, Tifton, Georgia, U.S.A.)

Amber-white seed mutant through chemical mutagenesis in rye (*Secale cereale* L).

Chemical mutagenesis using ethyl methane sulphonate (EMS) and diethyl sulphate (DES) was attempted for the first time using seeds produced from an open pollinated variety of rye, OD-275 (Univ. of Manitoba, Canada, accession number). Previous attempts to induce mutations in this crop have been limited to inbred populations (1). Cyto-morphological effects of treatments were studied in M_1 and M_2 generations. Sibbing between plants of each treatment combination was allowed but different treatments were kept isolated from each other. Out of the various treatment combination attempted, the most effective treatments gave chlorophyll mutations in M_2 with the following frequencies:

EMS:	0.4%	12 hrs.	-	2.76% of M_2 seedlings
	0.4%	6 hrs.	-	2.13% "
DES:	0.1%	4 hrs.	-	2.13% "

(DES treatment solution was changed after two hours).

These frequencies tend to be underestimates due to out-crossing between plants of a treatment. OD-275 undergoes complete cross-fertilization as controlled selfing never resulted in seed-set. Thus the calculation to realize actual frequency of chlorophyll mutations gave the figure of 8.3% for the observed 2.76% of M_2 seedlings. DES was more efficient than EMS by causing less seedling mortality and seedling height reduction in M_1.

A plant with amber white coloured seeds was isolated in M_3 generation of the treatment, 0.1% DES, 4 hrs. This mutant, otherwise, has retained all other characters of OD-275. Since in Indian sub-continent there is a strong preference for amber grain cereal varieties, this mutant may be useful in triticale - breeding programmes. Our preliminary results show this amber grain trait to be recessive.

REFERENCE

[1] MÜNTZING, A. and BOSE, S., Induced mutations in inbred lines of rye. I. EMS treatments. Hereditas 62 (1969) 382-408.

(Contributed by S.P. Tiwari, Division of Genetics, I.A.R.I., New Delhi, and N.S. Sisodia, Wheat Research Station, Powarkheda, Department of Plant Breeding & Genetics, J.N.A.U., Jabalpur, M.P., India)

Changes in the protein quantity and quality of soft winter wheat mutant lines

Through irradiation of seeds with cobalt 60 gamma rays in doses of 10 and 15 kR of the Kaukaz, Aurora and Bourgas-3 wheats, lines were obtained in M_2 which by morphological features differ from the initial varieties. Some constant mutant lines of M_3 (crop 1972) which in preliminary analysis showed a higher protein content than the initial varieties were used for a biochemical analysis in regard to crude and pure protein content and its fractional composition, after due selection. The analysed mutant lines proved substantially different from the initial varieties. Of the Bezostaya 1 variety, line M1/5362 and M23/105 were selected, whose high 1000-grain weight is combined with a high percentage of protein, while in the lines M160/765 and M327/1333 originating from Aurora a high percentage of protein is combined with a high lysine content. The indicated lines could be used for initial material in wheat breeding.

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[1] RACHINSKA, T. and DZHELEPOV, K. (Institut po Pshenitsata i Slynchogleda, General Toshevo, Bulgaria). Prouchvane na izmeneniyata v kolichestvoto i kachestvoto na beltyka v mutantni linii zimna meka pshenitsa. Rastenievyd. Nauki v.13(8) (1976) 3-7.

Chromosomal changes in ryegrass plants regenerated through tissue culture

Ryegrass plants were regenerated from callus obtained from an aborted triploid embryo 2n = 3x = 21 of hybrid origin, 2x (*Lolium perenne - multiflorum*) x 4x (*L. perenne*). The callus was maintained and proliferated on modified Murashige and Skoog medium (1). More than two thousand plants were regenerated on a continuous basis over 4 year duration. Twenty-five plants, from successive subcultures, were analyzed for their chromosome number and meiotic behaviour. These plants showed the following chromosome numbers:

2n =	15*	17	18*	19	20	21	27	29	30*
No. of plants	1	1	1	1	14	3	2	1	1

* Colchicine treated

Some plants showed pollen mother cells with polyploid numbers, e.g. 2n = 20, 40, 60, 200 or 2n = 19, 38, 57, from the same floret. Such cells appeared to originate from cell fusion during microsporogenesis. Most plants showed meiotic associations suggestive of translocations, inversions and deletions. It appears that whole chromosomal loss which following changes in chromosome structure, resulted in plants with lower than 21 chromosomes while spontaneous somatic cell fusion followed by chromosomal elimination produced plants with chromosome numbers more than 21 (e.g. 27 to 29). Inclusion of colchicine in the medium reduced as well as increased chromosome numbers (e.g. 2n = 15 and 30).

A large number of plants showed abnormalities in spike development; a few had no florets; others produced small, crinkled inflorescence with abnormal anthers and sterile pollen.

A wide array of phenotypic variants were obtained from the seed progeny of the in vitro regenerated plants. Plant regeneration through tissue-culture thus offers a powerful method to obtain novel variants and new recombinants in ryegrass.

