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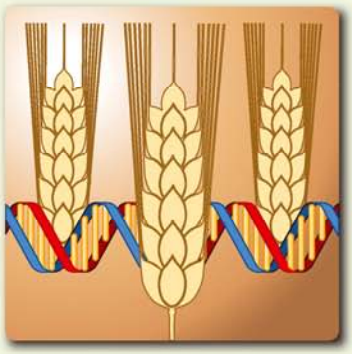

Contents

New Banana mutant variety, ALBEELY BANANA, with higher yield, developed by Dr. Mohamed Ahmed Ali, of the Tissue Culture Laboratory, Agricultural Research Corporation (ARC), Sudan, TC project SUD/5/026 (for details please refer to TC Project Highlights).

To Our Readers

The Plant Breeding and Genetics (PBG) Section of the Joint FAO/IAEA Programme (NAFA/AGE) recently implemented two Research Coordination Meetings (RCMs). In particular, I would like to mention the first RCM of the Coordinated Research Project (CRP) on Assessment of Nutrients Uptake from Bio-fortified Crops in Populations from Developing Countries, Vienna, Austria, 17–19 May 2006, which was co-organized with our nutritionist colleagues from the Division of Human Health, Nuclear Applications Department (NAHU), and sponsored by Harvest Plus (see PAST EVENTS). Hidden hunger and enhancing crop quality for nutrition will be given increased attention in the new biennium 2008–2009. We encourage you to share your input with us on this subject.

We also implemented several training courses in the framework of different Technical Cooperation (TC) projects. You will find details about these activities inside this Newsletter. A highlight of these activities, as in every year since 2001, was the Inter-regional Training Course on “Mutant Germplasm Characterization using Molecular Markers” at the Seibersdorf Laboratories, Seibersdorf, Austria, 14 May–16 June 2006).

IAEA International Atomic Energy Agency

The dedication and scientific interaction from the 20 participants from 20 Member States was most stimulating. This sixth Interregional Training Course was extended from four to five weeks, due to the focus on additional modules on mutation induction, bioinformatics and genomics. Information regarding the seventh Interregional Training Course in 2007 will be detailed in the next issue of our Newsletter.

Your success stories are exciting and gratifying to receive and we continuously try to highlight them in our newsletters (see NEWS). Once a Technical Cooperation Project, Coordinated Research Project, or Training Course is completed, contacts occasionally fade out. However, we are very interested in continuing to hear from you and your endeavours and we are most eager to receive news about new mutant lines/varieties which originated in these projects. We always appreciate receiving your input.

Last but not least, I am proud and relieved to report that the Plant Breeding and Genetics Section is again fully staffed. We welcome Dr. Yvonne Lokko (Ghana) to the team. Yvonne joined the PlantBreeding and Genetics Section as a Plant Breeder/Geneticist in January 2006. She was with the International Institute of Tropical Agriculture (IITA), Cassava Breeding Unit as a Graduate

Research fellow from September 1997 to August 2001. From September 2002 to December 2005 she was a visiting scientist with Programme A - Preserving and Enhancing Germplasm and Agro-biodiversity, working on molecular marker assisting breeding in cassava, yam, plantains and bananas and capacity building in NARSs. Prior to joining IITA, she was a Scientific Officer of the Biotechnology and Nuclear Agriculture Research Institute in Accra, Ghana, and was also a demonstrator/research assistant with the Department of Botany, University of Ghana. Yvonne holds a PhD in Crop Science from the University of Ghana, an MSc in Plant Biotechnology from Wye College, University of London and a BSc in Botany with Zoology from the University of Ghana.

Pierre J.L. Lagoda

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Forthcoming Events

IAEA/RCA Regional Training Course on "Target-selected Mutagenesis in Plants", RAS/5/040, Hangzhou, China, 7–16 August 2006

Technical Officers: Q.Y. Shu and Y. Lokko

The training course is open to senior plant breeders and geneticists from RCA Member States working on crop improvement and mutant characterization in each of the participating countries, who have been actively involved in the regional technical cooperation project IAEA/RCA RAS/5/040 of mutation techniques for food, pulse and oil improvement.

The objective of this training course is to provide senior breeders who lead research projects with updated knowledge of (1) plant molecular genetics and genomics related to plant breeding; (2) the molecular basis of mutation induction and characterization; (3) the principles of target-selected mutagenesis and its application in crop improvement. The course will also include training on breeding project management, particularly on the integration of modern breeding technologies, including mutation techniques and biotechnologies into breeding programmes.

The training course will include lectures, practical exercises (data analysis and laboratory exercises) and demonstrations in the following fields: (1) molecular basis of mutation induction; (2) design and development of molecular markers and their use for mutant gene targeting and mapping; (3) target-selected mutagenesis and detection; (4) induced mutation for functional genomic studies; (5) bioinformatics tools for mutant characterization. Field (mutation breeding programme) and laboratory visits, and research proposal development will be also included.

IAEA National Training Course on "Techniques and Strategies for Rice Quality and Nutrition Improvement", VIE/5/015, Ho Chi Minh City, Vietnam, 7–12 August 2006

Technical Officer: Q.Y. Shu

The training course will be organized by the Institute of Agricultural Sciences for Southern Vietnam, with the technical and financial assistance from the IAEA within the framework of VIE/5/015. It will be open to breeders, researchers and technicians who are involved in rice improvement in research institutes and universities in Vietnam.

The objectives of this training course is to provide trainees with updated knowledge/skills of (1) rice quality characters and their genetic control; (2) techniques and technologies used in rice quality assessment; (3) international and national standards of rice quality assessment; and (4) trends in rice quality improvement, including use of mutation techniques.The training course will include lectures, practical exercises, e.g. laboratory exercises and data analysis.

Training Course on "Molecular Markers for Development of Improved Crop Varieties", RAF/5/050, Roodeplaat, South Africa, 14 August – 1 September 2006

Technical Officer: M. Spencer

The International Atomic Energy Agency (IAEA) in cooperation with the Government of South Africa, through Roodeplaat Vegetable and Ornamental Plant Institute, Agricultural Research Council (ARC) will organise a regional training course on *Molecular Markers for Development of Improved Crop Varieties*.

This training course, which is part of the work plan for RAF/5/050 will give young scientists already involved in breeding programmes in their countries the opportunity to learn about molecular marker applications in crop improvement. A series of lectures on mutation induction, molecular markers, and *in vitro* techniques will be presented. The participants will also have the opportunity to conduct experiments and discuss the applicability of these techniques to their own programmes.

