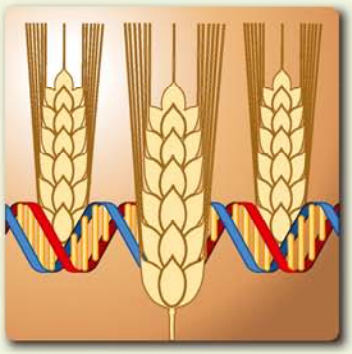
Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Plant Breeding & Genetics Newsletter

No. 22 January 2009

http://www-naweb.iaea.org/nafa/index.html
http://www.fao.org/ag/portal/index_en.html

ISSN 1564-2569



Contents

Openning Session of the FAO/IAEA Internation Symposium on Induced Mutations in Plants (ISIMP), Vienna, Austria, 12-15 August 2008 (for details please refer to Highlights)

To Our Readers

Undoubtedly, the biggest event we can report on for the last period is the successful International Symposium on Induced Mutations in Plants (ISIMP), Vienna, Austria, 12–15 August 2008. With your outstanding contributions, approximately 500 participants from 82 Member States of the IAEA and FAO, and nine international organizations/institutions, contributing short of 400 high level oral and poster presentations made this Symposium a milestone of the renaissance of mutation induction in applied and fundamental sciences.

Inside this issue, you will find more extensive reports on this event, which brought together scientists to focus on the latest innovations aimed at improving crop productivity in an effort to increase the global food security. Thus, this event aimed to provide a venue to disseminate information on current trends in induced mutagenesis in plants. The topics that were discussed covered: molecular genetics and biology of induced mutagenesis, new mutation techniques, induced mutations in crop breeding programmes, mutational analysis tolerance to abiotic and biotic stresses, and socio-economic impact of widespread mutant varieties.

We tried, and I believe we succeeded, to tailor ISIMP for scientists working in the fields of plant sciences, functional genomics and plant breeding as well as managers of both public and private institutions in these sectors. This Symposium was the eighth of a series promoted by the Joint FAO/IAEA Division in Vienna, an illustration of the UN delivering as one on behalf of its member states and humanity.

IAEA International Atomic Energy Agency

We received many messages congratulating us for the organization of this long over-due event. Although it is always pleasant to get congratulations for a job well done, this is your success, representing your work. We are proud that we could serve as a vehicle to transport this good news to the world. And I am pleased to be able to thank here my colleagues and especially Mr. Qingyao Shu, the Scientific Secretary, for their dedication and efficient work. Proceedings of the Symposium are being prepared and will soon become available.

Finally, I want to direct your attention to "Forthcoming Events". A new Interregional Technical Cooperation Project has been initiated focusing on the threat caused by the wheat black stem rust disease causing Ug99. The pandemic of wheat black stem rust spread by Ug99 is of global concern: Nobel Peace Prize winner Norman Borlaug believes Ug99 is the most serious threat to wheat and barley in 50 years. The threat might be compared to the Avian Flu as this Wheat fungal disease is not only threatening the world bread basket - it has already caused an increase in wheat prices, as all commercial varieties are sensitive to the disease - but it also threatens barley. Through the IAEA's Technical Cooperation Programme (TCP), laboratories are established along the projected routes of spreading of this fungus. The IAEA's operative capacities would ideally complement the normative Food and Agricultural Organization's (FAO) activities, monitoring and charting the spread of the disease in the framework of the Global Rust Initiative.

Pierre J.L. Lagoda
Head,
Plant Breeding and Genetics Section

Staff

Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture, Wagramer Strasse 5, P.O. Box 100, A–1400 Vienna, Austria (Phone: +431 2600 + extension; Fax: +431 2600 7; Email: Official.Mail@iaea.org)

Name	Title	Email	Extension
Qu Liang	Director	q.liang@iaea.org	21610

Plant Breeding and Genetics Section

Name	Title	Email	Extension
Pierre J.L. Lagoda	Head of Section	p.lagoda@iaea.org	21626
Qing Yao Shu	Plant Breeder/Geneticist	q.y.shu@iaea.org	21617
Marie Madeleine Spencer	Plant Biotechnologist	m.m.spencer@iaea.org	21623
Yvonne Rosaline Lokko	Plant Breeder/Geneticist	y.lokko@iaea.org	21619
Katayoun Allaf	Secretary	k.allaf@iaea.org	21621
Mario Dani	Secretary	m.dani@iaea.org	21620