REFERENCE

[1] AHLOOWALIA, B.S., Crop Sci. 15 (1975) 449-452.

(Contributed by B.S. Ahloowalia, Plant Breeding Department, Agricultural Institute, Oak Park Research Centre, Carlow, Ireland)

A homoeologous-pairing mutant isolated in Triticum durum cv. Cappelli

Among mutants induced through irradiation in durum wheat by Scarascia-Mugnozza, D'Amato and Bozzini (1961), a particular mutant affecting homoeologous pairing has been recently identified. The mutant line, characterized by a mutation for the color of the awns (which turn brown before maturity), was subjected in 1965 to cytological analysis to see whether or not chromosome aberrations were present. Meiotic analysis revealed the occurance of a simple reciprocal translocation, which was confirmed at mitotic level. The chromosome pair with the highest arm ratio (later classified as the chromosome 5B) showed an irregular morphology. In particular the long arm of this chromosome in some plants was longer than normal, whereas in others it was shorter. In metaphase I of the microsporocytes normal pairing was observed in the former type, while 2 to 4 univalents and rarely a multivalent were present in the latter type of plants.

Crosses between the mutant and Ae. longissima have now revealed in the microsporocytes of F_1 plants a tremendous amount of homoeologous pairing of up to 4 univalents, 4 bivalents and 3 trivalents per cell.

From the analyses so far carried out it seems that a non-equal translocation between the long arms of the chromosome 5B has taken place, so that individuals without the Ph locus have been obtained.

After the two mutations induced in bread wheat at the Ph locus by Riley et al. (1966, 1971) using EMS and by Sears (1975) using X-rays, this is the first mutant isolated in tetraploid wheat. It offers the possibility of transferring alien variation from wild related species to durum wheat.

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(Contributed by B. Giorgi, CNEN, Divisione per le Applicazioni delle Radiazioni, CSN Casaccia, S. Maria de Galeria, Roma, Italy)

Economic importance of semidwarf mutant rice variety "Jagannath"

The variety "Jagannath" released in 1969 represents a mutant induced by x-rays in the rice variety T141. Its positive features described were resistance to drought and shattering, resistance to leaf blight, moderate resistance to tungro virus, slender grain, good cooking quality, and suitability for ill drained soils during the main season. In the State of Orissa, where rice is grown on 4.7 Mill ha, about 500 000 ha are medium low land on which Jagannath could be cultivated. In this area, the variety has gained popularity as can be judged from its acreage:

1972 - 73	10 000
1973 - 74	15 000
1974 - 75	40 000
1975 - 76	70 000
1976 - 77	80 000

The area under this mutant cultivar in the neighbouring Indian states may be around 10 000 ha.

(Contributed by H.K. Mohanty, Department of Plant Breeding and Genetics, Orissa University of Agritulture and Technology, Bhubaneswar, Orissa (India)).

Early flowering mutant of Basmati rice released as "Kashmir Basmati" in Northern areas of Pakistan

In Pakistan, Basmati 370 rice is grown for its good cooking quality and aroma. It also earns foreign exchange of about 120 million dollars annually through export. Basmati 370 is most popular and is a rare freak of nature for its cooking quality. Unfortunately, this variety matures very late and it is difficult for the farmers to complete wheat sowing well in time in fields occupied by Basmati rice. It was possible to evolve an early flowering mutant EF-29-1 through induced mutation (Awan and Cheema, 1976).

The mutant matures about three to four weeks earlier as compared to the parent Basmati 370, without any appreciable change in yield potential and grain characteristics.

Unfortunately the mutant showed susceptibility to blast disease during last two years of field trials conducted in the major rice growing tracts of Punjab, as such its release was withheld in the plains.

The Northern hilly areas of Pakistan grow old indigenous types of coarse rice, with very low yield potential and poor cooking quality. Efforts were made from time to time to introduce high yielding varieties of coarse rice as well as Basmati. The introduced varieties either did not flower at all or in certain cases were very late in maturity and due to early onset of winter, the farmers could not even harvest their crop. Early flowering mutant EF-29-1 when grown in Azad Kashmir flowered and matured properly. The mutant gene/genes responsible for earliness also appear to have a pleiotropic effect on flower induction behaviour in Basmati 370. The average yield recorded last year was 2520 kg/ha. The climatic conditions of Azad Kashmir are not favourable for rice blast, therefore EF-29-1 escapes the blast attack. The other attributes being at par with Basmati 370, the mutant was released by the Department of Agriculture. Azad Kashmir for cultivation and named "Kashmir Basmati" during January 1977 (see MBNL No.10 p.15).

REFERENCE

[1] AWAN, M.A. and CHEEMA, A.A., Performance of early flowering mutant lines of rice variety Basmati 370. Mutation Breeding Newsletter No. 7 (1976) 4-5.