Second Research Coordination Meeting on "Identification and Pyramiding of Mutated Genes: Novel Approaches for Improving Crop Tolerance to Salinity and Drought", Accra, Ghana, 6–10 November 2006

Technical Officer: M. Spencer

20 participants from countries as diverse as China, Cuba, Egypt, Ghana, India, Indonesia, Israel, Italy, Pakistan, the Philippines (IRRI), Thailand, Tunisia, Turkey, United States of America, and Vietnam will be attending this RCM. These participants have been working for one year on identifying and selecting promising mutant lines through induced mutation and *in vitro* techniques with tolerance to drought or salinity. The genomic regions will then be characterized and tagged using molecular markers (AFLP, SSR, and micro-array chips technology). The second phase will include extending the mutated population to further generations in order to stabilise the mutations observed and pursue the molecular characterization with the aim of identifying interesting genes to be pyramided.

Final IAEA/RCA Project Progress Review Meeting on "Mutant Multi-location Trials and Mutation Enhancement of Genetic Diversity" RAS/5/040, Mumbai, India, 10–15 December 2006

Technical Officers: Q.Y. Shu and Y. Lokko

The project was first approved in 2002 and is further extended to 2006, with two main objectives: the establishment and implementation of mutant multi-location trials in the participating countries, and the establishment of a Mutation Germplasm Network (MGN) for crop improvement, materials and information exchange in the region. The meeting will provide an opportunity to review the progress made in the individual participating research institutes and in the region as a whole. A summarizing report will be made available after the meeting.

The future trends of nuclear and related biotechnologies in crop improvement will be dicussed, particularly with reference to the technology development and crop production situation in the region. This will also be connected to the planning of a future regional technical cooperation project for crop improvement.

Past Events

IAEA/RCA Expert Consultation and Project Progress Review Meeting on "Mutant Multi-location Trials and Mutation Enhancement of Genetic Diversity" RAS/5/040, Jakarta, Indonesia, 13–18 March 2006

Technical Officer: Q.Y. Shu

Twenty scientists from nine countries (China, India, Republic of Korea, Mongolia, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam) and five Indonesian scientists working on plant breeding attended the meeting. The meeting was opened by the Indonesian National Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA) Representative, Dr. Pramudita Anggraita. The director of the Center for Application of Isotope and Radiation Technology delivered her welcome speech and the Technical Officer from IAEA gave his remarks about the RAS/5/040 project. The head of the Agency of Agriculture Research and Development of Indonesia, Dr. Achmad Suryana, delivered his keynote speech about the importance of plant breeding, including mutations, for agricultural development in the country.

Each participant presented two progress papers: one on the Regional Mutant Multi-location Trials (RMMT) of relevant crops, and another on enhancement of genetic diversity by using induced mutations. Two sessions were organized for group discussions and workplan development for 2006. Consultations with invited experts for in-

dividual workplan development also took place. In addition, one session was organized for scientific and field visits and delivering open lectures. In this session, four Indonesia scientists were invited to present their research work on induced mutation and related biotechnologies; the participants visited the Indonesian Centre for Agricultural Biotechnology and Genetic Resources Research and Development (ICABIOGRAD) and Bogor Agricultural University, and the multi-location field trials of different crops organized by BATAN.

Dr. R.C.M. Lance, invited IAEA expert from Australia, and the Technical Officer delivered two lectures at the Bogor Agricultural University, which attracted some 100 students and faculty members. Both speakers addressed the importance of mutation techniques in crop improvement and gave examples of success stories in mutation breeding.

Substantial progress was made in most of the participating institutes in 2005. Some inspiring results of the RMMT were reported, e.g. one mutant mungbean variety (from Thailand), two sesame varieties (from Republic of Korea), and one soybean variety (from Vietnam) performed very well in the first three rounds of trial in Sri Lanka; and consequently these varieties will be tested in national yield trials in 2006 in Sri Lanka, which may lead to official release as new varieties. Four research groups (China-wheat; India-groundnut; Pakistan-mungbean; Vietnam-soybean) reported that new mutant varieties were officially released in 2004/5.

Second Research Coordination Meeting on "Pyramiding of Mutated Genes contributing to Crop Quality and Resistance to Stress Affecting Quality", Nanjing, China, 10–14 April 2006

Technical Officer: Q.Y. Shu

Seventeen scientists including five research agreement holders and 12 contract holders participated in the meeting, which was opened by the Vice President of Nanjing Agricultural University, Professor Guanghong Zhou. The RCM was then implemented in four technical sessions, including (1) Progress Report; (2) Improvement of Individual Workplan; (3) Group Work Session; and (4) Technical visit/Invited Lecturer. The participants presented their results and achievements made since the project was initiated, which were discussed and summarized during the group work session.

The team has been working on a total of eight crops with emphasis on rice, wheat, barley, and cotton. The targeted traits include important quality characters, such as nutritional components (e.g. lysine and protein content), end-user quality characters (e.g. eating and tasting quality in rice), processing quality traits (e.g. fibre strength in cotton and baking quality in wheat), as well as tolerance to biotic and abiotic stresses (e.g. virus disease resistance and tolerance to salinity).

A large number of mutant lines have been produced through chemical and physical mutagenesis, e.g. 64 mutant lines in barley, 106 mutant lines in wheat, and 104 mutant lines in cotton. Hybrid populations have been developed for mutation characterization and molecular marker tagging of the target traits. Various PCR-based molecular marker systems are deployed in tagging of these quality characters most often used are microsatellite markers (e.g. rice, wheat, cotton, potatoes), ALFP and MFLP markers (barley, okra, potatoes, sorghum). Several molecular markers have been identified closely linking to quality characters, e.g. pre-harvest sprouting in barley and starch quality characters in rice, and more than 10 fibre quality QTLs were identified in cotton. Notably, the Chinese group of Nanjing Agricultural University, China,

has developed their own EST-SSR markers, the information of which will be available for research groups all over the world.

More than 20 research papers have been published/accepted for publication or presented in meetings/conferences from the research groups of the CRP. The third RCM is planned to take place in Perth, Australia in October 2007.

