Mutation Breeding Newsletter

Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture

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Message from the Editors

The editors and the staff of the Joint FAO/IAEA Division would like to express their hope for a continued good cooperation with the readers of the newsletter and wish you success in your work during 1977.

Alexander Micke
Richard D. Brock
Leila Shawa

News from the Plant Breeding and Genetics Section

1976 was a year of financial crisis in UNDP and incisive measures within FAO. However, for us 1976 has been a year of continued activity in support of research for grain protein improvement, better disease resistance, more efficient mutation breeding methodology and use of mutants in cross breeding, carried out in Member States of FAO and IAEA. Scientists working on the genetic improvement of vegetatively propagated crop plants and woody perennials by induced mutations were invited to attend a research coordination meeting in Wageningen, from 17 to 21 May. Another group having active projects on mutagenesis and related problems was given the opportunity to join a Swedish/Bulgarian Symposium on Induced Mutagenesis in Plants in Varna, Bulgaria, and to discuss their own projects in a wider forum. Expert services were provided to institutes in Bangladesh, Brazil, Burma, Indonesia, Korea, Pakistan and Zaire. Nineteen scientists were given training opportunities abroad (please refer to table on page 18).

As a result of an advisory group convened in December 1975, a booklet was printed on "Induced Mutations in Cross Breeding" (see page 12) which, we hope, will not only find academic interest but will stimulate the practical use of induced mutants as valuable alternative or supplementary germ plasm sources in plant breeding. A questionnaire included in the last issue of this newsletter revealed, so far, that mutant assortments exist at more than 50 institutes, involving about as many different crop species. (We will attempt to publish a more detailed analysis of the answers received from our readers in our next issue.)

We regret that due to restrictions on staff increases within FAO it was not yet possible to establish a post for a plant pathologist in the Joint FAO/IAEA Division who is urgently needed to strengthen our work in the field of plant protection and disease resistance which, to us, appears to be of increasing importance. We hope, nevertheless, to do our best to serve our Member States and the scientific community also in this field, cooperating with the Plant Protection Service of our sister Division in FAO, Rome. The FAO/IAEA International Symposium on the Use of Induced Mutations for Improving Disease Resistance in Crop Plants, to be held in Vienna, 31 January to 4 February 1977, will be such a cooperative activity.

We have also established links between our own grain protein improvement programme, financially supported by the Federal Republic of Germany, and a FAO programme on protein improvement in spring wheat and barley which became active rather recently with financial support by the Swedish International Development Authority.

We hope that the future will see more comprehensive and cooperative efforts between FAO, IAEA and other international institutions involved in genetic improvement of crop plants for the benefit of plant breeding progress.

RESEARCH NEWS

Natural and induced plasmon variation affecting growth habit in peanuts, A. hypogaea

The growth habit of peanuts erect (= bunch) or trailing (=runner) is controlled by genic-cytoplasmic interactions. A study of nearly 100 representative cultivars and accessions from the germ plasm collection of peanuts showed that the trait is affected by at least three, and probably more, plasmons and at least three major nuclear genes which interact with each other and with the plasmons. One of the plasmon types, (O), is widespread while the other two, [V4] and [G], are rare.

The potency of gamma rays; the acridines, ethidium bromide and acriflavine; and the alkylating agents, ethyl methane sulfonate (EMS) and diethyl sulfate (DES) in inducing such mutations was studied in treatments of mature seeds and developing embryos. In treatments of the trailing line "TBR[V4]", 137 clear-cut erect mutations were found among 1804 M_2 families. Twenty-eight mutations which bred true in M_3 were crossed with appropriate testers: 14 behaved as nuclear (recessive) mutants (ten induced by gamma rays) and 14 as plasmon mutations (7 induced by gamma rays, 6 by EMS, 1 by acriflavine).

In treatments of several erect lines, 32 trailing mutations were recovered in 4,923 M_2 families. Because of continued segregation, the nature of these mutations could not be established so far.

(Contributed by A. Ashri and A. Levy, Faculty of Agriculture, The Hebrew University, P.O. Box 12, Rehovot, Israel).

Heterosis resulting from crossing specific radiation-induced pearl millet mutants with their normal inbred parent

Preliminary trials in 1972 and 1973 suggested that specific mutants of pearl millet might give some positive heterosis when crossed with their inbred parent.

In more extensive trials conducted in 1974 and 1975, a range of mutants from Tift 23 were crossed with their parent variety and the progeny compared with standard hybrids, In 1974 one hybrid, and in 1975 this same hybrid plus four others, significantly exceeded the check. Several hybrids yielded significantly less. Averaging the total yields of the 12 hybrids when crossed with different female testers revealed three, necrotic 6270, white-tipped mutant 6610, and stubby head number 47, which yielded significantly more than the check. The stubby head entry number 47 yielded significantly more than any other entry in the test. Three others, the red plant 24, the purple plant 25, and the lazy normal 42, gave significantly lower yields. The red plant and purple plant characters are dominant and they may reduce forage yields by reducing the efficiency of photosynthesis.

