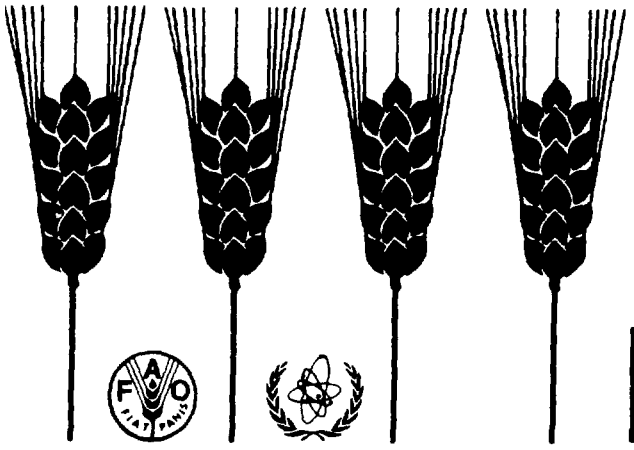

Mutation Breeding Newsletter

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Contents

Frantisek J. Novak
(1941-1993)
In Memoriam

Frantisek Novak was born in Olomouc, Czechoslovakia on 17 October, 1941. He graduated as an agronomist from the University of Agriculture, Brno in 1963, obtained his Doctorate in Natural Sciences from Charles University in Prag in 1970 and was awarded the degree of Doctor of Sciences by the Czechoslovak Academy of Sciences in 1986.

After leading the Plant Biotechnology Department of the Czechoslovak Academy of Sciences Institute of Experimental Botany in Olomouc, he joined the IAEA in 1983 and became Head of the Plant Breeding Unit of the FAO/IAEA Agricultural Laboratory in Seibersdorf. Within a very short time he succeeded in creating not only a world class research and training centre, but he also found ways to create new, superior genotypes of crops which truly can be said to be among the most staple food crops of the poor.

Although his published scientific papers reveal the wide variety of research contributions he made in the new and exciting field of plant biotechnology, especially *in vitro* culture, his first concern and his greatest success were in improving the *Musa* group of plants. These remarkable plants are not only the main export article of many developing nations. Their importance lies much more in the fact that there is hardly a human dwelling in the tropical regions of the world which doesn't have a banana tree planted in the back yard. If all else fails, the family has at least its banana tree with its abundant and nutritious fruit.

This is where Dr. Novak left his permanent mark. The extensive fields in all corners of the tropical world and the millions of households which will be growing new, high yielding and high quality banana varieties developed as a result of Dr. Novak's pioneering work, will be a lasting testimony to the scientific contribution he made to improve the lot of the poor and to ease their struggle towards a decent existence.

The large number of alumni who graduated from training courses and the fellowship holders he guided at the Seibersdorf Laboratory will continue to use what he taught them. Frantisek Novak was held in high esteem by his colleagues throughout the world. He was sought after as a lecturer, adviser and expert. The loss of Dr. Novak to the scientific world, to crop and agricultural research and to the development effort is enormous.

The loss to our small group at FAO/IAEA in Vienna and in Seibersdorf is both incomprehensible and irreparable. Frantisek was not only an able and respected colleague. He was a close and personal friend whom I admired and respected for his human qualities. He was a real gentleman with manners and a way of interacting with people that generated both warmth and respect.

I had known Frantisek long before we both joined the FAO and IAEA and I find it difficult to accept the fact that he has been so cruelly cut down in the middle of a brilliant career and grabbed away from us and from his family. We are proud and thankful for having had Dr. Novak on our staff. His personal and professional contributions to our activities provide a valuable background for our work as well as clear guidance for the future.

*(Contributed by **BJÖRN SIGURBJÖRNSSON**, Joint FAO/IAEA Division, Vienna, Austria)*

SALT TOLERANCE OF THE BARLEY MUTANT 'GOLDEN PROMISE'

'Golden Promise' was an extremely successful barley cultivar in the UK, being on the National Recommended Lists for over 20 years. It was developed by David Miln & Co. (Seedsmen) Ltd, Chester, England by irradiation of the cultivar 'Maythorpe' in 1956. Seeds of 'Maythorpe' were γ-ray treated (6-24 krad) and the irradiated seeds grown-on and selfed for several generations. Several mutant types were produced and 'Golden Promise' was developed from the mutant line 759/4 which was selected for its short stiff straw, good malting and yield characteristics. The short, stiff straw can be attributed to the 'Golden Promise' erectoides gene *(GPert)* which has pleiotropic effects on yield and quality components. The *GPert* gene is located on barley chromosome 7 (5H), it is inherited recessively, and is thought to be a mutation in a 'Maythorpe' height gene.

In salt tolerance tests at Scottish Crop Research Institute a significant difference has been detected between the shoot sodium content of salt stressed (grown in 150 mol m^{-3} NaCl) 'Golden Promise' and its parental line 'Maythorpe'. 'Golden Promise' was found to have about 50% of the sodium level in its shoots compared to 'Maythorpe'. Since shoot sodium accumulation is correlated with salt tolerance in the *Triticeae*, the results imply that a mutational difference between 'Golden Promise' and 'Maythorpe' is responsible for the increased tolerance to salt. This mutation has important implications for salt tolerance research and crop improvement. Current work aims to map the mutant locus to a specific chromosomal region, and to determine if the sodium exclusion character is a pleiotropic effect of the *GPert* locus or due to some other mutation. Differential screening at the DNA, RNA and protein levels may also be exploited in isolating and characterising the mutant locus.

Induced mutation has therefore produced an exceptional genotype in 'Golden Promise' from what was a mediocre cultivar, 'Maythorpe'. 'Golden Promise' was extremely important in the UK barley industry, and dominated the Scottish barley acreage in the 1970s to mid-1980s. However, the mutations in 'Golden Promise' may have greater potential in other agricultural systems, i.e. for improving the salt tolerance of cultivars in arid regions of the world.

*(Contributed by **B.P. FORSTER**, Cell and Molecular Genetics Department, Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA, Scottland, UK)*

INDUCTION OF SHRUBBY TYPE MUTANT IN *Stylosanthes guyanensis*

The genus *Stylosanthes* Sw. is one of the most studied within legumes in tropical countries due to its importance for animal nutrition. *S. guyanensis* has a great potential for use as a pasture crop in the tropics, however, one of its limitation is the susceptibility to antracnosis caused by *Colletotrichum gloeosporioides*. There is a limitation in the genetic variability concerning resistance to the different races of the fungus. Accession No. 1336 presents partial resistance to the disease. With the aim to obtain resistant mutants, this line was used in mutation experiments carried out in Sao Paulo State, Brazil [1]. One of the gamma ray doses used for seeds treatment was 38 krad.

In M_2 generation, besides the search for plants with resistance to antracnosis, a selection for various type mutants were made. One morphological mutant called for special attention. This type of plant was not found in existing germplasm collections of this species. It presents an upright growing habit (shrubby type), extremely different from the parental type which is prostrate.

Table 1. Some morphological characters of gamma ray induced shrubby type mutant of *Stylosanthes guyanensis*

Character	Parental line No. 1336	Mutant (M_2 generation)
growth habit	prostrate	shrubby type
leaf/stem ratio	1.4	1.6
foliar surface (cm^2)	1,026.1	2,103.4
leaf length (cm)	2.2	2.5
leaf width (cm)	0.4	0.6
root system	normal	modified

The data shows better suitability of this type of mutated plant, as a food for ruminants, in terms of leaf area in relation to stems. The presence of more and bigger leaves is of high interest for forage purposes. However, as shown in Table 1, the root system was undesired modified in the mutant type due to fungi occurrence below the soil surface. This problem is being studied from physiological point of view.

Besides this morphological mutant, some mutants lines were selected, which are, after eight years of observation, still resistant to antracnosis. Generally, induced mutations have made a substantial contribution to the breeding of *Stylosanthes*.

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INDUCTION OF COLD TOLERANCE IN KABULI CHICKPEA (*Cicer arietinum* L.) THROUGH INDUCED MUTATIONS

Kabuli chickpea is usually grown in the Mediterranean basin. The crop is normally sown in spring (late February to early May) and grown on soil with residual moisture. The yield of the crop is restricted by limited moisture availability and spring sowing which coincides with increasing and limiting temperatures [1] during the reproductive phase of the growth (a particularly sensitive stage of phenological development).

Research conducted at ALAD, Lebanon and ICARDA, Syria has shown that winter sown chickpea produces substantially higher yield than the spring sown crop [2]. However, winter-sown chickpea must possess resistance to Ascochyta blight and cold tolerance.

Table 1. Field reaction of 15 morphological mutants and two parent genotypes in M_3 generation to Ascochyta blight and cold at ICARDA, Aleppo, Syria, 1988-89.