First National Training Course on "Transfer of Molecular Marker Technologies to Enhance Breeding through Selection and Characterization of Mutant Germplasm" MYA/0/007, Yangon, Myanmar, 1–26 May 2006

Technical Officer: P.J.L. Lagoda

The IAEA, through the TC project MYA/0/007, is assisting Myanmar on biotechnology development. A staged strategy was devised, including scheduling of three consecutive expert training missions:

- Stage 1: basics of molecular biology (May 2006)
- Stage 2: molecular marker technologies
- Stage 3: marker assisted selection

One expert mission team addressing stage 1, Professor Dr. Zhang Yongqiang (team leader), Associate Professor Dr. Wang Zhixing, and Assistant Professor Dr. Hongmei Cheng from the Chinese Academy of Agricultural Sciences (CAAS), Biotechnology Research Institute, visited Yangon from 1 to 26 May. The team provided technical assistance and advice for the establishment of a biotechnology research laboratory and for proper conduct of laboratory work (good laboratory practices). One other focus of the assignment included thorough training on the following topics:

- Cellular biology (*in vitro* culture techniques);
- Molecular biology (DNA extraction, agarose/PAGE electrophoreses, restriction analyses, PCR);
- Marker technologies (introduction to microsatellites, AFLP, RFLP, mapping & QTL, genetic diversity analyses).

Sixth FAO/IAEA Interregional Training Course on "Mutant Germplasm Characterization Using Molecular Markers", Seibersdorf, Austria, 15 May – 16 June 2006

Technical Officer: C. Mba

Twenty applicants from 20 Member States (Bangladesh, Brazil, Bulgaria, Cameroon, China, Costa Rica, Cuba, Indonesia, Islamic Republic of Iran, Jamaica, Libya, Mauritius, Mongolia, Morocco, Myanmar, Nigeria, Sri Lanka, Syrian Arab Republic, Thailand and Uganda) were selected for the sixth FAO/IAEA Interregional Training Course. These participants worked with six external consultants from Finland, France, Israel, United Kingdom and the United States of America on a broad range of themes covering induced crop mutagenesis; the application of molecular genetic and cytogenetic markers to crop germplasm enhancement and characterization; *in vitro* techniques in crop improvement; high throughput identification of mutation events; and population genetic data management for the five–week period. Subprogramme and invited Scientists from the University of Natural Resources and Applied Life Sciences, Vienna (BOKU) and the Austrian Research Centre (ARC), Seibersdorf also gave seminars during the course.

The training programme also included field trips to the crop breeding stations of BOKU; the Cereals breeding station, "Saatzucht Donau". A visit to Wintersteiger, Ried, an agricultural equipment manufacturing company, highlighted mechanization in different agricultural processes.

First Research Coordination Meeting on "Assessment of Nutrient Uptake from Biofortified Crops in Populations from Developing Countries", Vienna, Austria, 17–19 May 2006

Technical Officers: P.J.L. Lagoda and T.P. Trinidad (NAHU)

This CRP is a collaborative project with our nutritionist colleagues from the Division of Human Health, Nuclear Applications Department (NAHU), at IAEA and the International Food Policy Research Institute (IFPRI), sponsored by Harvest Plus. The project's main objective is to evaluate innovative strategies to combat malnutrition by the introduction of nutritionally improved crop varieties, "biofortifcation". In particular, the usefulness of biofortified staple foods will be evaluated as sources of micronutrients (vitamin A, iron and zinc) by stable isotope techniques. In the long-term, this strategy is intended to improve nutrition, health and the well being of populations in resource poor areas.

Participating countries: Bangladesh, China, Mexico, United Kingdom, United States of America (2).

Final Coordination Meetong on "Field Evaluation of Bayoud-Resistant Date Palm Mutants" RAF/5/049, Algiers, Algeria, 19–21 June 2006 and Conference on "Protect Date Palm from Bayoud: Induced Mutations and Supportive Biotechnologies", Algiers, Algeria, 16–17 June 2006

Technical Officer: M. Spencer

This event consisted of a final coordination meeting from 19–21 June 2006 of the regional project RAF/5/049 as well as a conference from 16–17 June 2006. The objectives of this regional TC project were to assist Algeria, Morocco, and Tunisia in producing date palm trees with improved fruit yield, short height, and resistance to Bayoud disease. This project led to the identification and characterisation of a Bayoud toxin from *Fusarium oxysporum* f.sp. *albedinis*, which could be used to test promising mutant lines.

Both events were attended by the project coordinators from Algeria and Tunisia. This project on Bayoud will be completed this year. During this final coordination meeting, the participants reviewed the project achievements over the last five years and made plans for future activities. This conference was an opportunity to take stock of the project's scientific achievements, to share experiences and information, and to debate important technical issues for date palm trees.

The conference "*Protect Date Palm from Bayoud: Induced Mutations and Supportive Biotechnologies"* was attended by eighteen participants. Their abstracts were organised in a document, distributed during the conference. Two international speakers were invited to chair and moderate the conference: Dr. Alain Borgel (INRA IRD CIRAD - France) and Dr. A. Zaid, Prof. (EAU University - Date Palm Research & Development Programme – United Nations Office for Project Services – UNOPS).

The prospectus below was distributed by the Organising Committee in INRRA Algiers.

L'Institut National de la Recherche Agronomique (INRAA) et le Commissariat à l'Energie Atomique (MOMENA), en collaboration avec l'Agence Internationale de l'Enegie Atomique (AIEA)

Organisent une Conférence Régionale sur

Mutagenèse induite et Biotechnologies d'appui pour la protection du palmier dattier contre le Bayoud

El Djazair – Alger, Algérie, 17 et 18 juin 2006

Status of Coordinated Research Projects

Physical Mapping Technologies for the Identification and Characterization of Mutated Genes Contributing to Crop Quality

Technical Officer: M. Miranda

This CRP was initiated in 2002. The second RCM was held in Reykjavik, Iceland, 22–26 August 2005. The third RCM is planned to take place in Cordoba, Argentina in 2007.

Effects of Mutagenic Agents on the DNA Sequence in Plants

Technical Officer: P.J.L. Lagoda

This CRP was initiated in 2003. The first RCM was held in Vienna on 1–5 March 2004. The second RCM was held in Seoul, Republic of Korea, 14–18 November 2005.

The third RCM is tentatively planned for April 2007.

(For details, please refer to NEWSLETTER No. 16)

Pyramiding of Mutated Genes Contributing to Crop Quality and Resistance to Stress Affecting Quality

Technical Officer: Q.Y. Shu

This CRP was initiated in 2004. The first RCM was held in Vienna, Austria, 13–17 September 2004. The second RCM was held in Nanjing, China, 10–14 April 2006.

The third RCM is tentatively planned in Perth, Australia for 2007.

(For details, please refer to PAST EVENTS)

Identification and Pyramiding of Mutated Genes: Novel Approaches for Improving Crop Tolerance to Salinity and Drought

Technical Officer: M. Spencer

This CRP was initiated in 2004. The first RCM was held in Vienna, Austria, 14–18 March 2005.

The second RCM is planned for 6–10 November 2006 in Accra, Ghana.