The data suggests that single mutants (which in this case may involve a segment of a chromosome rather than a single gene) may produce hybrids with significant yield increases.

Yield performance of hybrids involving single gene mutants and two other inbreds of pearl millet, Tift 13 and Tift 18, also revealed some that yielded significantly more than the check indicating that the single gene mutants in those instances were also giving a significant heterotic affect.

(Contributed by Glenn W. Burton and Wayne W. Hanna, University of Georgia, Coastal Plain Experiment Station, Tifton, Georgia, U.S.A.)

Using mutants for obtaining heterosis

We have studied many F_1 hybrids, produced by crossing mutants of peas, tomatoes, corn and *Arabidopsis* with initial genotypes. These investigations showed that in several cases heterosis is caused by the action of specific separate genes controlling basic steps of development of complex quantitative characters. The level of monohybrid heterosis effect can be very high (in some cases = 25-30% increase in comparison with the best initial form).

The availability of mutant marker genes would facilitate a model of genetically controlled heterosis. Hence, it is important to investigate as many mutants as possible, especially those controlling such important characters and functions of plants as photosynthesis, mineral uptake and others.

(Contributed by V.K. Shumny, Institute of Cytology and Genetics, Siberian Branch, USSR Academy of Sciences, Novosibirsk, USSR)

Sodium azide mutagenesis in barley

In order to investigate the hypothesis that it may be possible to mutagenize the DNA replicating points in barley by pulsed azide treatments, we conducted experiments on azide uptake and removal from barley embryos. To carry out these experiments, we developed a bioassay for azide based on reversion of Salmonella typhimurium, strain TA 1530. The uptake of azide by barley embryos is very rapid reaching a maximum within 30 minutes. The removal of azide from seeds by washing, however, is a very slow and ineffective process. Approximately 50% of the azide present in the embryos is removed within the first 30 minutes of wash. Relatively little additional azide is removed with up to 3 hrs. wash.

(Contributed by A. Kleinhofs, Margaret Phillips, C.F. Konzak and R.A. Nilan, Department of Agronomy and Soils, Washington State University, Pullman, Washington 99163, U.S.A.)

Performance of mutants induced in sterile triploid turf bermudagrass

"Tifgreen", "Tifway" and "Tifdwarf" are sterile interspecific triploid hybrid cultivars of bermudagrass that cannot be improved by conventional breeding methods. Dormant rhizomes were subjected to gamma rays and 158 mutants were selected that were obviously different from the parent material. These mutants have been under evaluation now for several years in plots that are managed as for golf greens and fairways. Field readings of 4-6 year old bermudagrass mutant plots in 1976 indicate that there are several mutants equal or superior to the parent material.

In the fall of 1972, some of these mutants were planted in a greenhouse bed, that had been artificially infested with root knot nematode, Meloidogyne graminis. None of the mutants showed a really high level of resistance to root knot nematode, but several appeared to be more resistant than the parent clonal material.

The experimental field is heavily infested with sting nematode, capable of causing a great deal of damage to the roots of most bermudagrass. In 1974, it was observed that many mutants were inferior in stand to check clones but several were definitely superior.

In 1975, A.W. Johnson, USDA nematologist, prepared cuttings of six mutants that had shown promise in the field observations and planted them along with controls in soil infested with root knot, sting, ring and stubby root nematodes, but especially inoculated with sting nematodes. Five months later, the dry weight of tops and roots was determined per pot and the number of nematodes in 150 cc of soil counted. The most significant observations are that two pots planted with mutants Tifgreen 72-59 and Tifway 114 failed to develop any root knot nematodes indicating that these nematodes were unable to reproduce themselves on these two selections. Furthermore, it was noted that top and root weights of mutants Tifway 117 and Tifdwarf 45 were not adversely affected, even though there were rather heavy populations of nematodes on them.

Nine of the better mutants will be compared with their 3 parent hybrids in large replicated plots with management variables before final release to the public.

(Contributed by G.W. Burton and W.W. Hanna, ARS, USDA, University of Georgia, Coastal Plain Experiment Station, Tifton, Georgia 31794, U.S.A.)

Gamma ray-induced mutations in sugarcane

Sugarcane, a vegetatively propagated plant, appears to be a favourable material for mutation breeding.

The axillary buds of two popular cane varieties Co-740 and Co-419, exposed to acute gamma-rays (2kR) from a ^{60}Co source produced various types of morphological mutants. These induced variants were maintained in MV_2 generation.

An interesting mutant in Co-740 was of the non-drooping leaf type. In Co-419, the most useful type obtained was called 'thick-cane mutant'. It was confirmed in the MV_2 generation. These mutants appear to be promising because of their increased weight as well as per cent sucrose as determined by the Fisher's Refractometer. The salient features of the thick-cane mutants are presented in the following table.