(Contributed by M. Akbar, S. Hassan Mujtaba Naqvi and A. Shakoor, Nuclear Institute for Agriculture and Biology, Lyallpur, Pakistan)

Exploitation of induced mutant genes in Pisum: breeding new cultivars in Poland

Studies on inducing mutations in peas have been carried out in our Institute since 1965. They differ from other pea-oriented studies primarily in respect of the choice of initial material and that of different radiation doses [Jaranowski, 1976]. A wide range of mutations has been obtained of various physiological, morphological and biochemical characteristics [Jaranowski, 1976]. Following derivation of mutants and on basis of their characteristics, intensive work has been started on the assessment of selection value for certain mutant genes. The studies were designed to substitute normal genes in commercial cultivars and strains by mutated genes and to find out whether the value of the mutated gene was equal to that of the original one. The first stage of the studies covered three genes, viz. for earliness, large "magnifolialis" and changed "cirrhifolialis" leaves. Several dozens of new genotypes were obtained in all groups of peas [i.e. garden pea, edible pea and forage pea]. The experiments revealed that the mutant genes are in many cases equivalent to the normal ones, i.e. they do not influence the plant vigour and yield. However, from the practical viewpoint they carry additional values, e.g. resistance to lodging, tolerance to water deficiency, reduced disease effects, uniform maturity etc. Of particular interest are morphotypes involving two mutant genes: cir and mag. Their leaflets are changed into tendrils and they have remarkably enlarged stipules. The lines derived from them are subject to intensive breeding work carried out by several plant breeding stations. Two cultivars are currently under official testing and it is assumed that new varieties will be released in the coming years.

Apart from the breeding work carried out by the author, several other new genotypes, including also mutated genes have been obtained for testing through the "Pisum Genetics Association" collection and breeding programme [S. Blixt, Weibullsholm Plant Breeding Institute, Landskrona, Sweden].

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[3] BLIXT, S., Pisum. Genetic resources in plants - their exploration and conservation (1970) 321-326.

(Contributed by J.K. Jaranowski, Institute of Genetics and Plant Breeding, Academy of Agriculture, Poznań, Poland)

Induction of upright and compact plant type mutants in chickpea (*Cicer arietinum* L.)

Cultivars/land races of chickpea (*Cicer arietinum* L.) presently grown by the farmers in Pakistan are bushy and spreading in habit and have low yield potential. The excessive vegetative growth results in poor harvest index. The plant type in this crop is not amenable for growing under improved cultural practices. A breeding programme was undertaken with a view to evolving suitable plant type through induced mutations.

Dry seed of a commercial variety C727, containing 12% moisture were irradiated with 10 kR dose of gamma rays from ^{60}Co source. More than 10,000 M_2 plants resulting from 950 M_1 single plant progenies were raised. One of these progenies gave rise to three mutant plants showing upright and compact habit of growth. Individual plant progenies of these mutant plants were further studied in M_3 generation. Three progenies showed a uniform behaviour for upright, compact plant type whereas one progeny segregated for upright plant type.

Morphological characteristics of three upright and compact mutant lines and the parent cultivar C 727 (mean values):

lines	plant height(cm)	No. of primary branches	No. of secondary branches	No. of pods/plant	No. of grain/plant
CM 11	60.6	3.4	14.0	152.0	179.2
CM 15	71.8	2.6	13.6	123.8	146.0
CM 16	67.6	3.5	17.2	144.7	155.1
C 727(parent)	65.8	3.0	17.0	133.0	160.0

Invariably all the mutant lines possessed 2 to 3 rudimentary primary branches giving rise to secondary fruit bearing branches, whereas in chickpea normally fruit is borne on the tertiary branches. However, the mutant lines did not differ much in total plant length, as well as average number of pods per plant and average number of grains per pod as compared to that of the parent. The mutant lines differed slightly in number of days till flowering and time till maturity. No pleiotropic ill effect on fertility and seed size was observed in these mutant lines.

Based on average number of pods per plant and number of grains per pod, the grain yield potential per plant in the mutant lines appears to be similar to the parent variety. However, the upright and compact plant type seems to be better suited for dense planting and higher yields might be obtainable this way.

(Contributed by Abdul Shakoor, M. Ahsanul Haq and M. Sadiq, Nuclear Institute for Agriculture and Biology, Lyallpur, Pakistan)

Evaluation of spur mutants of sweet cherry

Dormant buds of sweet cherry varieties Durone di Vignola I, II, III, B. Moreau, B. Burlat, B. Napoléon, Mora di Vignola, Saccoccia and Ravenna have been treated with X-rays or gamma rays [1,2,3 and MBNL no.8 p.7]. In the MV_2 several mutations were observed and particularly those having a reduced shoot lenght were isolated and multiplied.

The more promising cherry mutants already isolated have been planted in the field in 1972 and their characteristics regarding shoot length and calibre, trunc diameter, plant volume and height, production per tree, size and taste of the fruit have been evaluated.

The mutants have in general, in comparison to the controls, a plant height reduction, higher production per tree and some of them are early in fructification. The characteristics of fruit size, taste and ripening period are unchanged.