Mutant/Genotype	Pedigree	Reaction to	
		Ascochyta	cold
ILC 3279	Parent	5	9
8081	ILC 3279 40 kR	5	9
9030	ILC 3279 40 kR	5	9
ILC 482	Parent	5	9
14031	ILC 482 40 kR	6	9
14064	ILC 482 40 kR	5	9
14097	ILC 482 40 kR	4	9
14241	ILC 482 40 kR	6	9
14246	ILC 482 40 kR	4	9
14248	ILC 482 40 kR	5	9
15045	ILC 482 50 kR	6	9
15060	ILC 482 50 kR	5	9
15183	ILC 482 40 kR	5	9
16070	ILC 482 40 kR	5	9
16077	ILC 482 40 kR	4	9
16119	ILC 482 40 kR	4	3
17019	ILC 482 0.1% EMS	3	9
ILC 263	Susceptible check	9	9

Kabuli chickpea genotypes ILC 482 and ILC 3279 along with other genotypes have been released in different countries in the Mediterranean basin for winter sowing because they possess field resistance to Ascochyta blight and high yield potential. However, these lines are sensitive to cold. No single line resistant to both stresses is available in the world germplasm screened so far [3]. Work was undertaken to induce genetic variability in Kabuli chickpea genotypes viz., ILC 482, ILC 3279 and ILC 6104 through the use of gamma irradiation or EMS and screen the segregating material for morphological mutants in M_2, M_3 and M_4 generations for identification of mutant(s) having increased level of resistance to Ascochyta blight and cold tolerance. The results of screening of M_2 segregating material indicated that mutagenic treatments were effective in inducing variability for Ascochyta blight resistance and

cold tolerance. An ILC 482 mutant No. 16119 (Table 1) proved one of two sources of cold tolerance in the world chickpea germplasm screened at ICARDA during 1989-90 and withstood -8.9°C in the middle of March [4]. The cold tolerant nature of the ILC 480 mutant was confirmed during 1990-91 and 1991-92.

This is the first report of induction of cold tolerance in chickpea through induced mutations. The mutant will be of great value as a source of cold tolerance and for studying mechanisms of cold tolerance.

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COWPEA-88, A NEW MUTANT CULTIVAR

Cowpea (*Vigna unquiculata* (L). Walp. is an important forage and pulse crop. Recently a new variety 'Cowpea-88' has been released for cultivation in the Punjab [1]. It has been developed from the progeny obtained by irradiating the F_1 seed of a cross between the standard variety 'Cowpea-74' and a virus resistant strain 'No. H-2'. It is a dual purpose variety which gives higher green fodder as well as higher grain yield than the check variety, 'Cowpea-74'. Moreover, it is highly resistant to yellow mosaic virus and anthracnose diseases. Its promising features are given in Table 1.

Table 1. Agronomic characters of 'Cowpea-88' in comparison to 'Cowpea-74'

Character	Cowpea-88	Cowpea-74
Leaf length (cm)	13.0	9.6
Leaf breadth (cm)	8.6	7.3
No. of pods/plant	17.7	23.3
Pod length (cm)	16.4	11.9
No. of seeds per pod	16.2	14.2
100-grain weight (g)	23.4	10.8
Seed color	chocolate brown	white with black scar
Seed taste	very loose	compact
Days to 50% flowering	53	58

Yield performance: 'Cowpea-88' was tested at the University Research stations as well as on farmers field throughout the state for its green fodder and grain yield performance. On the basis of these trials it is possible to state that 'Cowpea-88' has out-yielded the standard variety 'Cowpea-74' in both, green fodder and grain yield performance (Table 2). Apart from the yield, the cooking quality of 'Cowpea-88' as a pulse crop is very good and the nutritive value of its green fodder is superior to that of 'Cowpea-74' [2].

Table 2. Yield performance of 'Cowpea-88' in comparison to 'Cowpea-74' in Punjab

Parameter	No. of trials	Yield (q/ha)		Increase over Cowpea-74 (%)
		Cowpea-88	Cowpea-74	
(a) Green fodder yield	24	273.40	232.50	17.2
(b) Grain yield	36	10.98	6.90	59.1

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*(Contributed by **SOHOO, M.S., B.L. BHARDWAJ**, and **S.M. BERI**, Forage Research Unit, Department of Animal Science, Punjab Agricultural University, Ludhiana, India)*

'NOVENTA' - A NEW EARLY MUTANT VARIETY OF SOYBEAN, *Glycine max* (L.) Merill.

Since 1971, a mutation breeding program in soybean has been carried out at the Department of Genetics and Plant Breeding (University of Agricultural Sciences Gödöllö, Hungary). The objectives of mutation experiments were (1) to increase genetic variability in soybean cultivars by gamma radiation and (2) to screen for desired characteristics with the aim of developing superior breeding lines with early maturity, high yield and resistance to shattering.

Seeds of various soybean varieties were treated with gamma rays from ^{60}Co. Applied doses ranged from 100-300 Gy with the dose rate of 627 r/hour. Gamma irradiation was carried out on the gamma field of the Department of Genetics and Plant Breeding at the University of Agricultural Sciences, Gödöllö. All seeds of M_1 plants were sown separately in individual plant-to-progeny rows. Selection of mutants was performed in the M_2, M_3 and M_4 generations. A great number of morphological and early maturing (from 5 to 14 days earlier than the parent variety) mutants have been obtained. Among the numerous early mutants selected from variety 'Altona' there was an extremely early mutant having favorable agronomic characters (Tab. 1).

Table 1. Some agronomic traits of the early mutant 'Noventa' in comparison with the parent and standard cultivar

Character	Altona (parent variety)	Noventa	Fiskeby V. (standard variety)
Vegetation period/day	120-142	90-105	95-110
Date of ripening	3 Sept.	30 July	5 August
Plant height (cm)	46-50	40-46	36-40
Hylum colour	black	black	brown
Number of seeds/plant	60-80	60-110	30-50
Seed weight/plant (g)	5-16	8-19	4-10
1000 kernel weight (g)	170	177	175
Seed yield (t/ha)	1.5-2.3	1.8-2.4	1.3-1.7
Resistance to shattering	high	high	low

This mutant was detected in M_2 generation and was homozygous for earliness in M_3, M_4, M_5 generations. Registration of this mutant variety with the name 'NOVENTA', was performed in Hungary in 1989 (Reg. No 1117/89).

The mutant variety 'Noventa' is a new source of genes conferring an extreme earliness. Crossing early varieties of different origin to accumulate the early maturity genes is an effective method to develop extremely early soybean cultivars with improved agronomic characters for cool, long day-length, and short-growing season.

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INDUCTION OF VARIABILITY IN AVOCADO (*Persea americana* Mill) BY GRAFTWOOD IRRADIATION

One of the main objectives in avocado research is to obtain dwarf varieties or dwarfing rootstocks in order to reduce production costs, increase planting density and higher yield per hectare. Of 448 scions from seven avocado varieties or selections ('Colin V-33', 'Fuerte', '39 PMe', '137 PLS', 'Colinmex', 'Colin V-101', and '175 PLS'), 336 were exposed to gamma radiation at doses of 2.0, 4.0, 6.0 krad and 112 scions were used as a control with an objective to isolate dwarf mutants.

One day after irradiation, the scions were grafted, showing the following survival percentage: 'Colin V-33' - 62.5; '39 PMe' - 68.7; '137 PLS' - 31.3; 'Colinmex' - 62.5; 'Colin V-101' - 43.75; 'Fuerte' - 56.3 and '175 PLS' - 48,8. The rate of survival per dose was as follows: control - 88%; 20 krad - 77%; 4.0 krad - 52% and 6.0 krad - 0%.

From the survival grafts, those with doses higher than 2.0 krad had growth problems and eventually died. Thus, it was only possible to transfer to the field, the material treated with 2.0 krad and the control. Table 1 shows the vegetative growth of grafted scions 18 months after irradiation.

Table 1. Vegetative growth of irradiated and grafted scions of various avocado varieties and selections

Variety or selection	Treatment	Horizontal growth (percent of individuals)	Flowering (percent of individuals)	Graft length (cm)
Fuerte	D1	0	100	49.2
	D2	40	20	44.4
Colinmex	D1	0	100	30.0
	D2	100	100	38.2
39 PMe	D1	100	100	46.0
	D2	85	57	46.0
137 PLS	D1	50	100	52.0
	D2	80	60	19.2
Colin V-33	D1	100	100	19.0
	D2	50	100	20.0
175 PLS	D1	50	100	43.5
	D2	66	100	41.3
Colin V-101	D1	0	--	34.2
	D2	100	--	44.5

D1 = Control.