Characters	Control (bulk)	Thick cane mutants							
		No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8
Number of internodes/ meter	10.3	9.5	11.4	9.4	8.0	15.0	8.5	13.0	11.0
Thickness (cm) (Diameter)	5.3	6.2	6.2	6.3	6.3	6.8	6.7	6.7	6.8
Weight (Kg)/ meter	0.64	1.00	1.05	0.99	1.04	1.16	1.18	1.20	1.19
Sucrose (%)	19.8	19.2	22.2	23.4	23.0	22.3	19.5	21.0	21.0

Further multiplication of the material for mill test is under progress.

(Contributed by H.K. Shama Rao, Biology and Agriculture Division, Modular Laboratories, Bhabha Atomic Research Centre, Trombay, Bombay, India, and R. Sachan and Mangal Singh, Karnataka Institute of Applied Agricultural Research, Somaiya Sugar Works, Sameerwadi, Karnataka, India).

Induction and isolation of mutants in sugarcane

Research on induced mutations was started in 1968 to improve specific characters of commercial varieties of sugarcane. Single-budded sets were treated with mutagens, planted in small pots and transplanted to the field after 45 days. The first vegetative mutation generation (MV_1) data was examined periodically until harvest (12 months). The MV_2 generation was raised by planting cuttings from MV_1. The selected mutants were further multiplied and studied over several years for their stability. The promising ones were included in yield trials. Fifty-two mutants have been isolated from irradiated cultivars Co. 419, Co. 312, Co. 527, Co. 453 and Co. 997 and are maintained in the Institute. Among them are short plant types, non-flowering mutants and high sugar forms [1].

Glabrous leaf-sheath mutants in Co. 527 were isolated in 1968 after X- and gamma-ray treatments. They are of value when harvesting is by hand. There was segregation in subsequent generations and sometimes reversion, indicating the chimeric nature of the initial selection. Selection on the basis of individual stalks for 5 years was necessary before stability could be obtained in 1973. They were then tested for their yielding ability. Only a few yield better than the parent variety. Mutant-13 of Co. 527 not only yields better but does not flower, indicating that mutations occurred simultaneously for 2 economically important characters. Mutant-10 of Co. 527 grows faster than the parent variety.

Red-rot (Colletotrichum falcatum) and smut (Ustilago scitamine) are the two major diseases of sugarcane in India. Smut is also a major disease in Hawaii, Sri Lanka and several other sugarcane-growing areas of the world. For red-rot disease, there is no control other than growing resistant varieties. Hence, several susceptible varieties were subjected to mutagenic treatments in an attempt to induce mutations for resistance to red-rot and smut. Red-rot resistant mutant from Co. 449 and Co. 997 have already been released for cultivation. Co. 740, Co. 997 and Co. 453 were treated with mutagens in 1975 and the MV_2 generation was planted in March 1976 after inoculating the sets with smut spores. Co. 1287 was screened in the MV_2 generation in 1975. Out of 1057 stools tested, 32 were finally rated as free from smut infection. In order to confirm that they are not escapes or unstable chimeras, all the cuttings from these disease-free plants have been again inoculated and planted in March 1976. Cuttings from two stools have not taken the infection for the second year indicating that they may be stable mutants. Co. 1287 is a high yielding variety but was not approved for commercial cultivation because of high susceptibility to smut. These mutants will be included in yield trials for evaluation of their yield and other important characters before considering their suitability for release to cultivators.

REFERENCE

[1] JAGATHESAN, D. and SREENIVASAN, T.V., Induced mutations in sugarcane. Indian J. Agri. Sci. 40 (1970) 166-172.

(Contributed by D. Jagathesan, Sugarcane Breeding Institute, Coimbatore 641007, India).

Mutation breeding of groundnut, rice and pigeon pea

Groundnut:

The Indian Oil and Produce Exporters Association (IOPEA), in collaboration with the Vanaspati (Hydrogenated vegetable oil) Manufacturers Association of India, has sponsored a programme estimated to cost US$330,000, for rapid multiplication of the Trombay varieties of groundnut developed at the Bhabha Atomic Research Centre (BARC).

In 1975, BARC provided about one ton of nucleus seed of varieties TG-1, TG-3, TG-14, TG-17 and TG-18. This year, under the seed multiplication programme, approximately 37 tons of seeds were distributed to the selected farmers at a subsidized rate with the understanding that the graded, harvested produce will be repurchased at a premium of 20 per cent. First year of the seed multiplication programme resulted in the procurement of 250 tons of seed. The programme's target is to achieve an out-turn exceeding 100,000 tons in 1978-79.