FAO/IAEA Agriculture and Biotechnology Laboratory, Plant Breeding Unit, A–2444 Seibersdorf, Austria

Name	Title	Email	Extension
Erik Busch-Petersen	Head, Agriculture and Biotechnology Laboratory	e.busch-petersen@iaea.org	28267
Chikelu Mba	Head, Plant Breeding Unit	c.mba@iaea.org	28268
Rownak Afza	Biotechnologist	r.afza@iaea.org	28208
Bradley Till	Plant Molecular Biologist	b.till@iaea.org	28260
Harivelo V.S. Andrianaivo	Technician		28317
Mirta Matijevic	Technician	m.matijevic@iaea.org	28317
Joanna Beata Jankowicz-Cieslak	Technician	j.jankowicz@iaea.org	28275
Guenter Berthold	Technician	g.berthold@iaea.org	28414
Andreas Draganitsch	Technician	a.draganitsch@iaea.org	28414
Souleymane Bado	Technician	s.bado@iaea.org	28208
Owen Anthony Huynh	Technician	o.huynh@iaea.org	28279
Blessing Ifeyinwa Minz-Nwaiwu	Technician	b.i.nwaiwu@iaea.org	28213
Ann Lorenz	Secretary	a.lorenz@iaea.org	28274

Forthcoming Events

Mid-term Progress Review Meeting of the RCA Project on Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology, Ho Chi Minh City, Vietnam, 16–20 February 2009

Technical Officer: Q.Y. Shu

The meeting is open to up to two participants (the National Project Coordinator and a key member of the project team) from each of the Member States participating in this RCA Project.

The objectives of this meeting are:

- To review and evaluate achievements made during 2007-2008 in the implementation of the IAEA Regional Project on Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology. The participants should then present the project results and achievements made in their respective countries;
- To provide participants with the opportunity to exchange up-to-date information on new breeding methodologies and techniques for improvement of different traits and;
- To discuss and improve work plan for 2009 and 2011, in the context of new issues arising in crop production and new technologies becoming available.

First Coordination Meeting - Responding to the Transboundary Threat of Wheat Black Stem Rust (Ug99), INT/5/150, Nairobi, Kenya, tentatively planned for the second week of March 2009

Technical Officer: P.J.L. Lagoda

This Interregional Project is bound to complement ongoing international activities and provide a platform for the coordination of a network of laboratories (based on the previously established laboratory infrastructure through the Agency's technical cooperation projects) as a defense line against the Wheat Black Stem Rust (Ug99) disease. Implementing shall be conducted in the three following phases: (i) Normalization: adoption and training in the use of uniform protocols, in order to assure homogeneity of handling (capacity building); (ii) Quality control: double blind tests for identification and characterization of false positives vs. false negatives (periodic network performance meetings, quality management and steering); (iii) Multilocation trials of mutant germplasm in endemic hot spots/screen houses: production/screening of resistant mutant wheat and barley germplasm (including previously produced mutant germplasm in national and regional TCPs). These phases are not necessarily consecutive, but overlapping. A network of Ug99 surveillance laboratories shall be comprised of: (i) Front line: Kenya, Yemen, Sudan, Egypt, Jordan, Syria, Turkey, Ethiopia, Uganda and Iran; (ii) Tunisia, Morocco and Algeria; (iii) Pakistan and South Africa. Operative coordination shall include: The Agency (Vienna: scientific backstopping, Seibersdorf: quality control/training) in close collaboration with the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria. The FAO (Rome) is entrusted with the normative coordination. International collaborating laboratories and institutes include: ICARDA, the International Maize and Wheat Improvement Center (CIMMYT), the United States Department of Agriculture – Agricultural Research Service (USDA-ARS.

IAEA/RCA Regional Training Course on Mutation Breeding Approaches to Improving Protein and Starch Quality, RAS/5/045, Lismore, Australia, 23–27 March 2009

Technical Officer: Q.Y. Shu

The training course is open to RCA Member States participating in the project on Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology (RAS/5/045). The objective of this training course is to provide young scientists involved in the project with advanced knowledge and skills related to mutation breeding for improving quality traits especially of protein and starch. Particularly, various molecular genetic and bioinformatics tools related to mutant gene screening and characterization will be introduced and practiced during the training course.