Regarding growth habit, the same Table shows that a higher percentage of irradiated trees had horizontal growth than the control, except varieties '39 PMe' and 'Colin V-33'. Conversely, the proportion of flowering trees was higher among the non-irradiated ones. Nevertheless, in the irradiated group, some trees such as 'Colinmex' and '175 PLS' had set fruit. Furthermore, the length of the graft did not reflect a definite pattern between treatments.

The results obtained in our work do not allow us to determine an optimal irradiation dosage for scions, since the high sensibility of this material is attributed to the fleshy consistency of the graftwood [1]. However, in González's experiment [2], different varieties of avocado seeds, not scions, were irradiated successfully, and they were treated with the much higher dose, 20 krad of gamma rays.

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YIELD IMPROVEMENT OF *Canavalia virosa* (Roxb.) Wight et Arn. BY GAMMA RAY INDUCED MUTATIONS

Canavalia virosa (Roxb.) Wight et Arn. is found growing wild and is highly resistant to diseases and drought. Immature pods as well as mature seeds are not consumed by animals or humans as they are poisonous due to the presence of toxic compounds. However, the seeds are found to be a fairly rich source of canavanine ($C_5H_{12}N_4O_3$), a non protein amino acid [1] which is extensively used in biochemical research. It is known that L-canavanine, which is a toxic structural analog of L-arginine, has potential insecticidal properties [2]. As *C. virosa* is non-edible, it can possibly be used for canavanine extraction. Thus, attempts were made to improve the yield and the canavanine content using gamma radiation.

Dry seeds of *C. virosa* were treated with 4, 8, 12, 16, 24, 32 and 36 Krad of gamma rays, at a dose rate of 5.48 Krad/min. In M_1 population (24 Krad) a plant was observed showing higher yield than the control. This mutant bred true in M_2 generation and expressed the following important characters (Tab. 1):

1. Fasciated stem (well developed fasciations are observed on the stem; abnormal thickening at certain regions of the stem)
2. Delayed flowering (formation of flowers was delayed from 20 to 25 days as compared to control plants)
3. High yield (increased number of branches, pods and seeds over the control)
4. Conavanine content (seeds obtained from mutant showed slight increase in canavanine content, however, the overall increase of canavaninel is attributed to higher yield)

Table 1. Agronomic characters of the high yielding mutant of *C. virosa*

Geno-type	Branches/ plant (No.)	Days to flowering	Pods/ plant (No.)	Pod length (cm)	Seeds/ pod (No.)	Single seed weight (g)	Canavanine content (% of dry weight.)
Control	9.0	212	9.3	8.3	7.0	1.26	2.86
Mutant	23.0	236	16.0	9.2	9.0	1.19	2.92

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*(Contributed by **RODRIQUES, B.F.** and **S.G. TORNE**, Dept. of Botany, S.P. Chowgule College, Margao Goa, 403 601, India)*

INDUCED MUTANTS IN TOMATO

Tomato (*Lycopersicon esculentum* Mill) is an important solanaceous vegetable crop. The existing genotypes of tomato in India are poor yielders, susceptible to insects, pests and diseases. To create more variability in desired characters, seeds of 'Pusa Ruby' cultivar were treated with gamma rays, ethylmethane sulfonate (EMS) and N-nitroso-N-methyl urea (MNH). Exposure to gamma rays ranged from 10kR to 50kR at intervals of 10kR at 27°±2°C. The seeds were treated with different concentrations of EMS solution, ranging from 10mM to 50mM, at intervals of 10mM. MNH was used in 1mM, 2mM, 3mM, 4mM and 5mM concentrations.

In M_2 generation, early maturing and high yielding mutants were selected. Seven true breeding lines were chosen from the M_3 generation and these were grown as M_4 together with the parent cultivar. The experiment was done in a randomized block design with three replications. Mean values of investigated characters and percentage of control are given in Table 1.

Table 1. Agronomic characters of selected tomato mutant lines (M_4)

Mutant	Days to flowering		Fruit yield number/plant		Fruit yield weight/plant	
	Mean	Percent of control	Mean	Percent of control	Mean (g)	Percent of control
Control	67	100.0	21	100.0	785	100.0
PG 23	66	98.5	21	100.0	930	118.5
PG 24	71	106.0	26*	123.8	1,100*	140.1
PG 29	71	106.0	37**	176.2	1,080	137.6
PG 31	58*	86.6	22	104.8	865	110.2
PE 1	75*	111.9	27	128.6	1,035	131.8
PN 22	67	100.0	29*	138.1	1,190**	151.6
PN 31	73	108.0	31*	147.6	875	111.5

*Significant at 5% level **Significant at 1% level.

*(Contributed by **JAYABALAN, N.** and **G.R. RAO**. Department of Botany School of Life Sciences, Bharathidasan University, Tiruchirapalli 620 024, Tamil Nadu, India)*

MUTANT HETEROSIS AND PRODUCTION OF F_1-PERFORMING DH LINES

Heterosis in F_1 generation of some mutant crosses is a well known phenomenon, already described in many papers for such species as *Arabidopsis*, barley, groundnut, maize, *Melilotus albus*, pearl millet, *Petunia axillaris*, rice, sesame, sweet clover and tomato. This subject was reviewed by Maluszynski *at al.* [1]. The heterosis can appear in crosses between mutants from the same parent variety but also in some crosses of mutants with the parent variety. Statistically significant effect of heterosis in these crosses was described for such characters as plant yield (seed production, green matter production), plant height, leaf and flower size, tillering, root system, seed protein content, net assimilation rate. Very often the heterotic effect in some agronomically important characters has ranged from 30 to over 100% above the best parent variety. It was also observed that the heterotic effect is not correlated with agronomic performance of mutants used as parents in particular cross combination. Even mutants with extremely poor agronomic performance can give excellent F_1 plants, outyielding a parent variety. Nevertheless, the lack of suitable genetic systems for hybrid seed production has limited a practical exploitation of this phenomenon.

Dollinger [2] has suggested that heterotic effect obtained in crosses between maize mutants of inbred lines was related to recessive alleles with pleiotropic effects. It is difficult to say how far heterotic effect in mutant crosses depends on overdominance or additive effects of mutated genes. The existence of transgressive segregants in F_2 progeny of heterotic hybrids in our experiments with barley indicates that an additive genetic system is involved in the mutant heterosis phenomenon. Even if heterosis in mutant crosses only partly depends on additive action of mutated genes, the doubled haploid system is opening a completely new opportunity for fixing this effect. The general scheme for production of 'F_1-performing' doubled haploid lines can be proposed as follows:

1. Development of stable mutants from the best parent variety
2. Screening for heterosis in the F_1 of intermutant crosses
3. Production of doubled haploids from heterotic F_1's
4. Screening for 'F_1-performing' doubled haploids
5. Agronomic evaluation of selected DH lines (Fig. 1).

This theoretical scheme has already been confirmed in practice. Two barley mutants from our mutant germplasm collection gave an excellent heterosis effect in crosses, outyielding the parent variety Aramir by 50-60%. Doubled haploid lines were produced by anther culture from F_1 and about 5% of them reached the yield of heterotic hybrid (F_1). The same effect was observed in crosses of other barley mutants with their parent varieties. Additionally, a great number of DH_3 lines were obtained with yield only slightly lower than F_1 hybrids, but significantly exceeding the parent variety.

There are many advantages in the use of mutation and doubled haploid system for 'hybrid performing' seed production, with the main one, of course, being that once produced 'F_1 performing' DH plants can be later on multiplied by self-pollination. The other important advantages of mutant heterosis are related to the lack of problems with grain quality, plant height or disease resistance, as the DH 'mutant hybrid performing' line will present characters similar to the parent variety, except of a significantly increased yield.