The mutants will be readily multiplied and distributed for dense plantation.

Varieties/ mutants	Plant height m	Fruit production/tree (kg)		
		1975	1976	1977
B. Burlat	6.80	3.0	3.6	18.6
Mutant 69-118-B4	5.40	12.0	28.0	25.4
Mutant 69-150-A3	5.10	8.6	17.1	20.4
Durone II di Vignola	8.85	3.0	1.5	9.7
Mutant 67-7-A3	6.30	2.5	2.0	5.0
Mutant 67-38-B3	6.95	4.6	2.3	13.4
Mutant 68-98-B3	7.30	1.6	6.5	3.1
Mutant TS 7	5.50	1.2	7.8	7.9
B. Moreau	6.00	1.0	5.3	5.2
Mutant 69-26-B4	6.30	8.8	23.0	31.3

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[1] ROSELLI, G. and DONINI, B., Mutazioni radioindotte in un portainnesto clonale di ciliegio e in cultivar di ciliegio dolce. "Atti del 2° Convegno del Ciliegio", Verona (1973)

[2] DONINI, B., FIDEGHELLI, C. and ROSATI, P., Mutanti compatti indotti con radiazioni in varietà di ciliegio. "Atti del 2° Convegno del Ciliegio", Verona (1973)

[3] DELLA STRADA, G., DONINI, B., FIDEGHELLI, C., MANNINO, P. and ROSATI, P., Selezioni "compatte" di ciliegio dolce ottenute mediante radiazioni ionizzanti. Frutticoltura 39 No. 9 (1977) 15-20.

(Contributed by B. Donini, Laboratory of Agriculture, CNEN, CSN Casaccia, S. Maria di Galeria, Rome, Italy).

Induced early flowering, dwarf mutations in linseed (*Linum usitatissimum*)

TL-1 and TL-2 are two mutants isolated at this research centre from the recommended linseed var. Neelum following treatments of the seeds with 50 kR gamma rays and 0.05 per cent ethylmethane sulphonate respectively. The mutants are significantly early flowering, short in height and contain 3-5 per cent points more oil which is lighter coloured as compared to the parent. TL-2 has given about 30 per cent higher seed yield than Neelum, apparently due to increase in the number of primary branches. Among the two mutants, TL-1 is earlier and has bolder seeds than TL-2. The mutants TL-1 and TL-2 are at present in M_{11} and M_6 generations respectively. TL-1 and TL-2 have been crossed to develop strains with still better agronomic traits.

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

Comparison of mutagenicity of thermal neutrons and of N-ethyl-N-nitrosourea in rape

An experiment with variety 'Oro' of spring oilseed rape demonstrated that in genetically complex organisms thermal neutrons can show a higher or at least equal mutagenicity as N-ethyl-N-nitrosourea. In comparison with thermal neutrons, ENH induced high numbers of chimeric plants. No albino mutants were found. Viridis mutants occurred only after exposure to neutrons. Doses of 1.5×10^{13} n% cm^{-2} and 2×10^{13} n% cm^{-2} of thermal neutrons and concentrations of 0.03 and 0.02% of ENH showed the highest mutagenicity.

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[1] UHLIK, J., (Vysoka Skola Zemedelska, Prague, Czechoslovakia) Srovnani mutacni aktivity tepelnych neutronu a N-ethyl-N-nitrosomocoviny u geneticky sloziteho modelu. Genet. Slechteni 12(4) (1976) 197-205.

New induced mutants in *Portulaca grandiflora* Hook

In the course of investigations on inducing mutations in ornamental plants, seven mutants with distinct differences in flower colour, shape and size were obtained in perennial *P. grandiflora*, using chronic and acute gamma rays. Following the application of colchicine a tetraploid was also isolated from the five petal mutant evolved at this Centre. The tetraploid was early in flowering, by 14 days, with extra-large flowers and good fruit and seed set. The control is characterized by its carmine red flowers, numerous petals and stamens varying in number, and no fruit and seed set. Outer petals are long and broad, towards the centre short and narrow.

The salient features of the new mutants are presented in the following table:

Mutants	Salient features
1. Five petal mutant	Profusely flowering, petals five, flower buds pointed, flowers carmine red, stamens numerous, male sterile, stigma above the level of anthers.
2. Gerbera type	Sparsely flowering, petals in 3-4 rows, almost uniform in size, narrow, loosely arranged, and spreading (resembling *Gerbera* flower in shape).
3. Large semi-double	Flowers larger than in control, petals in 4-6 rows only, uniformly broader.
4. Small semi-double	Flowers smaller, than in control, petals in 2-4 rows.
5. Rosygreen	Flowers very small, do not open out, with rosy green margins, petals compactly arranged, stamens absent.
6. Light pink	Flowers as in control but with colour difference.
7. Tetraploid	Flowers extra large, petal five, pollen fertile, stigma almost below the level of anthers, good fruit and seed set.

The induced mutants are of better ornamental value.