Rice:

Trombay rice cultures were tested at Vadgaon by the Mahatma Phule Krishi Vidyapeeth (one of the Maharashtra State Agricultural Universities). The cultures TR-18 and TR-17 yielded respectively 7002 and 5643 kg/ha which were significantly superior to the best check variety yielding 4991 kg/ha. These strains were also tested in the fields of several farmers in the Maharashtra State.

Pigeon pea:

Early flowering mutants of *Cajanus cajan* with bold seeds and compact plant type were superior to the parent variety T-21 at two other locations besides Trombay. Five Trombay Tur (TT) cultures are being tested at 15 locations under the All India Co-ordinated Pulse Improvement Project. At several locations, TT-2 and TT-6 have maintained their earliness.

The scientists who are responsible for the projects are S.H. Patil, Chandra Mouli (Groundnut); N.S. Rao, P. Narahari (Rice); and S.E. Pawar (Pigeon pea).

(Contributed by C.R. Bhatia, Bhabha Atomic Research Centre, Trombay, India).

Induced mutations in glutinous rice in Thailand

In 1976, the Rice Division, Department of Agriculture, Thailand, proposed for release the glutinous variety "RD 6". This variety is a mutant selected from the non-glutinous variety Khao Dawk Mali 105 (KDML 105) after 20 krad gamma ray treatment applied in 1965. The parent variety is a popular rice variety in Thailand due to its good cooking quality, aromatic character, and yield. During 1972 to 1975, KDML 105 mutant lines, including RD 6 were entered in the Inter-Station Yield Trials in the North and North-East regions. Simultaneously, RD 6 was entered in the advanced Regional Yield Trials for a final yield decision. RD 6 has improved resistance to blast and has better yield and equal aroma to its parent variety.

RD 6 compares favourably in yield, aroma and cooking quality and matures three days earlier than Niaw Sanpah Tawng (NSPT), the most popular standard glutinous variety grown by the farmers in North and North-East Thailand. Yield tests from the Regional Yield Trials confirmed that the glutinous mutant line RD 6 had better yielding ability than NSPT. It appears to be a well-adapted type that could be grown under natural conditions of the farmers' fields which may lack good management control.

RD 6 and NSPT are both sensitive to photoperiod. RD 6 flowers approximately 3 days earlier and is about 10 cm shorter than NSPT. The mutant has better blast and brown spot resistance than NSPT. The grain length of RD 6 is a little shorter than NSPT but still acceptable to the farmers. Its cooking and eating quality is superior to NSPT. The mutant was preferred in a taste test by a group of testers in the Rice Division and by some selected farmers in the North and North-East.

The advantage of RD 6 as a new variety is that it provides a different genetic background from Niaw Sanpah Tawng. It can go along as an additional variety with Niaw Sanpah Tawng in the North and North-East to reduce the risk of loss by unexpected attack of new races of insects or diseases.

(Contributed by Pricha Khambanonda, Sermsak Awakul and Asanee Sarigabutr, Department of Agriculture, Ministry of Agriculture and Cooperatives, Bangkok, Thailand).

Mutagenicity of ethyl methane sulfonate and sodium azide in grain legumes

Ethyl methane sulfonate (EMS) and sodium azide (NaN_3) are known to be potent chemical mutagens in cereals and in lower organisms [1] and [2]. Treatments giving a high mutation frequency in barley were, however, not as effective in legumes. Our studies aimed at an efficient mutagen treatment method for grain legumes. The following procedure has proved useful:

1. The seeds should be fresh and germinate well.

2. Dry dormant seeds should be soaked in demineralized water for at least 3-4 hours at 20°C. Seeds with a hard seed coat after that time have a reduced water absorption and should be removed. The soaking water should be changed a few times to remove substances eluted from the seed testa (e.g. tannins, germination inhibitors, etc.).

3. Grain legume seeds are very sensitive to oxygen deficiency. Water and/or mutagen uptake without appropriate oxygen supply may lead to reduced germination. Excessive aeration or oxygenation is recommended during the various phases of mutagen treatment (e.g. presoaking, treatment, post-treatment).

Taking these points into consideration, many problems associated with grain legume seeds can be avoided.

In our investigations, we have applied EMS and NaN_3 treatments to seeds of Vicia faba minor cv. Wieselburger, Pisum sativum cv. Rheinländerin and Phaseolus vulgaris cv. Saxa. Results are based on seedling or epicotyl measurements, cytological investigations of mitotic anaphases in shoot tips and chlorophyll-deficient seedling mutations in the second generation (M_2). In addition, a number of inherited morphological deviations were identifiabl in young M_2 seedlings. Leaf spotting was found to be a poor measure of mutagenic efficiency of both chemical mutagens investigated.

Our most efficient EMS treatments were as follows:

1. Presoak (8-16 hours at 20°C).

2. Treatment (1-3 hours at 20°C with 0,3 - 1,0% EMS).

3. Postwashing (4-8 hours in running tap water).

Drying back and storage did not affect mutagenic efficiencies. The highest induced mutation frequencies obtained were 49% chlorophyll and morphological deviations on an M_1 plant basis in Pisum sativum, 43% in Phaseolus vulgaris, and 52% in Vicia faba.