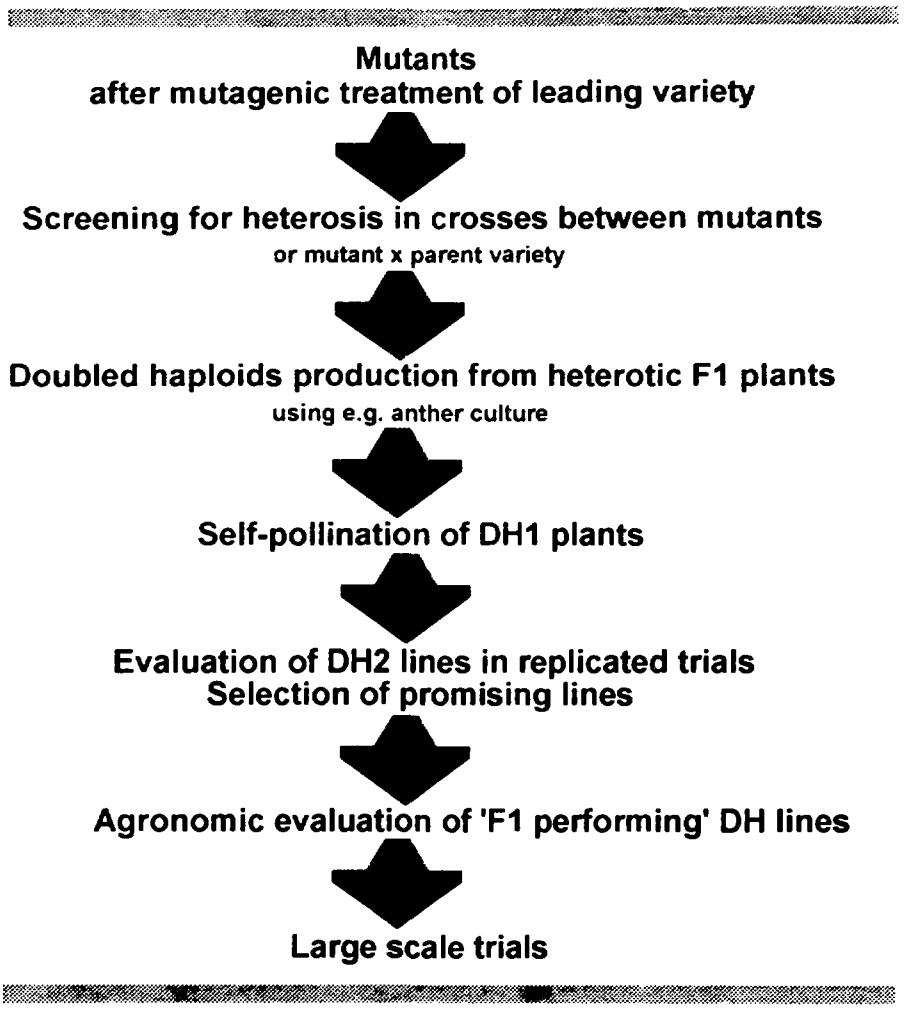

Figure 1. Scheme presenting the production of F_1-performing doubled haploid lines from heterotic hybrids derived from crosses of induced mutants

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[1] Maluszynski, M., A. Fuglewicz, I. Szarejko and A. Micke, 1989. Barley mutant heterosis. In: Maluszynski, M., (Ed.) Current Options for Cereal Improvement. Doubled Haploids, Mutants and Heterosis. Kluwer Acad. Publ., Dordrecht, pp. 129-146.

[2] Dollinger, E.J., 1985. Effects of visible recessive alleles on vigor characteristics in a maize hybrid. Crop Sci. **25**: 819-821.

*(Contributed by **MALUSZYNSKI, M.*** and **I. SZAREJKO**, Department of Genetics, Silesian University, Katowice, Poland; *Plant Breeding and Genetics Section, Joint FAO/IAEA Division, Vienna, Austria)*

GAMMA RAY AND ULTRASOUND INDUCED MALE STERILITY IN SUNFLOWER

Dry seeds of cultivars - 'Peredovik', 'Hemus', 'Progres', 'Vihren', 'Trudovik', 'Stadion', 'Start', 'Balkan' and lines - 1607, 1721 and 3004 were treated with gamma rays (20, 40, 60, 70, 80, 100, 120, 150 and 200 Gy). All mutated generations produced in the period 1983 - 91 were screened for male-sterile plants. The plants with normal pollen reproduction were self-pollinated under paper bags. To reproduce male-sterile plants, their inflorescences were pollinated by normal pollen of some of the cultivars or lines indicated above, for the maintaining of sterility.

The first sterile plants were produced in M_1 from 'Progres' cultivar during 1983 (Table 1). Sterile plants were observed in various varieties and doses of gamma rays. Their total number for the whole period of study is 18, with an average percent below 0.01%. There were cultivars and lines in which this percent was considerably higher, and other which did not produce sterile plants (Tab 1). Untill now two new sources of cytoplasmic male sterility (CMS) were developed by gamma rays treatment of 'Stadion' (70 Gy) and 'Hemus' (150 Gy) cultivars ('CMS-Stadion', 1984 and 'CMS-Hemus',1986).

Table 1. Male sterility induced by gamma irradiation

Cultivar/ Line	Sterile plants (No.)	Gamma rays (Gy)	Generation	Year	Maintained sterility (No.)
Hemus	1	150	M_1	1986	1
Peredovik	1	70	M_3	1984	-
	1	70	M_9	1991	
	1	80	M_1	1991	
Progres	1	70	M_1	1983	-
	2	100	M_1	1983	-
	1	100	M_1	1984	-
Stadion	1	70	M_1	1984	1
Trudovik	1	70	M_2	1986	-
L-1721	2	60	M_1	1991	
	4	100	M_1	1991	
L-3004	2	100	M_1	1991	

Seeds of variety 'Peredovik' were presoaked in water and treated with ultrasound. A double treatment was conducted. The first one was done with an intensity of the ultrasound -2 W/cm^2, 2 minutes exposure (in April 1984). After the treatment, seeds were dried at room temperature and stored in a dark and dry place. The second treatment was carried out in April 1985. The ultrasound intensity was 2 W/cm^2, 4 minutes exposure. The seeds were sown in the field, one day after the second treatment. The phenological observations of M_1 generation were conducted from the beginning of plant germination to complete maturity. The selected plants were isolated and self-pollinated in paper bags.

In 1987 three plants with male-sterile inflorescences were selected in M_3 generation in one of the segregating entries (141). Two of the inflorescences were pollinated separately with normal pollen from lines 3853 and 2934. 429 and 211 seeds were obtained, respectively. 100% sterile plants were developed from these seeds. Lines 32, 33, 69, 130, 1607, 2942, 3004. 4064, HA-89, HA-300, and cultivars 'Nadejdnii', 'Peredovik', 'Skorospelii', 'Stadion' and 'Vihren' were included as pollinators in crosses with the mutant. 100% male-sterile plants were produced in progenies of all these cross combinations. A cytoplasmic type of this male sterility was confirmed, which was designet as 'CMS-Peredovik'.

(Contributed by ***Christov, M.****, Institute of Wheat and Sunflower "Dobroudja" General Toshevo, Bulgaria)*

USE OF A PH-INDICATOR FOR AN EARLY DIAGNOSIS OF GLASS WASHING EFFICIENCY AND MICROBIAL CONTAMINATION IN BANANA MICROPROPAGATION

Large amounts of plant material and glass bottles are manipulated in commercial micropropagation or *in vitro* screening of mutants in mutation breeding programs. It is to troublesome to maintain good levels of microbial contamination control and glass bottle cleaning. Detergents can be released from inadequately washed glass bottles to culture medium when the glass bottles are autoclaved with the medium. This frequently decreases the growth rate and oxidation to the cultures. Glass washing inefficiency sometimes causes, the loss of several years of excellent work. Both, bacteria and detergents, change the pH of the culture medium. They can be indirectly detected by color change when the medium contains a pH indicator. For this reason, the effect of bromocresol purple (BCP), which is one of the pH indicators, wase studied on banana micropropagation.

Multiple shoots of banana variety "Maçã" (*Musa* sp., AAB group, Silk) and "Nanicão" banana (AAA group, Cavendish subgroup) were used as plant materials. They were maintained on a multiplication medium composed of MS salts and vitamins (Murashige and Skoog, 1962), 5 mg/l 6-benzylaminopurine, 3% sucrose, 8 mg/l BCP, 0.2% gellan gum (Gelrite: Kelco Division of Merk & Co., Inc.), pH 5.8, over more than two years. The bud explants (3 x 3 x 3 mm^3) were transferred to rooting medium composed of MS salts and vitamins, 0.25 mg/l α-naphthaleneacetic acid (NAA), 3% sucrose, 0.7% agar, pH 5.8, supplemented with 0, 2, 4 or 8 mg/l BCP; or to the multiplication medium with or without 8 mg/l BCP. The cultures were maintained in an environmentaly controlled room (28°C ± 2°C, 3000 lux) for one month before evaluation. Due to the difficulty in counting multiple buds, fresh weights, instead of bud numbers, were measured during the "Maçã" multiplication. Table 1 shows the effect of bromocreasol purple on the rooting medium. Statistical analysis did not indicate any significant effects of BCP on root growth.