(Contributed by V. Abraham and B.M. Desai, Biology and Agriculture Division, Bhabha Atomic Research Centre, Trombay, Bombay, India)

The kinetics of nitrogen accumulation in the *T. aestivum* variety Kalyan sona and its high protein mutant TW-1

TW-1 is a high protein mutant selected from the mutagenic treatment of Kalyan sona at the Bhabha Atomic Research Center, Bombay, India. (Seeds were kindly supplied by Dr. C.R. Bhatia, BARC). In order to understand how TW-1 reaches its high protein content, a study of the kinetics of nitrogen accumulation in the developing seed of the mutant and mother variety has been carried out at the IAEA Laboratory Seibersdorf. The two lateral seeds of each spikelet with the exclusion of the topc and bottom ones were analyzed.

Starting from 15 days after flowering, TW-1 showed higher rates of nitrogen accumulation than Kalyan sona. The maximum rate observed clearly surpassed that of the high protein reference variety ATLAS-66. Not only did TW-1 show higher rates of nitrogen accumulation, but the process itself lasted a few days longer than in the mother variety (Fig. 1a).

Both TW-1 and Kalyan sona responded positively to the additional application 50 kg of nitrogen (as ammonium nitrate) between heading and flowering, although with different intensity and in different ways (Fig. 1b). TW-1 showed an earlier rise of the rate of nitrogen accumulation but the maximum value obtained remained the same. Kalyan sona responded to late nitrogen application by progressively increasing rates of nitrogen accumulation, with the highest value approaching TW-1.

Besides the differences in the kinetics of nitrogen accumulation, a comparison of the dry seed weight, percent nitrogen, amount of nitrogen per seed, percent lysine and lysine content per grain was made (Table). The increase of nitrogen content in TW-1 occurred with only a very slight reduction of the lysine percent and without change in seed dry weight. Consequently, the total amount of lysine per seed increased substantially.

Mature seed characters of mutant TW-1, its parent variety Kalyan sona and of Atlas 66
"N1" = normal fertilization (40 kg N) "N2" = additional late application of 50 kg N

		seed dry weight mg	nitrogen		lysine	
			%	mg per seed	%	mg per seed
TW-1	N1	48.5	2.8	1.33	2.30	0.192
	N2	50.0	3.2	1.59	2.30	0.228
Kalyan sona	N1	48.0	2.3	1.08	2.40	0.162
	N2	51.5	2.7	1.38	2.50	0.215
Atlas 66	N1	41.0	3.5	1.44	2.14	0.192
	N2	42.0	3.5	1.47	2.18	0.200

(Contributed by A. Brunori, IAEA Laboratory Seibersdorf, Austria)

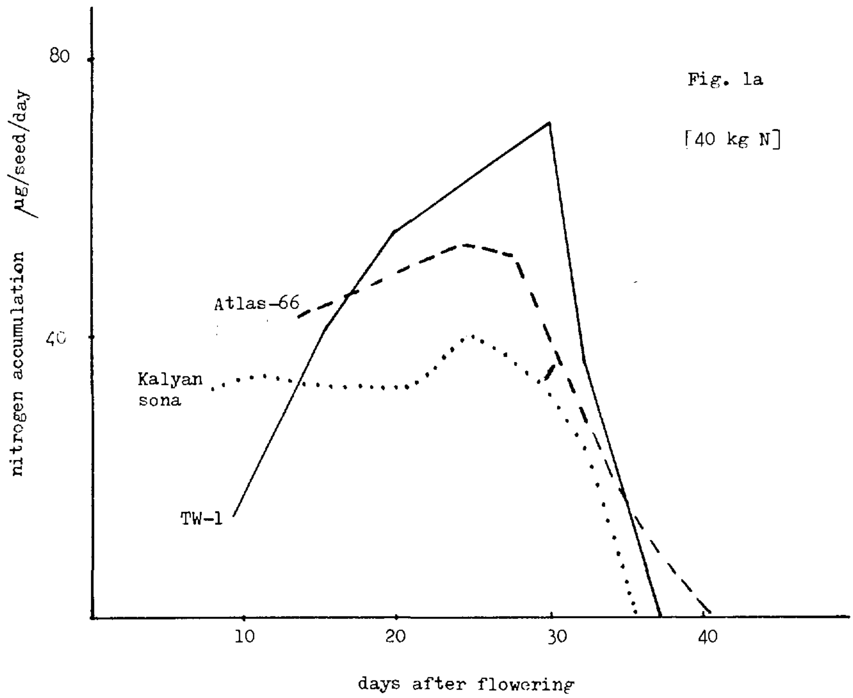
Fig. 1a
[40 kg N]
80
40
nitrogen accumulation µg/seed/day
Atlas-66
Kalyan sona
TW-1
10
20
30
40
days after flowering