Sodium azide induced high mutation rates at doses which did not cause physiological damage or chromosomal breaks to the same extent as EMS. It is, therefore, difficult to measure primary physiological damage related to mutation frequency. The principal effect on the cell cycle is a delay in mitotic activity, seedling growth, and ATP and DNA syntheses [3]. Delay in seedling growth and reduction in seedling or epicotyl height were evaluated. The efficiency defined as mutation yield on the basis of biological damage shows that 10^{-4} - 10^{-3} M azide concentrations at acidic conditions (pH 3 - pH 4) and 2-4 hours treatment at 20°C are highly efficient.

Presoaking in oxygenized water for 14 hours at 20°C enhanced the mutation rate compared with 4 hours or non-soaking. The highest NaN_3 mutation rates (59% M_1 families with mutants) in Vicia faba were obtained after treatment periods of 4 hours with 2 x 10^{-3}M azide in 0,1 M phosphate buffer at pH 4 followed by a postwash under running tap water for 1 hour. Dryback and storage at 4°C led to increased lethality. When the postwashing period was extended to 4 hours (1 hour in running tap water and 3 hours in 0,1 M oxygenized phosphate buffer at pH 7) physiological damage was strongly reduced and mutation yields after one week storage were 68%. The spectrum of mutants was largely dominated by viridis and morphological types followed by the more drastic aurea, viridoalbina, albina and tigrina types.

REFERENCES

[1] KONZAK, C.F., WICKHAM, I.M. and DEKOCK, M., Jr., Advances in methods of mutagen treatments. Induced Mutations and Plant Improvement, IAEA, Vienna (1972) 95-118.

[2] NILAN, R.A., SIDERIS, E.G., KLEINHOFS, A., SANDER, C. and KONZAK, C.F., Azide - a potent mutagen. Mutation Res. 17 (1973) 142-144.

[3] PEARSON, O.W., SANDER, C. and NILAN, R.A., The effect of sodium azide on cell processes in the embryonic barley shoot. Radiat. Bot. 15 (1975) 315-322.

(Contributed by H. Brunner, IAEA Laboratory, Seibersdorf, Austria).

Sesame - M_2 seeds for screening

In a research project supported by the IDRC of Canada for mutation breeding of sesame for indehiscence and other desirable traits, two cultivars have been treated with gamma-rays, EMS or EB. M_2 seeds are now available also for distribution to investigators interested in screening them for desirable traits under their conditions. Please write directly to the following address for the seeds:

Professor Amran Ashri
Faculty of Agriculture
The Hebrew University
P.O. Box 12
Rehovot, Israel

or address your requests to this newsletter.

Investigators may also write for exchange of information on treatment details etc.

FAO/IAEA/GSF Advisory Group Meeting on Nutritional Evaluation of Cereal Mutants

A group of experts, comprising nutritionists, analysts and plant breeders, met in Vienna, 26-30 July 1976. They attempted to specify the deficiencies of various cereal crops in nutrients essential to human diet and discussed the desirability of including nutritional aspects among plant breeding goals. They considered various plant traits influencing the value of plant products for human and animal nutrition and appraised the feasibility of improving these by genetic means including mutation induction.

Methods of assaying the amount, availability and digestibility of protein, amino acids and carbohydrates, and of determining the presence and amount of anti-nutritional factors were reviewed. These methods include chemical, enzymatic, microbiological and animal assays. Special attention was given to methods suitable for use in mutation plant breeding programmes. The methods recommended are complementary to those presented in the report "Screening methods for seed protein content and quality", published as Annex III to Breeding for Seed Protein Improvement Using Nuclear Techniques, IAEA, Vienna, 1975, and to PAG Guidelines No. 16 on Protein Methods for Cereal Breeders as Related to Human Nutritional Requirements (P.A.G. Bulletin 5 (2), 1975). A detailed report on the meeting will be published in the IAEA Panel Proceedings Series.

During the meeting, it was recognized that, unfortunately, there is still uncertainty about the nutritional requirements of man in general and the protein requirements in particular.