Table 1. Effect of bromocresol purple (BCP) on *in vitro* rooting of "Maçã" banana*

BCP (mg/l)	Root length (cm)	Root number above 1 cm-length per explant
0	6.40 ± 0.37	13.25 ± 1.93
2	5.46 ± 0.47	13.37 ± 1.70
4	4.43 ± 0.63	13.00 ± 3.22
8	4.98 ± 0.70	14.87 ± 2.12

* Values shown are means of eight explants per treatment. Duncan's multiple-range test (5% level) indicated the lack of significant differences between treatments.

Similarly, the BCP in the multiplication medium also did not cause any effects on shoot growth of "Maçã" and "Nanicão" banana varieties (Tab. 2 and Tab. 3). Roscoe and Bell [1] observed the same phenomenon on petunia protoplast culture. Therefore, it is suggested the BCP may be used in *in vitro* cultures of many other plant species.

Table 2. Effect of bromocresol purple (BCP) on *in vitro* multiplication of "Nanicão" banana*

Medium	Total number of buds per explant	Number of buds above 1 cm-length per explant
with BCP	2.98 ± 0.24	1.29 ± 0.10
without BCP	3.11 ± 0.21	1.30 ± 0.10

* Values shown are means of fifty explants per treatment. Duncan's multiple-range test (5% level) indicated the lack of significant differences between treatments.

With the addition of 8 mg/l BCP to the multiplication or rooting media, the media are of a pink color (pH 5.8) before autoclaving, and of pink-green (pH 5.6) after autoclaving. In some glass bottles when inefficiently washed, the BCP-medium color is different from others. In many cases, it turns into purple (pH > 6.0), making identification and elimination of poorly washed bottles possible before usage. When bacteria appear, the medium color becomes yellow (pH < 5.2).

Table 3. Effect of bromocresol purple (BCP) on *in vitro* multiplication of "Maça" banana*

Medium	Fresh weight (mg) per explant
with BCP	525 ± 58
without BCP	466 ± 64

* Values shown are means of seven explants (initial fresh weights were about 50 mg each) per treatment. Duncan's multiple-range test (5% level) indicated the lack of significant differences between treatments.

REFERENCE

[1] Roscoe, D.H. and G.M. Bell, 1981. Use of a pH indicator in protoplast culture medium Plant Sci. Lett. **21**: 275-279

*(Contributed by **MATSUMOTO, K., R.U. MATSUMOTO, M.L. BARBOSA, C. HIRAO and J.B. TEIXEIRA.** National Research Center for Genetic Resources and Biotechnology. C.P.02372. 70749-970 Brasilia-DF, Brazil)*

INDUCTION OF MULTIPLE MUTATION LINE IN WHEAT BY THE USE OF N-ETHYL-N-NITROSO UREA

The mutant line carrying many mutated characters was induced after mutagenic treatment of seeds of spring wheat variety 'Rena' with N-ethyl-N-nitroso urea (2, 4, 6 mM). This mutant line was named 'KS-5'. The most characteristic change in this mutant line is the decrease in the number of days to maturity when compared with 'Rena'. The mutant line is ready for harvest at the same time as variety 'Kosutkz', which is the earliest, of all the former Czechoslovak varieties. The mutant line 'KS-5' is shorter by 10 cm (average length of the stem is about 65 cm) than the parent variety 'Rena' and also more resistent to wheat powdery mildew.

The mutant was selected from a population sown in high density. This was achieved by sowing compact ears at a distance of 15 x 15 cm. The mutant line was sown in autumn. After multiple selection for improved overwintering, it was estimated that the critical temperature CT_{50} for this mutant line was -14.5°C.

In following generations other mutated characters were expressed. It was found that this mutant line reacts positively to the high plant density obtained with higher rate of sown seeds. An optimal plant density was obtained for this mutant line with about 800 seeds/m^2 (Table 1).

Table 1: Yield (t/ha) of the mutant lines sown in various plant density

Variety/ mutants	Density of sowing (seeds/m^2) 500	650	800	950
Rena	7.21	7.34	7.46	7.16
KS-5	7.85	8.33	8.87	8.05
KS-6	6.34	6.51	6.30	6.20
KS-10	7.30	7.36	7.45	7.12

Generally, at least five characters were changed by mutagenic action in this mutant line. From a practical breeding point of view all five characters are very useful. The partial out-pollinating which was inherited from the parent variety 'Rena' is a negative character of this mutant line. It is interesting, that the characters changed by mutagen were already detected in the M_2 generation and manifested like non-segregating mutations in the next generations. The 'KS-5' mutant line has already been used as a genetic source in the breeding programme in Slovakia.

*(Contributed by **ŠVEC, M.**, Comenius University, Department of Genetics, Bratislava, Slovak Republic)*

INDUCTION OF MUTATION IN JUTE BY POLLEN IRRADIATION

Pollen grains in angiosperms, being a relatively simple target for radiation, are used with commendable features for induction of mutation in several plant species. They are visible in recessive forms transmissible to M_2 generation. This technique was tried in jute, the most important bast fibre crop in commerce.

Pre-anthesis mature flower buds from two cultvars 'JRO 878' (*Corchorus olitorius*) and 'D 154' (*C. capsularis*) were irradiated with X-ray, doses of 4, 8, 12, 16 and 20 kR. Immediately after treatment irradiated pollen was used for pollination varieties 'JR0 632' and 'JRC 212', respectively. The above doses produced no variations in such characters as pod-setting, pod size, seeds per pod and seed-sterility. With higher doses, 40 and 50 kR, many variations in the above characters, except pod-set, were observed. A considerable number of mutants (physiological as well as morphological) were identified in M_2 and advanced generations even at lower doses like 4 kR and 8 kR. Some mutants, identical with those scored in the case of seed treatment [1] were identified when pollen, irradiated with much lower doses, were used (Tab. 1).

Table 1: Mutation types obtained after irradiation of pollen or seeds in jute

Species	Mutation	X-ray dose in kR	
		on pollen	on seed
C. olitorius	Deep green glossy leaf	20	40
	Dwarf heterophylly	8	60
	Oval pod	10	40
	Small pod	8, 10	40
	Narrow leaf	10,12	20
C. capsularis	Ribbon leaf	10	40
	Deep serrated narrow leaf	12	40

One tall mutant (tall cane), a major component for fibre yield and a seed colour mutant (chocolate colour seed coat) were isolated in the second or third generation after selfing. Some of these mutants appear to have prospects for jute production.

REFERENCES

[1] CHATTOPADHYAY, S. and BASAK, S,L., 1982. Induction of mutation in jute by chemical and physical mutagenic agents. MBNL. **20**: 5-60.

*(Contributed by **CHATTOPADHYAY, S.** and **G.C. MITRA***, Central Research Institute for Jute and Allied Fibre, Barrackpore - 7431019; *Present address - R & D, Bankim Krishi Gabeshanagar, Baidyabati - 712222, India)*

EFFECT OF GAMMA RADIATION ON *Corchorus olitorius* L.

Corchorus olitorius is one of the most important vegetables in Nigeria. The leaves and the fruits are mainly used for cooking. In India and other countries, the stem provides high quality fibre (Tossa fibre) for industrial purposes. The low germination capacity of the seeds is one of the problems of production. The method of steeping seeds of *Corchorus* in hot water for about 10 seconds to break the dormancy has been used in production [1] and [2].

Work was carried out with gamma irradiation ranging from 3 krad - 25 krad to create genetic variability and to break the dormancy. The M_1 generations of *Corchorus* seeds (NH87/Co_4) irradiated with 12 krad gave 100% germination. The seeds germinated between 2-3 days after sowing without requiring hot water treatment. A mutant selected in M_3 had high yield with 3-4 fruits on the same node. The normal plants (untreated with radiation) had only one or two fruits on the same node. Some of the seeds had been given out for trials in other ecological zones in Nigeria.

REFERENCES

Akoroda, M.O., 1985. Morphotype diversity in Nigeria landraces of *Corchorus olitorius*. J. Hortic. Sci. **60**: 557-562.

Akoroda, M.O., 1988. Cultivation of jute (*Corchorus olitorius* L.) for edible leaf in Nigeria. Trop. Agric. **65(4)**: 297-299.