First Research Coordination Meeting on Improving Nutritional Quality by Altering Concentrations of Enhancing Factors Using Induced Mutation and Biotechnology in Crops, D2.30.28, Vienna, Austria, tentatively planned for March 2009

Technical Officer: Y. Lokko

In addition to providing the major calories in human diets required to sustain life, plants are also the major source of health-beneficial agents, such as vitamins and minerals required for vital physiological process. The major staple crops, however, do not provide the essential vitamins and minerals in adequate quantities and qualities. A sustainable way to ensure that adequate amounts of vitamins and minerals can be obtained from diets is to develop crops that provide the required amounts in their edible tissues.

Induced mutations are a proven tool in creating desirable genetic variability in plants that translate in enhancing accumulation of essential minerals; synthesis of precursors of vitamins; modified quantities and qualities of starch, proteins and oils as well as secondary plant metabolites that play critical roles in improving human health and nutrition. The CRP aims at utilizing the wealth of mutant germplasm in model crops, such as rice, tomato and barley, to understand and identify genes involved in the biosynthesis of nutritional quality enhancing factors, and to develop efficient screening methods to facilitate the genetic improvement of nutritional quality. The goal is to transfer knowledge and technologies of beneficial mutants associated with nutritional factors from model crops to improve nutritional quality into other crops.

Participating scientists will be meeting in Vienna, for the first Research Coordination Meeting (RCM) to discuss the individual project activities, adapt the work plans, and to facilitate possible collaboration between the research teams.

First Research Coordination Meeting on Enhancing the Efficiency of Induced Mutagenesis through an Integrated Biotechnology Pipeline, D2.40.12, Vienna, Austria, tentatively planned for the second quarter of 2009

Technical Officers: C. Mba and B. Till

This RCM is tentatively planned to be held in the second quarter of 2009 under the condition that enough proposals will reach us until end of January 2009. For the moment participants for this CRP are being selected.

For detailed information, see 'Status of Coordinated Research Projects'.

Past Events

Regional Training Course on PCR Based Molecular Marker Systems, RER/5/013 Katowice, Poland, 30 June–11 July 2008

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

Trainees practicing molecular marker techniques

Under the regional TC project RER/5/013 on Evaluation of Natural and Mutant Genetic Diversity in Cereals Using Nuclear and Molecular Techniques, a training course on Methods PCR Based Molecular Marker Systems was organized by the International Atomic Energy Agency (IAEA) in cooperation with the Government of Poland through the Department of Genetics, University of Silesia. Dr. A. Janiak served as the Course Director; Prof. R. Tuberosa (Italy) and Mr. Q.Y. Shu (IAEA) lectured at the training course as international experts, Prof. M. Maluszynski, Prof. I. Szarejko, and their colleagues from the University of Silesia gave most of the lectures and instructions.

Fifteen researchers from 11 countries from the European region attended the course, which covered theoretical lectures and practical exercises in the following fields:

1. Molecular markers and their applications in plant genetics and breeding;
2. PCR reaction – principles, optimization, primer design and PCR modifications;
3. Types of PCR based markers;
4. Application of molecular markers in fingerprinting and genetic diversity studies;
5. Gene mapping and molecular maps construction;
6. SNP markers;
7. TILLING and EcoTILLING – reverse genetics strategies for discovery of new alleles;
8. Molecular markers, QTL mapping, and association mapping;
9. Use of SSR markers for mutant quality control; and
10. Plant molecular mutation breeding.

The training course also included a session in which participants' were able to give presentations on their research activities in their home institutes.

A very high score was given to both, lectures and practical exercises. The trainees felt that the laboratory practical trainings were excellent and very useful for their research in their home institutes.