Further uncertainties in defining research goals are dictated by the difficulty of predicting the level and importance of dietary, agricultural and economic factors over the 10 to 20 years required for the breeding, testing and establishment of new varieties. It is, however, certain that cereals will provide also in the future the major portion of both energy and protein for mankind and will also be extensively utilized as feed for animals. Therefore, it will be the primary objective for varieties of all of the major cereal species to have high and stable yield. The extent to which this requirement can be supplemented with increased nutritional value has to be judged in each case taking into account the intended use, nutritional characters, available genetic diversity, and the technology for measurement and selection. Attempts were made to define nutritional goals for the major cereal species, and for special end uses of the plant product. It was recommended that efforts should be made to:

(a) improve the content and availability of protein and the limiting amino acids (predominantly lysine) of cereals;

(b) increase the protein content of rice without adversely affecting yield, cooking or eating quality;

(c) increase the bulk energy density, protein content and protein utilization of rice for use as a weaning food;

(d) increase the content and availability of protein, lysine and possibly threonine in wheat for child feeding in developing countries;

(e) undertake further efforts to improve the protein quality of maize, sorghum and barley, without adversely affecting total yield, by reducing the proportion of prolamines;

(f) recognize and reduce the levels of anti-nutritional factors such as tannins, phytates, amylase and trypsin inhibitors, lectins, glucans, resorcinols and adverse isoleucine/leucine ratios in the species in which they occur and for the end uses for which they are important.

It was appreciated that these objectives are not universally important, but increased attention should be given to including nutritional goals among plant breeding objectives. Where direct selection for nutritional criteria is not applied, at least nutritional characteristics should be checked in varieties proposed for release to insure that new varieties are not nutritionally inferior.

FUTURE EVENTS OF INTEREST

1977

FAO/IAEA/GSF Research Coordination Meeting on Seed Protein Improvement Using Nuclear Techniques, 27 March - 1 April 1977, Baden (Austria).

8th Congress of the European Association for Plant Breeding Research (EUCARPIA), 23-25 May 1977, Madrid (Spain).

2nd International Conference on Environmental Mutagens, 11-15 July 1977, Edinburgh (Scotland).

16th Congress International Society of Sugarcane Technologists, 3-30 September 1977, Sao Paulo (Brazil).

FAO/IAEA Inter-regional Seminar on the Improvement of Rice Production through Research Using Nuclear Techniques, 26-30 September 1977, Jakarta (Indonesia).

1978

5th International Wheat Genetics Symposium, 23-28 February 1978, New Delhi (India).

FAO/SIDA Seminar on Improvement of the Nutritional Quality in Barley and Spring Wheat, March 1978, New Delhi (India).

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

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

FAO/IAEA/GSF International Symposium on Seed Protein Improvement Using Nuclear Techniques, September 1978, München (FRG).

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

RECENT PUBLICATIONS

Induced Mutations in Cross-Breeding. Proceedings of an Advisory Group, Vienna (Austria) 1975.
IAEA, STI/PUB/447, US$17.00.

Monogenic heterosis
W. Gottschalk

Hybrid vigour in mutant crosses: Prospects and problems of exploitation studied with mutants of sweet clover
A. Micke

Induced mutations in highly heterozygous vegetatively propagated grasses
J.B. Powell

Conclusions and Recommendations

Bibliography

Improvement of Vegetatively Propagated Plants and Tree Crops through Induced Mutations. Proceedings of a Research Coordination Meeting, Wageningen (Netherlands) 1976.
IAEA-194, Vienna 1976.
(Available as microfiche copy on prepayment of US$0.65).

Isolation and propagation of mutations in Dahlia by *in vitro* culture
T. Asahira, H. Yamagata, M. Inagaki and S. Osuga

The development of (new) *in vivo* and *in vitro* techniques of significance for mutation breeding of vegetatively propagated crops
C. Broertjes

Improving sterile turf and forage bermuda grass hybrids by gamma radiation
G.W. Burton

Induction and isolation of somatic mutations in vegetatively propagated plants
B. Donini

Project on production of mutants by irradiation of *in vitro* cultured tissues of coconut and banana and their mass propagation by tissue culture
E.V. de Guzman

Use of induced mutations in potato improvement
H. Kishore, B. Das, K.N. Subramanyam, R. Chandra and M.D. Upadhya

Genetic, cytological and physiological studies on the induced mutants with special regard to effective methods for obtaining useful mutants in perennial woody plants
H. Kukimura, F. Ikeda, H. Fujita, T. Maeta, K. Nakajima, K. Katagiri, K. Nakahira and M. Somegou

Trials with X-rays and γ-rays on oil palm pollen and seeds
E. Ogor and J.A. Odetola

Production of solid mutants in citrus, utilizing new approaches and techniques
P. Spiegel-Roy and J. Kochba

Induced mutations in apple and sour cherry cultivars
S.W. Zagaja

Conclusions and Recommendations

Tracer Manual on Crops and Soils. Technical Reports Series No. 171
IAEA, 1976, STI/DOC/10/171, US$17.00.