(Contributed by ADETULA, O.A., National Horticultural Research Institute, P.M.B. 5432, Idi-Ishin, Ibadan, Nigeria)

REPORT OF ESNA WORKING GROUP 4
PLANT GENETICS, BREEDING AND PHYSIOLOGY

The working group convened for 5 sessions during the 23rd Annual Meeting of ESNA at Halle, Germany, September 5 - 9, 1993, covering the following topics:

1. Mutation Breeding:

AHLOOWALIA Beant S., Radiation induced mutants in ornamentals. (Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna, Austria)

ABO-HEGAZI A.M.T. et al., Response of wheat to drought and salinity in three generations after irradiation. (Ain Shams Univ. Cairo, Egypt)

CAGIRGAN M., Factor analysis of agronomic characters and performance of outcrossing frequency in mutant populations of barley. (Dept. of Field Crops, Akdeniz Universitesi, Ziraat Fakultesi, Antalya, Turkey)

ABO-HEGAZI A.M.T. et al., Effects of irradiation and reirradiation on cotton yield in M_4 generation. (Ain Shams Univ. Cairo, Egypt)

TÖKEI Máizik K., TÖTH Lökös K., Does pre-soaking effect on the yield components of gamma-irradiated pea varieties? (POSTER). (Department of Genetics and Plant Breeding, Gödöllö, Hungary)

2. Micropropagation and Breeding:

KOWALSKI B., First results of the evaluation of potato somaclones under cuban conditions. (Strachau, Germany)

BUGÁKROÁ, Z. and PRETOVÁ A., Androgenesis - unconventional methods of potato breeding. (Institute of Plant Genetics, Slovak Academy of Sciences, Nitra, Slovak Republic)

ROSU A. and INDREAS A., An optimized method for *in vitro* culture of hybrid abortive embryos in grapevine. (Faculty of Horticulture, Univ. of Agronomical Sciences, Bucharest, Romania)

INDREAS A. and ROSU A., Methods and results in obtaining seedless grapevine varieties in Romania. (Faculty of Horticulture, Univ. of Agronomical Sciences, Bucharest, Romania)

ROSU A. and PETRESCU C., *In vitro* culture of somatic tissues in cucurbits (watermelon, melon, cucumber) for assessing their regenerative capacity. (POSTER). (Faculty of Horticulture, Univ. of Agronomical Sciences, Bucharest, Romania)

GRIGA M. and STEJSKAL J., Organogenesis and somatic embryogenesis *in vitro* in pea (*Pisum sativum L., P.arvense L.*) and field evaluation of somaclones - a preliminary report. (Research Institute of Technical Crops & Legumes, Sumperk, Czech Republic)

ABBAS E., BORKOVEC V., PROCHAZKA S., HAVEL L., Uptake of nutritive and regulative substances by tissue cultures of tobacco, cabbage and cucumber differing in organ formation. (University of Agriculture, Brno, Czech Republic)

HRISTOFOROGLU K., SCHMIDT J., BOLHAR-NGRDENKAMPF H.*, Effects of carbohydrate source on development and germination of *Ablis alba* somatic embryo. (Austrian Res. Centre Seibersdorf, and *Institute for Plant Physiology, University of Vienna, Austria)

WAINDINGER-WILHELM E. and RODKACHANE P., Micropropagation of juvenile and adult *Castanea sativa* by using thidiazuron. (POSTER). (Austrian Research Centre Seibersdorf, Austria)

CORNEANU M., CORNEANU G.C., BICA D. and VEKAS L., The amplification of hormones role in culture medium through using magnetic fluids. (POSTER). (University of Craiova, Genetics Section and Techn. University of Timisoara, Romania)

AHLOOWALIA B.S. and SCHMIDT J*., Potentials of gene transfer for plant breeding purposes. (Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna and *Austrian Res. Centre Seibersdorf, Austria)

3. Genotyping:

BOUBRIAK I.I. and OSBORNE D.J., Methodology for the measurement of DNA damage and repair in pollen grains. (Institute of Cell Biology and Genetic Engineering, Kiev, Ukraine and Oxford Research Unit, Oxford, England)

NAUMENKO V.D., BOUBRIAK I.I., SOLOPICHENKO N.L. and GRODZINSKY D.M., Isolation of DNA from birch pollen suitable for the molecular genetic analysis of DNA damage and repair. (Institute Of- Cell Biology and Genetic Engineering, Kiev, Ukraine)

VOLKMANN P., FLUCH S., GLÖSSL J., BURG K. and SCHMIDT J., Development of molecular genetic tools to assess the genetic diversity of oaks. (Biotechnology Dept., Austrian Research Centre Seibersdorf and Centre for Applied Genetics, Univ. f. Bodenkultur, Austria)

HEINZE B. and SCHMIDT J., Uniform patterns of randomly amplified DNA from somatic embryos of Norway spruce. (Biotechnology Dept., Austrian Research Centre Seibersdorf, Austria)

CURN V., Isozyme markers in purity testing of androgenetic oil seed rape breeding lines. (Faculty of Agriculture, Univ. of South Bohemia, Ceské Budéjovice, Czech Republic)

4. Plant Disease Effects and Diagnosis:

THOMAS H.T., The use of diagnostic methods in sugar-beet research. (IACR Broom's Barn Experimental Station, Bury St Edmunds, Suffolk, England)

LIEBISCH H.W., Double-labelling experiments to demonstrate alterations in the phenylpropane metabolism in elicitor-induced suspension-grown cells. (Institute of Plant Biochemistry, Halle/S., Germany)

RODEVA V. and STANCHEVA J., *In vitro* selection of tomato using *Alternaria solani* culture filtrates. (POSTER). (Inst. of Veg. Crops, Plovdiv and Inst. of Plant Research, Jadovo, Bulgaria)

WAINDINGER-WILHELM E., RODKACHANE P. and ZIPKO H., Use of endophytic bacteria as biocontrol agent against chestnut blight. (POSTER). (Austrian Research Centre Seibersdorf, Austria)

5. General Physiology and Analytical Methods:

LOUGHMAN B.C., Application of *in vivo* ^{31}P-NMR and ^{32}P methods in problems of plant nutrition. (Oxford, UK)

ZELENA E. and ZELENY F., Indoleacetic acid, ethylene and indolylacetylaspartate interactions in rooting of stem bean cuttings. (Research Institute for Crop Production, Praha, Czech Republic)

BORKOVEC V. and PROCHFIZKA S., The level of ABA in leaf and ear of winter wheat prior to and after anthesis. (University of Agriculture, Brno, Czech Republic)

KOVACHEVA T.Iv., Effect of boron deficiency and excess on nitrate reductase activity in sunflower plants supplied with different nitrogen forms. (Institute of Plant Physiology, Sofia, Bulgaria)

BADICA C., CORNEANU G.C., CORNEANU M., A proposed mathematical method of selection for biochemical analysis of plants. (POSTER). (University of Craiova, Computer Dept. and Genetics Section, Romania)

The next ESNA meeting is set for September 12-16, 1994 at Varna, Bulgaria. Registration forms are available from:

Prof. B. Todorov, Local Secretary, XXIVth ESNA Meeting,
Head, Department of Radiobiology, Radioecology and Animal Protection
Faculty of Veterinary Medicine, 6000 Stara Zagora, Bulgaria.
Fax: +359-42-34102 or -39057.

Abstracts (less than one page) must be sent to the working group chairman, **Dr. Tudor Thomas**, IACR Brooms Barn Experimental Station, Higham, Bury St Edmunds, Suffolk !P28 6NP, England (Fax: +44-284-811191), or vice-chairman, **Josef Schmidt,** Biotechnology Department, Austrian Research Centre Seibersdorf, A-2444 (Fax: +43-2254-7803653, E-mail: schmidt@zdfzs.una.ac.at).

*(Contributed by **SCHMIDT, J.**, Austrian Research Centre Seibersdorf, Austria)*

LIST OF NEW MUTANT CULTIVARS

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

Name of cultivar	Country and date of release (or approval) Name of principal worker(s) and institute	Mutagenic treatment [parent variety] or cross with mutant or with mutant derived variety	Main character improved
***Allium cepa* L. (onion)**			
KIK-11	USSR, 1991 Vodjanova, O.S. *et al.*, Kazakh Research Institute Potato and Vegetable Farm Kekelinskii Region	cross (Caratalinskii x Valencia) x mutant from Octjabrskii (all 0.05% ENH induced mutants)	yield
Tabys (KIK-13)	Russia, 1993 Vodjanova, O.S *et al.*, Kazakh Research Institute, Potato and Vegetable Farm, Kekelinskii Region	ENH, 0.05% [Octyabr]	yield
***Amaranthus sp.* L. (amaranth)**			
Sterkh	USSR, 1992 Central Republican Botanic Garden Ukrainian Academy of Science, Kiev	chemical mutagen [*A. paniculatus* x *A. nutans*] hybrid seed treated	drought and frost tolerance
***Arachis hypogea* L. (groundnut)**			
Ganhua No.1	China, 1990 Yao Dean, Agricultural Sci. Inst. of Liujiazhan, Jiangxi	gamma rays, 20kR [Yueyou 551-11]	earliness, yield