(For details, please refer to FORTHCOMING EVENTS)

Molecular Tools for Quality Improvement in Vegetatively Propagated Crops Including Banana and Cassava

Technical Officer: C. Mba

This CRP was initiated in 2004. The first RCM was held in Vienna, Austria, 18–22 July 2005.

The second RCM is tentatively planned in Kerala, India, for 2007.

Assessment of Nutrient Uptake from Biofortified Crops in Populations from Developing Countries

Technical Officers: T.P. Trinidad and P.J.L. Lagoda

This CRP was initiated in 2005. The first RCM was held in Vienna, Austria, 17–19 May 2006.

The second RCM is tentatively planned for the end of 2007.

(For details, please refer to PAST EVENTS)

Technical Cooperation Projects

Currently Active Projects

Project Number	Title	Technical Officer
COS/5/025	Development of Induced Mutations and Biotechnology for Improved Productivity and Competitiveness	M. Miranda, M. Spencer
GHA/5/032	Enhancing Production and Use of Cassava	M. Spencer, Y. Lokko
INS/5/030	Sustainable Agricultural Development in Yogyakarta	M. Spencer
INS/5/031	Mutation Breeding of Horticultural Crops	M. Spencer, M. Miranda
INT/5/147	Developing Salt-tolerant Crops for Sustainable Food and Feed Production in Saline Lands	M. Spencer, M. Miranda
IRQ/5/015	Induction of Mutations in Crops through *In Vitro* Culture	P.J.L. Lagoda
KEN/5/024	Crop Improvement and Management through Application of Nuclear and Biotechnology Techniques	Y. Lokko, Q.Y. Shu
MYA/0/007	Nuclear Science and Technology Training Centre (currently a Human Development Project)	Q.Y. Shu
MYA/5/010	Development of Improved Rice with Tolerance to Drought and Soil Salinity	Q.Y. Shu
NIR/5/031	Radiation-Induced Mutations for the Development of Cowpea Varieties	P.J.L. Lagoda
PAK/5/040	Improvement of Heat-Tolerant Semi-Dwarf Bread Wheat through Radiation Induced Mutations	P.J.L. Lagoda
PAK/5/042	Induced Mutation to Improve Salt-tolerance in Non-aromatic Rice Varieties	Q.Y. Shu
PAK/5/044	Improvement of Drought Tolerance in Chickpea through Induced Mutations	M. Spencer
PER/5/028	Use of Nuclear Techniques to Improve Cotton Production	Y. Lokko
PHI/5/029	Enhancing Agricultural Productivity through Radiation Technology in Mindanao	M. Spencer, Y. Lokko
RAF/5/049	Field Evaluation of Bayoud-Resistant Date Palm Mutants	M. Spencer
RAF/5/050	Increasing Production of Nutritious Food through Mutation Breeding and Biotechnology (AFRA III-3)	M. Spencer, Q.Y. Shu
RAS/7/014	Monitoring of Food Fortification Programmes Using Nuclear Techniques	P.J.L. Lagoda
RAS/5/040	Enhancement of Genetic Diversity in Food, Pulses and Oil Crops and Establishment of Mutant Germplasm Network (RCA)	Q.Y. Shu, Y. Lokko
SAF/5/008	Mutant Amaranth, Bambara Groundnut and Cowpea with Enhanced Abiotic Stress Tolerance	Y. Lokko
SIL/5/007	Development of High-yielding Rice Varieties for Low-input Agriculture Systems using Mutation Techniques	Q.Y. Shu, Y. Lokko
SUD/5/026	Improvement of the Productivity and Sustainability of Industrial Crops	Q.Y. Shu
TUN/5/023	Radiation-Induced Mutations for Improvement of Cactus	M. Miranda
TUR/5/023	Application of Nuclear and Gene-Based Biotechnology in Agriculture	M. Miranda
URT/5/023	Enhancing Crop Productivity through Radiation Technology	M. Miranda, Q.Y. Shu

Project Number	Title	Technical Officer
VIE/5/015	Enhancement of Quality and Yield of Rice Mutants using Nuclear and Related Techniques, Phase II	Q.Y. Shu
YEM/5/007	Use of Induced Mutations and *In Vitro* Culture for Improving Crops	P.J.L. Lagoda
ZAI/6/009	Mutation Techniques for Improving Medicinal Plants with a Curative Effect on Human Diseases	M. Miranda, M. Spencer
ZAM/5/022	Crop Improvement through *In Vitro* Mutation Technique	Q.Y. Shu

TC Project Highlights

Improvement of the Productivity and Sustainability of Industrial Crops SUD/5/026

The research capacity in the counterpart institutes have been significantly enhanced through the implementation of this TCP, in addition to the successful release of new mutant.

A Gamma Irradiator was provided to the Sudan Atomic Energy Commission. The facility is now functioning quite well, not only providing irradiation services to plant breeders but also serving as equipment for researchers in other fields. This will significantly facilitate the application of mutation techniques in crop improvement in Sudan.

One molecular laboratory was established with the equipment supported by the IAEA and other infrastructure by the national authorities.

This laboratory will play an important role in molecular characterization of induced mutations and marker assisted selection in crop improvement programmes and has been already used for rapid identification of haploid plants derived from crosses between different cotton species.

The tissue culture laboratory established through the national and regional TCP (RAF/5/050) has been extensively used for banana tissue culture and wheat doubled haploid production.

One banana mutant variety, ALBEELY BANANA, was developed by Dr. Mohamed Ahmed Ali, of the Tissue Culture Laboratory, Agricultural Research Corporation (ARC). **After his fellowship training in the IAEA's ABL in Seibsdorf in 1997**, Dr. Ali started a banana mutation breeding project which resulted in the release of the new variety (see cover photo). The mutant variety performed well in yield trials, showing a yield advantage up to 30% over local control varieties. The mutant variety has already been well accepted by farmers in certain areas.

Ongoing Activities at the Plant Breeding Unit, Seibersdorf

Introduction

The Plant Breeding Unit (PBU) of the Agriculture and Biotechnology Laboratory, IAEA's Laboratories, Vienna and Seibersdorf, has responsibility for the laboratory activities of the crop improvement components of the Sustainable Intensification of Crop Production Systems Subprogramme. Within the overall mandate of working with plant breeders from Member States (MS) of FAO and the IAEA in the use of induced mutations to develop better crop varieties, the Unit carries out research and development (R&D) activities aimed at the development, adaptation and deployment of validated technologies to support national capacities for the use of induced crop mutagenesis facilitated by robust biotechnologies to develop better crop varieties. The provision of support and analytical services to, and human capacity building of, scientists from national agricultural research systems (NARS) of developing MSs also form the core of the Unit's activities.