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/cross (parent variety)	Main improved attributes of variety
SPRING WHEAT			
Sirius	1968 UK, 1969 FRG, 1970 Luxemburg, 1974 France K. Hoeser, K. Wenisch Bayr. Landesanstalt f. Bodenkultur u. Pflanzenbau, Weihenstephan (FRG)	Weihenst. Stamm Noha (irrad. 1951 + 1952 with 15 kR X-rays) x Stamm GZ Ho LiHe	Good lodging resistance and baking quality
Els	1960 FRG for export only K. Hoeser, K. Wenisch Bayr. Landesanstalt f. Bodenkultur u. Pflanzenbau, Weihenstephan (FRG)	Erli x (Lichti früh x Tr. carthlicum) single grain bulk from above cross irradiated 1953, 54, 55 with X-rays √ 1300-2500 R	Short straw, lodging resistance, good baking quality Commercially used until 1963
BARLEY			
Trumpf	GDR 1973 Inst. für Getreideforschung Bernburg-Hadmersleben	Diamant x several other sources of disease resistance	Short stem, lodging resistance, mildew, stripe rust, leaf rust, resistance Superior to Diamant in yield 1975: 334,000 ha cultivated

Nadja	GDR 1975 Inst. für Getreideforschung Bernburg-Hadmersleben	Diamant x several other sources of disease resistance	Short stem, lodging resistance, mildew, stripe rust, leaf rust, resistance Superior to Diamant in yield 1975: 52,000 ha cultivated
RICE			
Calrose 76	1976 U.S.A. J.N. Ruger, M.L. Peterson, C.H. Hu, W.F. Lehmann, USDA-ARS and Department of Agronomy University of California Davis	^{60}Co γ- rays 1969 25 kR [Calrose]	Short stature (ca 95 cm against 120 cm of Calrose) due to shortening of all internodes otherwise essentially unchanged
AZALEA			
Mevr. R. de Loose	1974 Belgium R. de Loose Rijksstation voor Sierplantenteelt Melle	X-rays and gamma rays, recurrent irradiation 1965-1969 (de Waele's Favorite)	Flower colour change from blue-red with white edge to yellow-red with white edge (flavonol synthesis stopped)
BEGONIA REX			
Gin-Sei	Japan, 1976 K. Shigematsu, H. Matsubara M. Oka Tokyo Metropolitan Isotope Research Center, Tokyo	Adventitious buds of cut leaves, 10 kR, ^{60}Co gamma-rays (1966) [Winter Queen]	More showy leaf colour (changed from very volute leaves of silver-white colour to smooth leaves of green colour with numerous silver-white spots) than original variety.

Name of new variety	Place and date of release (or approval) and name of principal worker and institute	Kind and date of mutagenic treatment/cross (parent variety)	Main improved attributes of variety
Ryoku-Ha	Japan, 1976 H. Matsubara, K. Shigematsu, H. Suda Tokyo Metropolitan Isotope Research Center, Tokyo	Adventitious buds of cut leaves, 10 kR, ^{60}Co gamma-rays (1966) [Winter Queen]	More fine wave-volute leaf figure (changed from very volute leaves of silver-white colour to wave-volute leaves of green colour with a small number of silver-white spots) than original variety. Ozone sensitive habit
<u>BEGONIA</u> <u>MASONIANA</u>			
Orange-Iron	Japan, 1976 H. Suda, H. Matsubara Tokyo Metropolitan Isotope Research Center, Tokyo	Adventitious buds of cut leaves, 0.5 kR, ^{60}Co gamma-rays (1971) [Iron Cross]	More soft-warm colour (changed from large size and yellow-coloured leaves of a wry heart form to middle size and orange-green coloured leaves of a symmetrical form) than original variety. Very soft impressionable plants
Mini-Mini-Iron	Japan, 1976 H. Suda, H. Matsubara Tokyo Metropolitan Isotope Research Center, Tokyo	Adventitious buds of cut leaves, 1 kR, ^{60}Co gamma-rays (1971) [Iron Cross]	Smaller plants (change from large size leaves with a cross figure of purplish brown colour to small size leaves with a red-brown stripe) than original variety. Very miniature plants. Very pretty and dwarfish plants
Big-Cross	Japan, 1976 H. Suda, H. Matsubara Tokyo Metropolitan Isotope Research Center, Tokyo	Adventitious buds of cut leaves, 3 kR, ^{60}Co gamma-rays (1971) [Iron Cross]	Larger leaves of unequal heart form having larger cross-shape figures with bright purple-brown colour than original variety. Very strong plants

Kaede-Iron	Japan, 1976 H. Suda, H. Matsubara Tokyo Metropolitan Isotope Research Center, Tokyo	Adventitious buds of cut leaves 10 kR, ^{60}Co gamma-rays (1972) [Iron Cross]	Larger leaves of irregular and pentagonal form having large cross-shape figures with subdued red-brown colour than original variety. Very strong plants.
ABELIA GRANDIFLORA			
Mei-Fu-Hana-tsukubane-Utsugi	Japan, 1976 H. Suda, H. Matsubara Tokyo Metropolitan Isotope Research Center, Tokyo	Rooted young stem cuttings, 3 kR, ^{60}Co gamma-rays (1972) [Hanazono-Tsukubane-Utsugi]	More fixed variegated plants of deep green having brightly yellow colour in margins of leaves than other variegated varieties (original variety, green). Very dwarf, bright variegated leaves in the four seasons. Very strong.