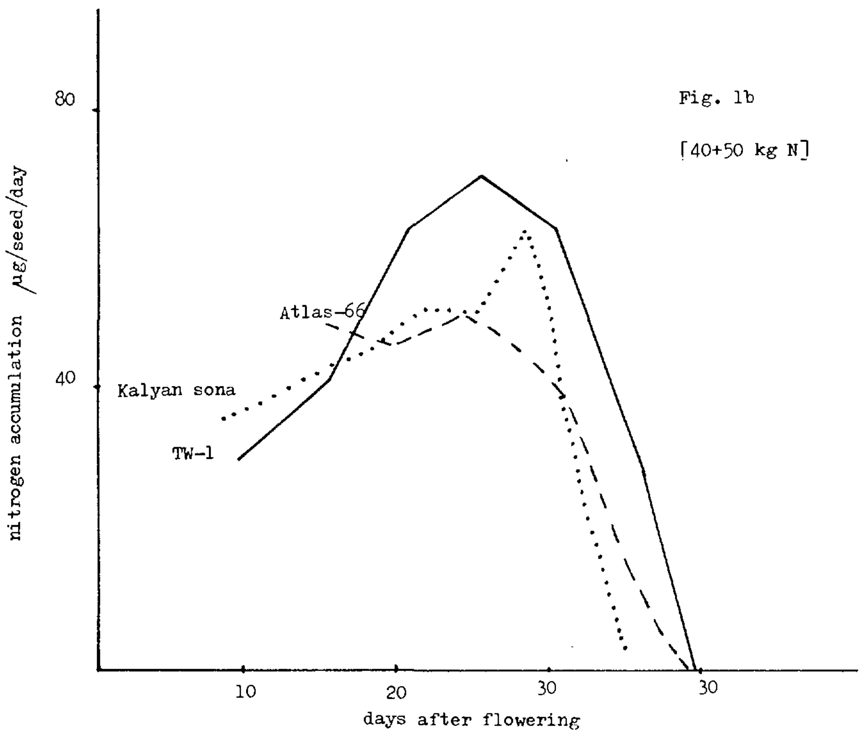
Fig. 1b
[40+50 kg N]
80
40
nitrogen accumulation µg/seed/day
Atlas-66
Kalyan sona
TW-1
10
20
30
30
days after flowering

MEETING REPORTS

FAO/IAEA Regional Seminar on Improvement of Rice Production through Research using Nuclear Techniques. Scientific Secretary: K. Mikaelsen, Plant Breeding and Genetics Section, Joint FAO/IAEA Division, Vienna.

This seminar was convened in Jakarta, Indonesia 10-14 October 1977 with 43 participants from 10 countries and from the International Rice Research Institute (IRRI). 23 scientific papers were presented at the meeting. These presentations demonstrated the many valuable contributions nuclear techniques have made and can make to rice research in fields such as crop improvement, fertilizer application and pest control.

The field of plant breeding was particularly well presented. Many good results from mutation breeding were reported. Mutants with agronomically valuable characteristics were obtained in many national programmes, having early maturity, short stature or lodging resistance, improved blast or leaf blight disease resistance, improved kernel size or shapes, improved amylose or protein content. Several mutants had also shown high yield potentials in trials, and some had already been released as new varieties or are expected to be approved for practical use in the near future. Varieties were released e.g. in Bangladesh, Burma, Pakistan, Philippines, Thailand and the United States.

In field of soil fertility and crop nutrition the most important results came from uses of ^{15}N in studies on efficient nitrogen fertilizer applications.

In reviewing the entomological applications of nuclear techniques in pest management and control, concern was expressed about the serious problems facing rice production in South East Asia countries by brown plant hopper, gall midge and other insect pests. With the limited gene resources for resistance against these pests, induced mutations could be an important tool to obtain genotypes with improved resistance or tolerance.

Blast and bacterial blight are the most important diseases in rice, but in recent years tungro virus, grassy stunt virus and sheath blight have become more serious in the region. Although here, induced mutations can be considered as a potential source of genotypes with improved resistance. It was strongly recommended that FAO and IAEA assist in regional cooperative efforts for improving pest and disease resistance of rice.

Another important subject of the discussions was the use of mutants as parent in cross-breeding programmes. A large number of mutants of agronomic value have been produced in the various national breeding programmes. It was stressed that genetic evaluation of such material needs to be done and it was recommended that valuable mutant genotypes be collected for use in breeding programmes as well as preserved in national and international germ plasm centres.

FAO/IAEA Advisory Group Meeting on Use of Induced Mutations for Resistance of Crop Plants to Insects, Dakar (Senegal) 17 - 21 October 1977
Scientific Secretaries: I. Moore, Entomology Section, A. Micke, Plant Breeding and Genetics Section, Joint FAO/IAEA Division, Vienna.

Participants were experts from France, India, Netherlands, Sudan, U.K., U.S.A.(2) and representatives of ICRISAT and FAO field projects in Nigeria and Senegal.

The objective of the meeting was to review the need for and feasibility of plant breeding for resistance to insect pests and to make recommendations as to where and when induced mutations could make a useful contribution in this respect.