At the Unit, the strategic matrix of a 3-commodity crops platform of rice, banana and cassava *by* enabling biotechnologies of *in vitro* and molecular genetic techniques has been adopted for developing and adapting technologies to the circumstances of MSs. The current emphases are targeted at:

Developing saline tolerant rice varieties

Salt contaminated soils, approximately 900 million ha globally, severely limit rice productivity making the development of saline tolerant rice varieties, hitherto an intractable breeding objective, an imperative. Induced salt tolerant rice varieties developed at PBU in response to this bottleneck have been adopted by breeders and integrated into breeding programmes in Asia while their dissemination to Africa is ongoing. Molecular genetic marker assays are being used to better understand the mechanisms for this tolerance and for the identification of markers that can be deployed to enhance efficiency in varietal development through marker-aided selection (MAS) for this trait. The International Rice Research Institute (IRRI), Manila, Philippines is an invaluable collaborator in this endeavour.

Developing black sigatoka disease-tolerant bananas

Combined, banana and plantains are a major staple for hundreds of millions of people in tropical and subtropical regions of the world, where they are produced in over 100 countries. One of the major production constraints to these crops is the banana leaf spot disease, caused by *Mycosphaerella fijiensis* Morelet. This disease poisons banana plants and can reduce yields by 50%. Our activities target the development of induced banana mutants with enhanced tolerance to this major production constraint. Our activities are enriched through collaborations with other members of the Global Musa Genomics Consortium, and Promusa.

Parallel to the development of superior mutant variants, we expend an appreciable amount of effort in the development and validation of robust polymerase chain reaction (PCR)-based molecular genetic markers for the Musa genome, an endeavour that has resulted in the development of new simple sequence repeat (SSR) markers and their use in assaying a Promusa-wide core 48 accessions. We are also contributing to the development of genomics tools for the Musa genome through BAC-end sequencing and fingerprinting.

Adding value to cassava

Cassava, *Manihot esculenta* Crantz, is one of the most efficient starch accumulating crops and one of the most productive and inexpensive sources of dietary starch and calories, making it a particularly appropriate food security crop in many tropical regions of the world, especially in sub-Saharan Africa. The crop also has the potential to become a major cash crop through the development of varieties with appropriate starch characteristics for specific industrial applications. Genotypes with 'extreme' contents of amylose or amylopectin would command premium prices, easily translating cassava to the cheapest source of both industrial and dietary starch with implications for enhanced income generation for the resource-poor small-scale farmers who grow the crop. High sugar content mutants would also be ideal for the ethanol industry and thereby a cheap alternative energy source. Activities in the Unit are therefore directed at the use of induced mutations to develop cassava varieties with altered starch properties, while improving or maintaining desirable dietary attributes. For these activities, we collaborate with 2 centers of the Consultative Group for International Agricultural Research (CGIAR), the International Centre for Tropical Agriculture (CIAT, its Spanish acronym), Cali, Colombia and the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria and several NARS.

Services

The services provided by the Unit in support of activities in MSs for the period December 2005 to May 2006 are summarized below:

Irradiation

A total of 216 irradiation treatments were carried out and are broken down thus:

Number of requests	16
Number of species	15
Number of varieties	168
Number of treatments	216
Number of requesting Member States	10

Research collaboration with International and National Agricultural Research Centres

Over 7000 putative induced cassava mutants from 22 accessions were shipped to the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria and the International Centre for Tropical Agriculture (CIAT, its Spanish acronym), Cali, Colombia as part of the on-going collaborative activities with these 2 Centres of the Consultative Group for International Agricultural Research (CGIAR). These materials will be phenotyped as a basis for integration into breeding programmes and for the use of the materials as functional genomics resources for the crop.

Other activities

1. Mr. C. Mba traveled to the headquarters of the Food and Agriculture Organization of the United Nations (FAO), Rome, Italy from 28 February to 3 March 2006 in order to represent the IAEA at the Expert Consultation on Biosafety within a *Biosecurity* framework: contributing to Sustainable Agriculture and Food Production.

2. Ms. R. Afza attended the International Conference on "Haploid in Higher Plants III" held at Vienna, Austria from 11 to15 February. A poster on "Doubled haploid and induced mutation in breeding salt tolerance in rice and wheat" was presented during the poster sessions and an abstract was published in the proceedings. An oral presentation was delivered during the Cost Action 851, "Gametic Cells and Molecular Breeding for crop improvement" meeting.

Molecular genetic fingerprinting

Most of our activities in this regard have been dedicated to the use of our high throughput facility for in-house needs for DNA fragment sequencing and separation. Over 1000 samples were analyzed in the past 6 months.

Visitors to the Unit

Our ability to work with MSs is greatly enhanced through interactions with scientists and policy makers from these countries. Our Unit therefore regularly plays host to national counterparts with collaborative endeavors usually arising from such meetings. The following were the Scientific Visitors during the period under review:

Visiting Scientists

Name	Country	Subject Area	Period
S. Toudjani	Niger	Induced mutation in rice/cassava	January 2006
H. Theobald	Germany	Induced mutation in ornamental plants	February 2006
S.M. Jain	Finland	Induced mutation for crop improvement.	February 2006
S.D. Johnson	Sierra Leone	Induced mutation for crop improvement	April 2006
J.N. Asafu-Agyei	Ghana	Strengthening national agricultural research through collaboration/capacity building in the area of mutation induction for crop improvement	15 May – 27 May 2006
L. Liu	China	Initiation of research collaboration.	May 2006

Fellows/Cost-Free Interns

Name	Country	Area of Training	Period
A. Kareem	Iraq	Induced mutation in vegetatively propagated crops	September 2005 – February 2006
M. Rahimi	Islamic Republic of Iran	Induced mutation and related biotechnologies in rice improvement	1 April – 31 July 2006
T.H. Soe	Myanmar	Induced mutation in seed propagated crops and application of molecular marker techniques for germplasm and mutant characterization	1 May – 30 September 2006
N.C. Win	Myanmar	Induced mutation in seed propagated crops and application of molecular marker techniques for germplasm and mutant characterization	1 May – 31 September 2006
O. Owoseni	Nigeria	Induced mutation and related biotechnologies for crop improvement	1 April – 30 August 2006

Consultants

The following consultants worked with us on a short-term basis during the period under review:

Name	Purpose	Period
S. Gvozdenovicc	Induced mutation in sunflower	20 February – 31 March 2006
C. Vornberg	Data input Clerk	1 March – 30 May 2006

News

National Training Course on Mutation Breeding in Indonesia

A national training course on plant mutation breeding was organized by Dr. Moch. Ismachin Kartoprawiro of the Center for Application of Isotope and Radiation Technology (BATAN) in Jarkarta, Indonesia 20-24 March 2006. The training course attracted about 15 participants. Most of the participants are young lecturers from universities and scientists from research institutes in Indonesia. The Former Deputy Director General of BATAN, Mr. Sutaryo Supadi, opened the training course.