Second Coordination Meeting on Evaluation of Natural and Mutant Genetic Diversity in Cereals Using Nuclear and Molecular Techniques, RER/5/013, Vienna, Austria, 11–15 August 2008

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

Cereals are the most important grain crops in South-Eastern Europe. Their production is greatly affected by various biotic and abiotic stresses, particularly drought. New varieties with enhanced tolerance to drought stress are in high demand to ameliorate cereal production in the affected areas; however, due to the complex nature of drought stress and its effect on various physiological activities of plants, development of drought tolerance has been hampered by the lack of necessary knowledge of biological control as well as by the methods and techniques that can be efficiently used by the breeding programmes in developing countries.

The objective of this regional project is to evaluate and increase genetic diversity in major cereals using nuclear techniques, molecular genetics and biotechnology.

The Second Coordination Meeting of RER/5/013 was held in the IAEA Headquarters, Vienna International Centre, Vienna, Austria, from 11 to 15 August 2008 in conjunction with the International Symposium on Induced Mutations in Plants (ISIMP). The main purposes of the meeting were: i) to report results of various activities achieved since the last coordination meeting under this project, within the project team and; ii) for some selected participants, to deliver oral or poster presentations at the International Symposium on Induced Mutations in Plants; iii) to discuss work plan of national and project-wide activities; iv) to learn the recent developments in science and technologies related to the project and to interact with international experts as well as exchanging views and ideas about relevant research activities.

Seventeen scientists from Albania, Bulgaria (2), Kazakhstan, The Former Yugoslav Republic of Macedonia, Republic of Moldova, Poland (2), Romania, Serbia (2), Turkey (2), Ukraine and Uzbekistan participated in the meeting. Each participant made detailed presentations reporting on progress made and on planned activities under this project for the coming year.

International Symposium on Induced Mutations in Plants (ISIMP), Vienna, Austria, 12–15 August 2008

Scientific Secretary: Q.Y. Shu

Conference Coordinator: K. Morrison

On the 80th anniversary of mutation induction in crop plants, the International Symposium on Induced Mutations in Plants (ISIMP) was organized by the International Atomic Energy Agency (IAEA) and the United Nations Food and Agriculture Organization (FAO) through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

In the past decade, with the unfolding of new biological fields, such as genomics and functional genomics, bioinformatics, and the development of new technologies based on these sciences, there has been an increased interest in induced mutations within the scientific community. Induced mutations are now widely used for developing improved crop varieties and discovering genes controlling important traits and understanding the functions and mechanisms of actions of these genes. Progress is also being made in deciphering the biological nature of DNA damage, repair and mutagenesis. The application of mutation techniques, *i.e.* gamma rays and other physical and chemical mutagens has generated a vast amount of genetic variability and has played a significant role in plant breeding and genetic studies. All these developments were reflected in the various sessions of the symposium.

The symposium comprised of one open session, two plenary sessions and 10 concurrent sessions, covering topics from induced mutations in food and agriculture, plant mutagenesis, genetic diversity, biofortification, abiotic stress tolerance and adaptation to climate changes, crop quality and nutrition, seed and vegetatively propagated plants, gene discovery and functional genomics. A workshop on low phytate rice breeding was also organized. Approximately 500 representatives from 82 Member States of the IAEA and FAO, and nine international organizations/institutions attended the symposium, with a good balance between the private and public sectors, and developing and developed Member States.

For detailed information, see ‘Highlights’.

Consultants Meeting on Plant DNA Damage, Repair and Mutagenesis, Vienna, Austria, 12–16 August 2008

Project Officer: Q.Y. Shu

Five experts, Drs. K. Riha (Austria), H. Puchta (Germany), A. Levy (Israel), B. Hohn (Switzerland), and A. Britt (United States of America), were invited to attend this meeting. They presented their work in concurrent session two of the International Symposium on Induced Mutations in Plants (ISIMP) and also worked on a proposal for a coordinated research project on Plant DNA Damage, Repair and Mutagenesis.

They suggested a change in the title of the project to ‘Plant Mutagenesis’. After post-meeting consultations, a proposal entitled Isolation and Characterization of Genes Involved in Mutagenesis of Crop Plants was submitted for approval and review to the Agency’s Committee for Coordinated Research Activities (CCRAs).