The participants concluded that host plant resistance to insects would be a most desirable component of integrated pest control, more so for subsistence agriculture and low cash value crops, where chemical control is too costly, but increasingly also for cash crops, where chemical pest control may leave harmful residues in the crop product or present critical environmental hazards. Any level and any type of resistance can be valuable. Realizing, that development of host plant resistance and its incorporation into cultivars together with high yield, good quality and other needed resistances requires sustained long range work and a team approach, the participants recommended: a) to offer training opportunities in plant breeding for insect resistance and related subject matters, b) to support research in entomology, plant physiology and genetics related to insect resistance for the development of adequate screening techniques, c) to strengthen the collection, evaluation and maintenance of germ plasm valuable for improving insect resistance of crop plants, d) to foster synthetic methods of genetic manipulation including mutation induction, if adequate sources of resistance cannot be found or if further genetic variability is needed, e) to actively seek and utilize heritable characters, that will reduce post-harvest loss to insects, f) that international organizations such as FAO and IAEA incorporate plant breeding for insect resistance in their programmes and include the development of corresponding entomological techniques among the research topics eligible for support.

Full proceedings of the meeting are to be published by IAEA during 1978.

RECENT PUBLICATIONS

Manual on Mutation Breeding, 2nd revised Edition.
IAEA Vienna 1977, STI/DOC/10/119, US$20.

Induced Mutations against Plant Diseases. Proceedings of the FAO/IAEA/SIDA Symposium Vienna, 31 January - 4 February 1977.
IAEA, Vienna 1977, STI/PUB/462, US$42.

Nutritional Evaluation of Cereal Mutants. Proceedings of an Advisory Group Meeting, 26 - 30 July 1976 Vienna.
IAEA, Viennna 1977, STI/PUB/444 US$14.

Induced Mutations for the Improvement of Grain Legumes in South East Asia (1975). Proceedings of a Regional Seminar at Colombo, Sri Lanka 8 - 13 December 1975. IAEA, Vienna, non-priced document No. 203.
(Available as microfiche on prepayment of US$0,65)

Seed Protein Improvement by Nuclear Techniques. Proceedings of Research Coordination Meetings 28 March - 1 April 1977 at Baden and 26 - 30 September 1977 at Vienna.
IAEA Vienna 1978, STI/PUB/479, US$45.

WANTED

Wheat breeder with experience in disease resistance as well as mutation induction. Mymensingh (Bangladesh) up to 2 months. (BAN/5/03/Exp) B-5.

Plant pathologist experienced in disease resistance breeding (particularly leguminous plants and rice) up to 4 months. (BAN/5/03/Exp) D-4.

Crop physiologist for project on genetic improvement of grain legumes. Mymensingh (Bangladesh) up to 6 months. (BAN/5/03/Exp) A-2.

FUTURE EVENTS

1978

3rd International Congress of Plant Pathology, 16-23 August 1978, München, FRG.

4th International Congress of Plant Tissue and Cell Culture, 20-25 August 1978, Calgary, Canada.

14th International Congress of Genetics, 21-30 August 1978, Moscow, USSR.

4th International Virology Congress, The Hague (Netherlands), 3-9 September 1978.

International FAO/IAEA/GSF Symposium on Seed Protein Improvement by Nuclear Techniques, 4-8 September 1978, Neuherberg, FRG.

Regional FAO/IAEA Seminar on the Utilization of Induced Mutations for Crop Improvement in Africa, 23-27 October, IITA Ibadan (Nigeria).

6th International Cereal and Bread Congress, 16-22 September 1978, Winnipeg, Manitoba (Canada).

1979

5th Symposium on Tropical Root Crops, Cebu City (Philippines). Contact: M.R. Vinnarueva, National Root Crops Research Center, Baybay, Leyte 7127, Philippines.

14th Pacific Science Congress, Academy of Sciences of the USSR, Novosibirsk (USSR).
Contact: Prof. A.P. Kapitsa, President of Far East Research Centre, Academy of Sciences of USSR, 50 Leninskaya Street, Vladivostok, USSR, August 1979.

Plant Breeding Symposium II at Iowa State University (USA) 12-16 March 1979. Contact: K.J. Frey, Agronomy Department, Iowa State University, Ames. Iowa 50011.

LIST OF MUTANT 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 cross (mutant underlined)	Main improved attributes of variety
RICE			
Irat 13	1978 Ivory Coast I.R.A.T. B.P. 635 Bonakè (Ivory Coast)	^{60}Co chronic γ-irradiation 1972 [63-83]	Short culm, resistant to lodging
Kagahikari	1973 Japan T.H. Keyama et al. Ishikawa Pref. Agric. Exp. Station	Mutant of Koshihikari (γ-ray) x Fukei 72	Early maturity, improved grain quality and taste
Hayahikari	1976 Japan T. Hirano et al. Tohoku Nat. Agric. Exp. Station	Reimei x Toyonishiki	Lodging resistance
Fujihikari	1977 Japan K. Fuji Chugoku Nat. Agr. Exp. Station	[(Fukei 71 x Fukei 67) x Koshihikari] x R151	Season-neutral, ripening within ca. 100 days most suitable in tight crop rotations