Dr. Qingyao Shu of IAEA and Dr. H. Nakagawa, Director of Radiation Breeding Institute of Japan delivered opening lectures. Indonesia has been very successful in plant mutation breeding during the past two decades and has officially released 24 mutant varieties, including 15 rice and four soybean mutant varieties. The rice mutant varieties are now widely cultivated in 23 provinces in Indonesia.

Subprogramme publications: Plant Mutation Reports

Plant Breeding and Genetics Newsletter is not the sole publication we produce in order to reach you, our colleagues, worldwide. Since the first issue of Mutation Breeding Newsletter (MBNL) was born in May 1972, and her sister Mutation Breeding Review (MBR) ten years later, there were 46 issues of MBNL and 13 MBR published, both MBNL and MBR, being the only specialised publications on mutation breeding worldwide. They have been enthusiastically supported by our contributors and readers. During the past half century, mutation induction has matured from a focal research area to sophisticated technologies in modern plant improvement. Doubtlessly, these two publications played unique and important roles in fostering the development and application of mutation techniques in plant research, germplasm innovation, and new variety development. We are indebted to our predecessors at Plant Breeding and Genetics Section, and especially to Dr Alexander Micke, to have born and raised these publications and fostered their spread.

In 1998, a new newsletter, Plant Breeding and Genetic Newsletter (PBGN), became a regular bulletin, covering all activities in our Section. Therefore, a major function of the MBNL was largely replaced by PBGN. On the other hand, the FAO/IAEA Mutant Variety Database (http://www-mvd.iaea.org/MVD/default.htm) has also taken over some functions of these two publications. Because of this and other reasons, we are facing a dwindling number of suitable submissions from outside for these two periodicals, and MBNL and MBR have been irregular publications since 2001. Even though, we, as well as many of you, contributors and readers, still believe that these two publications have reason to exist, in order to keep them alive, significant evolution is inevitable.

During the recent decade, mutation techniques are no longer used solely as a tool for crop improvement of traditional traits, e.g. yield, resistance to disease and pests, but more frequently for diversified uses of crop end-products, enhancing quality and nutritional values and tolerances to abiotic stresses. Thanks to the massive progress in research of plant molecular biology and biotechnology, particularly plant genomics, we are witnessing new impulses in plant mutation research, from fundamental studies on mutagenesis to reverse genetics. Breeders are now able to use mutation techniques with more sophistication and efficiency than ever before dreamed possible.

With all these on-going developments, we are confident that MBNL and MNR should and could evolve, step by step, towards a periodical of higher scientific value, possibly as an international journal on mutation research and application in plants. The first step was to fuse the MBNL and MBR into Mutation Breeding Newsletter and Reviews (MBN&R) issue No. 1 (replacing MBNL 47 and MBR 14). The next step was to rename MBN&R more fittingly into Plant Mutation Reports (PMR) and we will try to publish it for a couple of years under this format, before we attempt a final upgrade.

We will strive to improve the quality of Plant Mutation Reports towards a periodical of higher scientific value, as a specialized international journal on plant mutation research and its application in crop improvement. We look forward to your constructive proposals in this endeavour. Your continuing contributions are highly appreciated and positively encouraged in the following areas:

1. Induction and characterization of novel mutant germplasm, focusing on the novelty of induced mutant characters;
2. New techniques and methodologies of mutation induction, selection and use in breeding;
3. New varieties developed by using mutant techniques including indirect use of mutants;
4. Economic and social impact analyses of mutant varieties;
5. Review articles.

MBNL has been a valuable source for plant breeders to exchange the up-to-date information in mutant germplasm enhancement and their utilization in crop improvement. In the post-genomic era, induced mutations are becoming unique tools and important resource materials. In this connection, we would also encourage you to provide information on mutants without apparent application in breeding, because they might be extremely useful in functional genomics.

Koshihikari International Rice Prize 2006

Prof. Dr. Akihiko Ando of the Center for Nuclear Energy in Agriculture (CENA), Brazil, won the *Koshihikari International Rice Prize 2006*. Prof. Ando was chosen in recognition for his outstanding activities on research, teaching and extension related to rice breeding using mutation induction for the last 40 years. Prof. Ando was a fellow at the IAEA Laboratories in Seibersdorf between 1972 and 1973.

The Koshihikari International Rice Prize was established in 1997 to celebrate 50 years of development of one of Japan's most popular rice cultivars, the Koshihikariin. Each year the prize committee laureats two rice researchers among nominees from around the world. The second winner of the 2006 prize is Dr. Moussa Sié from the Africa Rice Center (WARDA) in recognition for his significant contributions to rice breeding in sub-Saharan Africa. The award ceremony took place on 15 April in Fukui, Japan.

Announcements

The First International Symposium on Cassava Plant Breeding, Biotechnology and Ecology, Brasilia, Brazil, 11–15 November 2006

The Conference is organized by the University of Brasilia and the Ministry of Environment, Brasilia, Brazil. **Theme:** Cassava improvement to improve livelihoods in sub-Saharan Africa and northeastern Brazil. **Venue:** Hotel San Marco, Brasilia, Brazil. **Conference Website:** http://www.geneconserve.pro.br/meeting2/

Contact:

Dr. Nagib Nassar, E-mail: nagnassa@rudah.com.br

Plant Mutation Report, Vol. 1, No. 1

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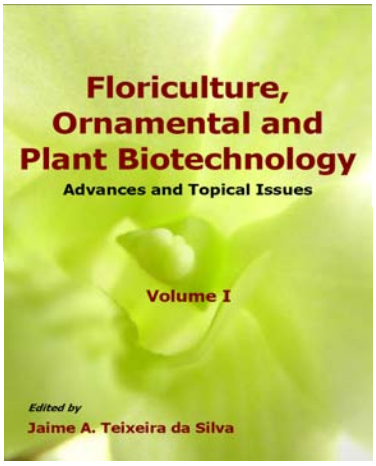
For administrative/technical reasons, MBN&R No. 2 will now be replaced by Plant Mutation Reports (PMR) Vol. 1, No. l. Please accept our deepest apologies for any trouble this might cause. We will continue to strive to improve the quality of Plant Mutation Reports towards a periodical of higher scientific value, as a specialized international journal on plant mutation research and its application in crop improvement. Your comments and suggestions on this subject are very much welcomed and appreciated!