Name of cultivar	Country and date of release (or approval) Name of principal worker(s) and institute	Mutagenic treatment [parent variety] or cross with mutant or with mutant derived variety	Main character improved
Somnath	India, 1989 Mouli, C., Bhabha Atomic Research Center Trombay, Bombay	cross TG-18A x M-13 (20kR gamma ray induced)	earliness, seed size, oil content
TAG-24	India, 1991 Patil, S.H., Bhabha Atomic Research Center Trombay, Bombay	cross (TG-18A x M-13) x (line x TG-9)	earliness, bud necrosis resistance
Xianghua No.1	China, 1985 Xia Xiaonong, Plant Research Institute Hunan Agricultural Sci. Academy	cross Yueyou 551 x Furong	earliness, yield
***Beta vulgaris* L. (fodder beet)**			
Tymiryazevskaya 87	USSR, 1992 Tymyrjazev Agricultural Academy Moscow	gamma rays and chemical mutagens, [Ekkendorfskaya zheltaya x Pervenets] (hybrid seeds were treated)	yield, disease resistance
Tymiryazevskaya odnos	USSR, 1988 Vavilov, P.P. *et al.*, Tymiryazev Agric. Academy, Moscow	EI [Ekkendorfskaya zheltaya x single seed line] (hybrid seeds treated)	yield
Tymiryazevskaya okrug	USSR, 1992 Tymyrjazev Agric. Academy, Moscow	EI [Leitevitskaya x Pervenets] (hybrid seed treated)	yield
Umanskii polusakharnyi	USSR, 1990 Kornienko, A.V. *et al.*, All Union Res. Inst. of Sugar Beet Bielja Cerkov	cross MS sugar beet line x Mangel Tsenta	rhizocarp (white), disease and insect resistance

***Brassica napus* L. (rapeseed)**

Hua-Yellow No.1	China, Han Ji-Xiang, Inst. Crop Gen. & Breeding Agricultural University, Wuhan	gamma rays	viability
Ivanna	USSR, 1990 Gidash, V.D. *et al.*, State Agric. Exp. Station for Cabbage Family crops, "Ivano-Frankovsk"	MNH, 0.0025% [Jet-Nef]	oil content, insect resistance
Tismenitskii	USSR, 1989 Gidash, V.D. *et al.*, State Agric. Exp. Station for Cabbage Family crops, "Ivano-Frankovsk"	MNH, 0.0025% [Gloria]	oil content, disease resistance

***Brassica oleracea* L. var. *acephala* (kale)**

Vekha	USSR, 1990 Tymyrjazev Agric. Academy, Moscow	chemical mutagen [Mozgovaya zel.vol.]	disease resistance, insect resistance

***Bromus inermis* Leyss. (brome grass)**

Fakel 89	USSR, 1989 Budjak, V. *et al.*, All Union Res. Institute of Forage Crops, Moscow	DMS, 0.006% [Morshanskii]	winterhardness, disease resistance

***Capsicum annuum* L. ((sweet) pepper)**

Nush-51	USSR, 1991 Nushykjan, V.A. *et al.*, Republic Station for Crop Production and Selection	EI, 0.05% [Lastochka]	yield, quality

Name of cultivar	Country and date of release (or approval) Name of principal worker(s) and institute	Mutagenic treatment [parent variety] or cross with mutant or with mutant derived variety	Main character improved
Orangeva Kapia	Bulgaria, 1991 Daskalov, S., Institute of Genetics, Sofia	x-rays, 120 Gy [Pasardjshka kapia]	beta carotene, provitamine A
Pirin	Bulgaria, 1991 Todorova, J., Institute of Genetics, Sofia	gamma rays, 80 Gy [Kurtovska kapia]	powdery mildew resistance, lack of anthocyanin
***Hordeum vulgare* L. (barley)**			
BIOS-1	Russia, 1993 Res. Stat. Industrial Union "Podmoscovie", Moscow Region	cross, DH DH x Moscovskii (interspecific hybridization)	lodging and disease resistance, seed size
Bastion	USSR, 1992 Shevtsov, V., Krasnodar Res. Inst. of Agronomy, Krasnodar	cross Vavilon x Radikal	stiffness
Eight-Twelve	USA, 1991 Wesenberg, D.M. *et al.*, University of Idaho Res. & Extension Center, Aberdeen	cross (Steveland x Luther) x Wintermalt (EMS induced mutant)	spike length, grain colour, short rachilla hairs
Mamluk	USSR, 1992 Shevtsov, V., Krasnodar Res. Inst. of Agronomy, Krasnodar	NTMU, 0.05%;18h [line 137/9]	earliness, grain size, yield
Tone-nijo	Japan, 1990 Aida, S., Sapporo Brewery Company, Sapporo	cross M4-66 x Nittakei-1	

***Lactuca sativa* L. (lettuce)**

Novogodnii	USSR, 1991 Tymin, N.I. *et al.*, All Union Res. Institute, Selection & Seed Production for Vegetable crops, Moscow Region	EI, 0.02%; 12h [Moskovskii parnik]	yield, photosynthesis, Vitamin C content

***Linum usitatissimum* L. (flax)**

Baltyuchai	USSR, 1991 Bachjalys, K., Lithuanian Agric. Res. Institute	ENH, 0.012% [Vipegantas]	disease and lodging resistance
M-5	USSR, 1991 Ivashko, L.V. *et al.*, Byelo Agric. Res. Institute, Jodino	DMS, 0.05% [Orshanskii 2]	disease and lodging resistance

***Lupinus angustifolius* L. (blue lupin)**

Bar	Poland, 1991 Mikolajczyk, J., ZD Har Przebedowo, Goslina	cross Mutant I x 1.456/76/78 (mutant from '*Turkus*' after treatment with NMH, 5mMol)	non-branching, earliness, uniform maturing

***Matricaria chamomilla* L. (chamomile)**

Podmoskovnaya	USSR, 1984 Glazova, M.V. *et al.*, All Union Res. Institute for Medicinal Plants, Moscow Region	colchicine, 0.2%	lodging and disease resistance, ploidy level

***Nicotiana tabacum* L. (tobacco)**

American 307	USSR, 1981 Dydenko, V.P. *et al.*, Crimean Zonal Exp. Station for Tobacco	cross (*N. silvestris* x *N. tomentosa*) x Dubek 44 x Krupnolystnyi B-3	leaf colour

***Onobrychis sp.* L. (esparcet)**

Krasnodarskii 84	USSR, 1992 Krasnodar Agric. Res. Institute, Krasnodar	chemical mutagen [Krasnodarskii 2834]	yield

Name of cultivar	Country and date of release (or approval) Name of principal worker(s) and institute	Mutagenic treatment [parent variety] or cross with mutant or with mutant derived variety	Main character improved
***Oryza sativa* L. (rice)**			
Hu 2205	China, 1987 Zhen Hanting, Inst. for Atomic Energy for Agricultural Use Hubei Academy Agric. Science	gamma rays, 1 kR [IET 2938]	cooking quality, lodging resistance
Liaoyan 2	China, 1992 Zhang, Futao, Saline & Alkali Soil Util. Res. Institute Dawa, Liaoning	gamma rays [Toyonishiki]	salt tolerance
***Panicum miliaceum* L. (millet)**			
Cheget	Ukraine, 1993 Ukrainian Res. Institute for Plant Breeding, Selection and Genetics, Kharkov	cross mutant x mutant (both chemical mutants)	drought tolerance, disease resistance
***Phaseolus coccineus* L. (scarlet runner)**			
Eureka	Poland, 1991 Witek, Z., Garden Plant Breeding Station, Szymanow	gamma rays (local ecotype)	dwarfness
***Pisum sativa* L. (pea)**			
Kwestor	Poland, 1991 Swiecicki, W.K., Plant Breeding Station Wiatrowo, Wagrowiec	gamma rays, 10kR [Paloma]	stem length, pod number
Talovets 60	Russia, 1993 Agric. Research Institute for Black Earth Zone, Voronej	cross Orlej x Smaragd	lodging resistance, wide adaptability

***Ricinus communis* L. (castor bean)**

Khersonskaya 10	USSR, 1981 Ivanuk, S.A. *et al.*, Herson Agric. Institute	chemical mutagen	oil content, yield

***Rubus idaeus* L. (raspberry)**

Kolokol'chik	USSR, 1991 Sokolova, V.A., Horticultural Res. Institute 'Lysavenko'	ENH, 0.025% [Karnaval]	disease resistance, *winter hardness*

***Sorghum sudanense* (Piper) Stapf (sudan grass)**

Mironovskaya 8	USSR, 1990 Mironov Agric. Res. Inst. for Wheat selection and seed production	cross Kubanskii jantar 84/327 x Mironovskaya 10 x Donetzkaya 5 (DMS induced mutant)	earliness, lodging resistance, drought tolerance