Akihikari	1976 Japan Aomori, Akita, Hiroshima and Nagano Prefectures, Hisao Sato et al.	Toyonishiki x Reimei	Short and stiff culm, high yielding capacity
BARLEY			
Atlanta	1977 Canada J.D.E. Sterling Agric. Canada Res. Stat. Charlottetown Prince Edward Island	(Anoidium/Montcalm 3/2/Herta/ Br M57/754/3) x Hellas	Lodging resistant superior yield
Fuji 2-jyo II	1974 Japan Kirin Brewery Co. Ltd. and H. Yamaguchi Fac. of Agriculture Tokyo University	Seeds presoaked 15 hrs, 5-bromodeoxyuridine (1mM, 1 hr) + 1 kR gamma rays [Fuji 2-jyo]	Resistant to lodging by stiff straw
Deawn	1975 USA R.S. Albrechtsen and W.G. Dewey Dep. Plant Science Utah State Univ. Logan. Utah	cross with Bonneville 70	Shorter culm and earlier ripening than Bonneville
SOYBEAN			
KEX-2	1973 Korea S.H. Kwon, K.H. Im Rad. Research Inst. Seoul	24 kr x-rays (1963) [Keum Kang-Dai-Rip]	Earlier maturity (11 days) higher yield (16%) large seed size
CASTORBEAN			
Sowbhagya (157-B)	1976 India L.G. Kulkarni IARI Regional Station Hyderabad	(Aruna x dwarf mutant of HC-6) x (dwarf mutant of HC-6 x Mauthners dwarf)	Long duration, dwarf type, non shattering, suitable particularly for intercropping

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 cross (mutant underlined)	Main improved attributes of variety
PEARL MILLET			
New Hybrid Bajra 5 (NHB5)	1974 India B.R. Murty, S.C. Pokhriyal	35 Krad γ-rays [male sterile inbred line Tift 23A]	Resistance against mildew (*Sclerospora graminicola*) by using resistant mutant line 5071A as male sterile parent

CORRECTIONS

PEANUT			
Vikram (TGl)	1973 India Bhabha Atomic Research Centre Trombay	x-rays, 75kR [Spanish Improved]	Large kernels (TKW 8800 g) particularly suitable for export as "HPS" class 47-48% oil, maturity 130-135 days yield potential up to 4 to/ha under irrigated conditions
PEPPERMINT			
Todd's Mitcham	1971 USA M.J. Murray, A.M. Todd Co., Kalamazoo, Mich.	thermal neutrons (1955-59) [Mitcham]	*Verticillium* wilt resistant, Darker green herbage colour, smaller leaves, more erect and less branched plant habit, earlier maturity (5-10 days)

REQUESTS

"Non-nodulating" mutants in legume species

At a FAO/IAEA Advisory Group Meeting on the Potential Use of Isotopes in the Study of Biological Dinitrogen Fixation, held 21-25 November 1975 in Vienna, much emphasis was given to the need for "non-nodulating" controls for experiments designed to measure the amount of atmospheric N_2 fixed by legume-Rhizobium symbiosis. Non-nodulating isolines of soybean are extensively used in such experiments but similar mutants are not available for other legume species.

Any non-nodulating mutants which occur in mutation projects with leguminous plants could be extremely valuable. We would like to know of them and be supplied with seed samples and all relevant data about method of induction and selection, and the range of Rhizobium species against which they have been tested. R.D. Brock, FAO/IAEA, P.O. Box 590, A-1011 Vienna, Austria.

Tester stocks with heterozygous marker genes

For studies with radiation and chemical mutagens we would like to utilize tester stocks of various plant species being heterozygous for one or several known marker genes. We are interested in all crop plants, but would wish to obtain such stocks particularly for dicotyledonous crop plants whether generatively or vegetatively propagated. Of special value would be stocks of tropical or sub-tropical crop plants. We would appreciate anyone of our readers who might have suitable material available or could make useful suggestions to contact: A. Micke, FAO/IAEA, P.O. Box 590, A-1011 Vienna, Austria.

Announcement

FAO and IAEA are planning to organize a "Regional Seminar on the Utilization of Induced Mutations for Crop Improvement in Africa", 23-27 October 1978 at the International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria. Subjects suggested for discussion at the Seminar are:

1) Restriction of plant breeding progress by insufficient germ plasm
2) Suitability of mutagenesis for producing desired genetic variants
3) Methodology of mutation induction and selection
4) Prospects and achievements of improving relevant crop plant characters by utilizing induced mutants.

Participation will require official nomination through Governments. Those who are interested in attending the Seminar should contact their governmental authorities in charge of atomic energy affairs or liaison to FAO. It would be appreciated, if they would indicate their intention as soon as possible to the Scientific Secretary A. Micke, FAO/IAEA, P.O. Box 590, A-1011 Vienna, Austria.

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International Atomic Energy Agency
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