Publications

Biotechnology and Mutatenesis in Improving Ornamental Plants

Jain, S.M. and Spencer, M.M., vol. 1, pp 589-600. in: Floriculture and ornamental Biotechnology: Advances and Tropical Issues, J.A. Teixeira da Silva (Editor), Global Science Books.



Summary

Floriculture, Ornamental and Plant Biotechnology: Advances and Topical Issues is a network of review articles, research and original papers, and a compendium of opinions and techniques that deals with the most important issues in the forefront of Floriculture and Ornamental Biology, Plant Science and Biotechnology. The book contains contributions from leaders at internationally reputed research institutions, universities and independent scientists who are at the forefront of research in issues and topics that affect and influence all plant scientists. The book also encompasses fields that are usually not associated with floriculture, and attempts to find, in the reader and in the book, potential links between interdisciplinary topics of research, written by eminent scholars on various advanced aspects of floriculture and plant biotechnology. Flower-related topics include research tools for floriculture biotechnology; flower colour and chimerism; manipulation of flower colour and shape; modification of plant and flower architecture and fragrance; molecular cloning, floral volatile analysis, scent-pollinator interactions; micro- and macro-arrays for floriculture; genomics, proteomics, and transcriptomics for ornamental and floricultural biotechnology; role of volatiles emitted from flowers and leaves; floral and leaf senescence and genetic engineering of ethylene-insensitivity; regulating growth of floriculture crops; light, lighting, photosynthesis and flowering; circadian clocks; domestication/introduction of novel ornamental crops; improvement of post-harvest shelf life of flowers, post-harvest techniques and quality control; standardization of cut foliage and dry flower production technology; germplasm collection and maintenance *in vitro* and *ex vitro*; *in vitro* thin cell layer technology, embryogenesis, synthetic seeds and cryopreservation; agrotechniques for improved flower crop production and analysis; nursery stock and ornamental foliage and pot-plant production; aeroponics, hydroponics, micro-irrigation and water optimization, environmentally-friendly and organic farming for ornamentals; *Agrobacterium* and viral expression vectors; classical and insertional mutagenesis; plastid, chloroplast and protoplast transgenics; commercialization of genetically modified plants; programmed cell death, transgenic expression mechanisms and silencing; genetic and metabolic engineering for drought-tolerance, pest resistance; pollen biology; analysis of ethylene signal transduction; plant stress, polyamines and signalling; integrated pest management (IPM) and control (IPC) strategies and effective quarantine measures; viruses and viroids, their resistance strategies and detection; weeds and ornamentals; plant-plant interactions and allelopathy, plantmicrobe, plant-insect, plant-pest interactions; soil-water and soil-root/plant interactions and soil management strategies; greenhouse and protected structures and dynamics, management strategies, mechanization and robotics; ornamentals in landscaping and gardening; impact of the floriculture and ornamental industry and plant biotechnology in reducing poverty and hunger in developing and underdeveloped nations; cut-flower, ornamental plant, foliage and pot-plant economics and markets; certification, plant protection and patents; ornamental and floricultural ethics, and people-plant interactions; floriculture and its future in both science and society.

In addition, the book takes on a unique flavour by incorporating techniques commonly used in other plant species or other sectors of non-plant biotechnology, and examines its potential use in floriculture and plant biotechnology: space research, nanotechnology, allelopathy, mutagenesis, plants for revegetation and bioremediation, rare sugars, secondary metabolite production, ethnobotany, and herbs and medicinal plants as ornamentals and in cuisine.

This book series will be essential in the exposure of modern techniques and themes for undergraduate, postgraduate and research students of floriculture, plant science and plant biotechnology, as well as for scientists and policy makers involved with genetically-modified organisms, floriculture and plant biotechnology industry.

This book series will take Flower and Ornamental Plant Biotechnology to a new frontier.

Jaime A. Teixeira da Silva

(2006) ISSN 1749-0294 (Paper), 1749–0308 (Online), 1749-03016 (CD-ROM)

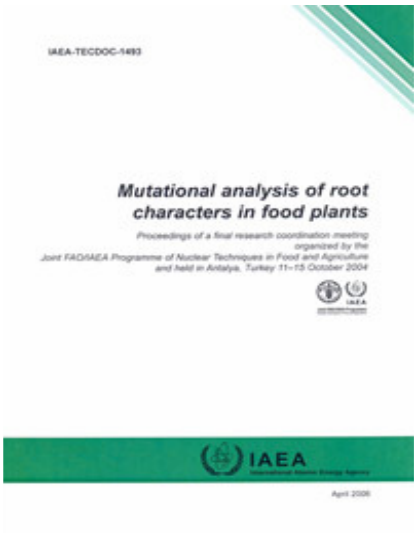
Recent Progress of Rice Mutation Breeding and Germplasm Enhancement in China

Chen, X., Liu, X., Wu, D. and Shu, Q.Y. Plant Mutation Reports, Vol. 1, No. 1, pp 4–6.

(2006)

Mutational Analysis of Root Characters in Food Plants

IAEA-TECDOC Series No. 1493



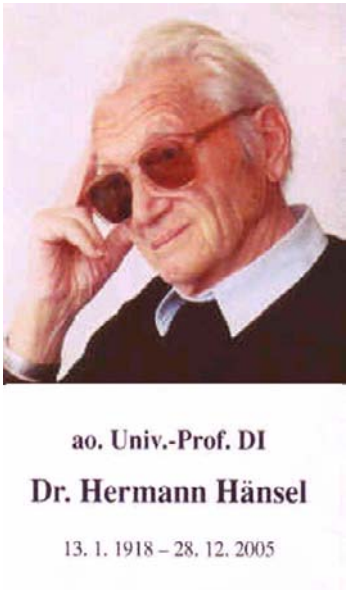
Efficient exploration for water and nutrient uptake from the soil is achieved by adaptation of root architecture, plasticity of root construction, specialized root structures, root physiological responses and beneficial relationships with microorganisms. Roots may also serve as storage organs for carbohydrates and as perennating structures that last for many years. Historically, the genetic analysis of root traits has been neglected, largely because of the difficulty in accessing this below ground organ. Consequently, few characterised root mutants of crop plants are available. The scarcity of root mutants has resulted in the inability to evaluate specific root traits in breeding programmes.