***Triticum aestivum* L. (wheat)**

Hezu 8	China, 1992 Gao Mingwei, Inst. for Nuclear Agric. Science, Zhejiang Agr. University, Hangzhou	gamma rays, 1 kR [line 1908] (F1 from Henong No.1 x Zhemai No. 1)	yield, early maturity, scab resistance
Longfumai No.5	China, 1991 Sun Guangzu, Heilongjiang Acad. of Agric. Science, Harbin	*beta* rays [IXIII-4 White]	*earliness*, yield, quality

***Tulipa sp.* L. (tulip)**

Den' Pobedy	Russia, 1993 Kudrjavceva, M.M., *Central Bot. Garden, Academy of Sciences,* Minsk, Belarus Republic	chemical mutagen [London]	decorative flower, disease resistance

Name of cultivar	Country and date of release (or approval) Name of principal worker(s) and institute	Mutagenic treatment [parent variety] or cross with mutant or with mutant derived variety	Main character improved
***Vicia faba* L. (faba bean)**			
Tinos	Poland, 1992 Starzycki, S., Plant Breeding & Acclim. Institute, Radzikow Blonie	cross ti mutant x 'Minden'	determinate growth, early maturity, dwarfness
***Zea mays* L. (maize)**			
Hua Feng 100	China, 1976 Shi-chang, Hu, I.A.A.E., Shandong Academy of Agric. Science	gamma rays, 34 kR [Hua 160 x Feng Ke 1] (F_1 seed was irradiated)	ear lower on stem, grain weight, combining ability
Hybrid ChK 3-18 TV	USSR, 1991	cross ChK 1 x ChK 3 (both induced with NENG; 0.104%)	earliness
KNEJA-674	Bulgaria, 1989 Hristova, P., Maize Breeding Institute, Kneja	cross (cross with mutant inbred line XM-199 rf3 rf4)	yield
Kollektivnyi 100SV	USSR, 1988	cross hybridization with ChK3 SV (induced mutant from hyb. DE 04, with NENG; 0.104 %)	earliness
Yuan-wu 02	China, 1975 Shi-chang, Hu, I.A.A.E., Shandong Academy of Agric. Science	gamma rays, 30 kR [Wudan Zao]	early maturity, ear length, combining ability

SELECTED PAPERS RELATED TO THE USE OF MUTATION TECHNIQUES IN GENETICS AND PLANT BREEDING RESEARCH

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NEW BOOKS

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FUTURE EVENTS

1994

5-8 October

19th EUCARPIA Fodder Crops Section Meeting: Breeding for Quality
Brugge, Belgium
Contact: Dirk Reheul
Burg. Van Gansberghelaan 109
B-9820 Merelbeke
TEL: 32 9 252 19 81
FAX: 32 9 252 11 50

7 November - 2 December

FAO/IAEA Regional (Europe & Middle East) Training Course on Mutation Techniques for Improvement of Stress Tolerance in Basic Food Crops
Damascus, Syria
Contact: IAEA Training Courses Section
Wagramerstrasse 5, P.O. Box 100
Vienna, Austria
TEL: (43) 1-2360 x2385
FAX: (43) 1-234564

6-8 December

4th International Conference on Plant Diseases
Palais des Congrès de Bordeaux Lac, France
Contact: Ms. Catherine Marchais - ANPP
6, Bd de la Bastille
75012 Paris, France
TEL: (33) 43 44 89 64
FAX: (33) 43 44 29 19

13-16 December

3rd International Conference on DNA Fingerprinting
Hyderabad, India
Contact: Dr. Lalji Singh
Tel: 040 852082
E-mail: lalji@ccmb.uunet.in
Secretariat: Centre for Cellular & Molecular Biology, Hyderabad, 500 007 India
Fax: 040 851195
Telex: 0425 7046 CCBM IN

1995

5-9 March

XVIIIth EUCARPIA Symposium Section Ornamentals
Tel-Aviv, Israel
Contact: Symposium Secretariat
Dan Knassim Ltd.
P.O. Box 57005
Tel Aviv, 61570, Israel
TEL: 972-3-5626470
FAX: 972-3-5612303

18 April - 26 May	**IAEA/FAO Interegional Training Course on Advances in Plant Mutation Techniques** Contact: IAEA Training Courses Section Wagramerstrasse 5, P.O. Box 100 Vienna, Austria TEL: (43) 1-2360 x2385 FAX: (43) 1-234564
22-24 May	**22nd Stadler Genetics Symposium** Columbia, Missouri, USA Contact: J.P. Gustafson 206 Curtis Hall University of Missouri-Columbia Columbia, Missouri 65211, USA TEL: (314) 882 7318 FAX: (314) 875 5359
19-23 June	**FAO/IAEA International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement** Vienna, Austria Contact: IAEA Conference Service Section Wagramerstrasse 5, P.O. Box 100 Vienna, Austria TEL: (43) 1-2360 x1316 FAX: (43) 1-234564 (see attached announcement)
31 July - 4 August	**XIV EUCARPIA: Adaptation in Plant Breeding** Jyväskylä, Finland Contact: Eucarpia Congress 1995 Congress Management Systems P.O. Box 151, 00 141 Helsonki TEL: 358 0175 355 FAX: 358 0170 122
20-26 August	**Sixth International Symposium on Buckwheat** Shinshu University, Ina, Nagano, Japan Contact: VI ISB, Organizing Committee Faculty of Agriculture Shinshu University Ina, Nagano 399-45, Japan TEL: 0265 72 5255, ext. 311 or 312 FAX 0265 72 5259:
11-15 September	**12th International Chromosome Conference** San Lorenzo de El Escorial, Madrid Contact: M.J. Puertas Departamento de Genetica Facultad de Biologia Universidad Complutense 28040 Madrid, Spain TEL: 43-1-394 50 44 FAX: 34-1-394 48 44

Joint FAO/IAEA Division
of Nuclear Techniques in Food and Agriculture
P.O. Box 100, A-1400,Vienna, Austria; FAX: (43) 1-234564

FAO/IAEA INTERNATIONAL SYMPOSIUM ON THE USE OF INDUCED MUTATIONS AND MOLECULAR TECHNIQUES FOR CROP IMPROVEMENT

19-23 June, 1995
Vienna, Austria

The Symposium is intended to cover all aspects of mutation and current molecular biology research techniques for use in crop improvement. This Symposium will bridge the gap between practical plant breeding and state-of-the-art laboratory techniques. Furthermore, the Symposium will provide a forum to discuss problems related to crop improvement world-wide, and possible solutions involving the uses of mutation and molecular biology techniques.

The International Organizing Committee:

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AREAS TO BE COVERED IN RELATION TO INDUCED MUTATIONS:

Genetic Diversity in Plant Breeding (Plant Architecture, Seed Quality, Stress Tolerance, Disease Resistance, Biology of CMS, Other Agronomic Traits)
Genome Manipulation, Somatic Hybridization, and Genome Architecture
Genetic Transformation
Methylation and Gene Expression
Insertional Mutagenesis
Molecular Markers (Genetic and Physical Maps)
Map-based Cloning
Biosafety

Call for papers:

Prospective authors must send an extended synopsis of 800 words (two A-4 format pages) together with the form for submission of a paper (Form B) through the competent official authority to reach the Meeting Secretariat by **15 December 1994.**

Participation:

An advance notification of intended participation (Form D) should be sent directly to the Meeting Secretariat by **15 December 1994**. At the same time, all persons wishing to participate in the Symposium must submit the participation form (Form A) through one of the competent official authorities (Ministry of Agriculture, Ministry of Foreign Affairs, National FAO Committee or National Atomic Energy Authority) for onward transmission to the Meeting Secretariat. The information circular and all forms can be obtained from the **IAEA Conference Service Section, Wagramerstrasse 5, P.O. Box 100, A-1400, Vienna, Austria; FAX: (43) 1-234564.**

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The Plant Breeding and Genetics staff, consisting of those in the Joint FAO/IAEA Division located in the Vienna International Centre and those in the IAEA's Seibersdorf Laboratory are listed below:

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LAST BUT NOT LEAST

This Newsletter is distributed free of charge. To have your name added to our mailing list, please send your request to the address shown on the back cover. In addition to your full name, request should indicate the detailed name of your institute, university or plant breeding station. Please note that if a copy is available in your library, a duplicate cannot be sent.

Please submit your contribution to the Mutation Breeding 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 speculations. The length of contributions should not exceed 2-3 double-spaced typewritten pages including tables. We regret that for technical reasons photographs cannot be accepted. References to publications containing a more detailed description of methods for evaluation of findings are welcome but should generally be limited.

Miroslaw MALUSZYNSKI

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