NOTE: Readers are kindly requested to report to us any information about commercial mutant varieties including varieties which have induced mutants in their pedigree. Of particular interest is information about the commercial value of such varieties (acreage covered, amount of certified seeds produced, date of withdrawal from commercial production).

EXPERTS AND CONSULTANTS 1975/76

During 1975/76, the following experts and consultants were employed in connection with the programme of the FAO/IAEA Plant Breeding and Genetics Section:

Name of Expert/Consultant	Duty Station
K. Auckland, ICRISAT (India)	Vienna (Austria)
M.S. Balal (Egypt)	Lyallpur and Tandojam (Pakistan)
S.G. Blixt (Sweden)	Piracicaba (Brazil)
A. Brunori (Italy)	Vienna (Austria)
G. Burton (U.S.A.)	Vienna (Austria)
F.L. Dieleman (Netherlands)	Vienna (Austria)
S. Haq (Bangladesh)	Yezin (Burma)
A.K. Kaul (India)	Mymensingh (Bangladesh)
E.I. Kivi (Finland)	Tuwaitha, Baghdad (Iraq)
K. Mikaelsen (IAEA, Austria)	Piracicaba (Brazil)
K. Mikaelsen (IAEA, Austria)	Jakarta (Indonesia)
F.L. Nuque (Philippines)	Soeul (Korea)
B. Sigurbjörnsson (Iceland)	Vienna (Austria)
O.M.B. de Ponti (Netherlands)	Vienna (Austria)
F. Walther (FRG)	Lyallpur and Tandojam (Pakistan)

FELLOWSHIP TRAINING 1975/76

Name and Country of Fellow	Training Station
A. Ando (Brazil)	IAEA, Seibersdorf (Austria)
O. Chita (Romania)	IAEA, Seibersdorf (Austria)
R. Chirila (Romania)	Casaccia (Italy)
A. Della (Cyprus)	IAEA, Seibersdorf (Austria)
D.M. Fernando (Sri Lanka)	Long Ashton (U.K.)
K. Hendratno (Indonesia)	Knoxville, Tenn. (U.S.A.)
I. Isaakidou (Greece)	Milan (Italy)
J.R. Kim (Korea)	Los Baños (Philippines)
L. Langer (CSSR)	Ames, Iowa (U.S.A.)
M.A. Mansur (Bangladesh)	Knoxville, Tenn. (U.S.A.)
P. Narahari (India)	Göttingen (FRG)
A. Rahman (Bangladesh)	Svalöf (Sweden)
C.S. Saha (Bangladesh)	Ohmiya (Japan)
S.H. Siddiqui (Pakistan)	Honolulu, Hawaii (U.S.A.)
S. Soepraptopo (Indonesia)	Honolulu, Hawaii (U.S.A.)
A.M. Soomro (Pakistan)	Tokyo (Japan)
R. Sumanadasa (Sri Lanka)	IAEA, Seibersdorf (Austria)
S.M. Tsai Saito (Brazil)	Canberra (Australia)
B. Tulu (Ethiopia)	Grünbach (FRG)

WANTED

Plant breeding expert (sorghum) for the University of Zulia, Maracaibo (Venezuela). One month.

Plant breeding expert (cotton), familiar with mutation induction techniques, for the Shambat Agricultural Research Station, Khartoum (North Sudan). Two assignments, approximately 3 months each.

Radiobiologist, with experience in plant breeding, for the Nuclear Research Centre in Tajura (Libya). Two months.

Plant breeder, familiar with mutation induction techniques, for the University of Addis Ababa, Addis Ababa (Ethiopia). One year.

REQUEST

Irradiation of whole barley plants

For the purpose of inducing chromosomal interchanges within hybrids of *Hordeum vulgare* and *H. bulbosum*, gamma irradiation of hybrid clones is planned. Anyone having experience with such type of radiation treatment is kindly requested to contact:

Dr. Dale Smith
Ontario Agricultural College
Department of Crop Science
University of Guelph
Guelph, Ontario, N1G 2W1 Canada.

HAVE YOU ....

returned the questionnaire which was included in MBNL No. 8 ???????

LAST BUT NOT LEAST

Please submit your contributions to the Newsletter by 1 June and 1 December of each year.

Authors are kindly requested to take into account that the readers want to learn about new findings and new methods but would also like to see the most relevant data on which statements and conclusions are based. Conclusions should be precise and distinguish facts from speculation. The length of contributions should not exceed 2-3 typewritten pages including tables. We regret that photographs cannot be accepted for technical reasons. References to publications containing a more detailed description of methods or evaluation of findings are welcome but should generally be limited to one or two.

Alexander Micke
Richard D. Brock
Leila Shawa

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International Atomic Energy Agency
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