This publication summarizes the results presented at the third and final Research Coordination Meeting (RCM) of the CRP, which was held in Antalya, Turkey, 11-15 October 2004. The IAEA officers responsible for this publication were M. Maluszynski, who initiated this CRP, and Q.Y. Shu of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture. Special acknowledgement goes to Z. Dhlamini (Zimbabwe) for compiling and preparing this publication.

(2006) ISBN 92-0-103106-8
ISSN 1011-4289
IAEA-TECDOC-1493 €15.00

In Memoriam

Hermann Hänsel (1918 – 2005)



Prof. Hermann Hänsel passed away in December 2005 at the age of 87.

He studied Agriculture at the University of Agricultural Sciences in Vienna and in 1984 completed these studies with a PhD. in plant breeding. Postdoctoral studies followed in Cambridge (UK) and Wageningen (NL).

He worked as a practical plant breeder at the "Probstdorfer Saatzucht" in Austria, while at the same time taught as external professor at the university in Vienna for more than 33 years on specific topics such as mutation breeding. He published more than 140 peer-reviewed papers and bred 55 cereal varieties.

Professor Hänsel was associated with the FAO/IAEA programme in plant breeding and genetics since its beginning and contributed to several programmatic meetings such as:

- FAO/IAEA Panel on Coordination of Research on the Production and Use of Induced Mutations in Plant Breeding, Vienna, 17–21 January 1966.
- FAO/IAEA Research Coordination Meeting on the Use of Induced Mutations in Plant Breeding, Vienna, 11–15 September1967.
- FAO/IAEA Panel on Mutation Breeding for Disease Resistance, Vienna, 12–16 October 1970.
- FAO/IAEA Study Group Meeting, Buenos Aires, 16–20 November 1970.
- FAO/IAEA Consultants Meeting on Selection in Mutation Breeding, Vienna, 21–25 June 1982.

It is with great sorrow that we have to accept the final journey of one of the Subprogramme's earliest and finest supporters, advisors and friends. His achievements will be a lasting testimony to his life, and we are proud of the privilege of his dedication to and interest in our work at the IAEA.

Alexander Micke
Pierre J.L. Lagoda

Publications related to Mutation Breeding

HÄNSEL, H. und J. ZAKOVSKY

Röntgen-induzierte Mutanten der Vollkorngerste.

I. Bestrahlung und Auslese auf Mehltauresistenz.

Bodenkultur **9**, 50–64, 1956.

HÄNSEL, H.

Vergleichende Untersuchungen über Entwicklung, Trockensubstanzzuwachs und assimilierende Oberfläche einer *erectoides*-Mutante und ihrer Stammform (*Hordeum distichum nutans*) im Hinblick auf die Ertragsbildung.

Report 2nd Congr. EUCARPIA, Cologne, 82–84, 1959.

HÄNSEL, H. und J. ZAKOVSKY

Untersuchung über die „Alterung" von mit Gammastrahlen behandelten Weizensamen (*Triticum aestivum* L.) im Verlaufe einer zweijährigen Lagerung, gemessen am Wachstum der primären Keimwurzeln.

Bodenkultur **11**, 238–253, 1960.

HÄNSEL, H., J. G.ROSS and C.C. HUANG

Irradiation-induced mutations in a colchicine-reactive genotype of *Sorghum.*

Crop Science **3**, 242–245, 1963

HÄNSEL, H.

Untersuchungen über die Häufigkeit induzierter Chlorophyllmutationen nach ÄMS-Behandlung, Neutronen- und Röntgenbestrahlung von Gerstensamen.

Bodenkultur **16,** 325–339, 1965.

HÄNSEL, H.

Induction of mutations in barley: Some practical and theoretical results

In: Mutations in Plant Breeding 117–137. IAEA Vienna 1966.

HÄNSEL, H.

Model for a theoretical estimate of optimal mutation rates per M1-nucleus with a view to selecting beneficial mutations in different M-generations.

In: Induced Mutations and their Utilisation.

Erwin-Baur-Gedächtnis-Vorlesungen IV. Gatersleben 1966. 79–87.

Akademie-Verlag, Berlin 1967.

HÄNSEL, H.

An estimate of the rate of chlorophyll mutations in barley taking account of multiply mutated M1-nuclei.

In: Mutations in Plant Breeding II, 139–151, IAEA Vienna 1968.

HÄNSEL, H.

Experience with a mildew-resistant mutant (Mut.3502) of 'Vollkorn' barley induced in 1952.

In: Mutation Breeding for Disease Resistance. 125–129, IAEA Vienna 1971.

HÄNSEL, H., W. SIMON and K. EHRENDORFER

Mutation breeding for yield and kernel performance in spring barley.

In: Induced Mutations and Plant Improvement (Proc. FAO/IAEA Study Group Meeting Buenos Aires 1970), 221–235, IAEA Vienna 1972.

HÄNSEL, H. and C.F.KONZAK

Identification, evaluation and documentation of mutants.

In: FAO/IAEA Manual on Mutation Breeding. Second Edition. 142–146, IAEA Vienna 1977.

HÄNSEL, H.

Selection for components of complex characteristics.

In: Selection in Mutation Breeding, 49–55, IAEA Vienna 1984.

PLEASE COMPLETE THIS REGISTRATION FORM AND SEND IT TO THE PLANT BREEDING AND GENETICS SECTION AT THE FOLLOWING ADDRESS:

Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria
Telefax: (+43-1) 26007, Telephone: (+43-1) 2600

New Crop Variety Developed through Mutation Induction or by Crossing with Induced Mutants

A. Latin name of species:

English name:

B. Name of new variety (cultivar):

C. Year of release from breeder:

A.1.1. D. Place and Date of official approval:

E. Parent variety(ies) - if new variety results from a cross with mutant, indicate which is the mutant:

	mutant
1.	yes / no
2.	yes / no
3.	yes / no

F. Main improved characters of variety (indicate if character is derived from mutation or not):

	mutation derived
1.	yes / no
2.	yes / no
3.	yes / no

G. Kind(s) of mutagenic treatment:

H. Doses(s) and/or concentration(s):

I. Year of mutagenic treatment:

J. How was the variety bred:

K. Name(s) of breeder(s) and institute(s):

Address:

L. Extent of acceptance by growers:

- **Commercial value:**

_____

- **Hectares of cultivation:**

_____

- **Other:**

_____

M. References (published articles, official documents, etc.):

Name of person contributing this information: _____

THANK YOU FOR YOUR COOPERATION!

IAEA
International Atomic Energy Agency

Plant Breeding and Genetics Newsletter
No. 17
July 2006

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