Fourth Research Coordination Meeting on Physical Mapping Technologies for the Identification and Characterization of Mutated Genes Contributing to Crop Quality, D2.30.24, Vienna, Austria, 11–15 August 2008

Technical Officer: Y. Lokko

Physical and molecular mapping techniques are tools that allow identification of landmarks on DNA including genes and provide new opportunities for the rapid advancement of marker-assisted selection in breeding programs including the and are applicable to gene manipulation for crop improvement. It has been well established that the utilization of mutagens is a very important approach for manipulating many value-added traits for improved crop production on a world-wide scale (for example, improved nutritional quality and abiotic stress tolerance). It is envisaged that understanding of gene expression, gene interaction, and physical location will improve the ability to manipulate and control genes, and directly lead to crop improvement.

Despite the wealth of publicly available genomic information, plant breeders are still not able to utilize these to carry out the directed gene manipulation such as a better understanding of genome structures and variation (spontaneous and induced). The CRP aimed at addressing the problems of application of molecular and mutation technologies for breeding value-added crops. An understanding of the physical organization of genomes and chromosomes is important to the utilization of induced mutations for plant improvement.

The final Research Coordination Meeting of this CRP was held in the IAEA Headquarters, Vienna International Centre, Vienna, Austria, from 11 to 15 August 2008 in conjunction with the International Symposium on Induced Mutations in Plants (ISIMP). The main purposes of the meeting were: i) to present and discuss the results of the research carried out in the course of the CRP; ii) to evaluate achievements of the project in accordance with the project objectives and expected outputs; and c) to review the manuscripts prepared for the production of an IAEA TECDOC publication and peer reviewed publications.

Eleven research contract holders from Argentina, Bulgaria, China (2), Czech Republic, Pakistan (2) and Poland and three research agreement holders from Germany, Iceland and the United Kingdom attended the meeting. Each participant made a detailed presentation on the main findings of their research work. Thereafter, participants critically evaluated the expected outputs of the project and formulated the main achievements, conclusions and recommendations.

For detailed information, see 'Status of Coordinated Research Projects'.

Third Research Coordination Meeting on Identification and Pyramiding of Mutated Genes: Novel Approaches for Improving Crop Tolerance to Salinity and Drought, D2.30.26, Vienna, Austria, 11–16 August 2008

Technical Officer: M. Spencer

The third RCM was held in conjunction with the International Symposium on Induced Mutations in Plants (ISIMP). All 20 participants took part at the meeting and the reports presented were quite outstanding. In fact, some of the participants were consequently invited to give oral presentations at the International Symposium, concurrent session four on Induced Mutations for Traits that Affect Abiotic Stress Tolerance and Adaptation to Climate Change.

This was really an uplifting experience for the participants, as not only were the most recent results highlighted in front of world renowned scientists, but it was also an excellent opportunity for the participants to discuss and interact with more than 400 scientists interested in the application of mutation induction in crop improvement. Furthermore, participants were introduced to the new avenues of research using this particular technology.

The participants are all tackling the difficult task of identifying and possibly pyramiding genes governing the various aspects of tolerance to drought and/or salinity with or without the aid of molecular markers.

During the discussions, the research team was divided in to two groups:

- The first group included scientists applying induced mutation to enhance the efficiency of their breeding programmes. The advanced mutant populations are carefully screened for traits associated with resistance to salinity and drought in order to identify traits to be used in a pyramiding scheme.
- The second group included scientists relying more on the use of molecular markers to screen and identify markers associated with traits directly involved in tolerance, either for future pyramiding or for gene expression studies.

Some of the research teams performed great work leading to some of the following interesting results:

- A segregating population developed from crosses between salt tolerant genotypes of *Brassica juncea*: CS 52 and CS 54 and sensitive genotype: Krishna in order to develop a reliable recombinant population for further molecular characterization studies.
- A durum wheat TILLING population was generated and molecular markers studies initiated to assist in future pyramiding experiments.
- Ten Arabidopsis mutants with enhanced tolerance to oxidative stress were isolated and partially characterized.
- Seven gain of function (GOF) rice mutants with enhanced drought tolerance/aerobic adaptation and physiological characterization conducted for response to water stress were confirmed at IRRI.
- Several screening protocols for assessment of salinity response in rice seedlings were developed and standardized.
- Eighteen advanced mutant lines were obtained in IR64 and are being screened for salinity and alkalinity response at microplots level (eq. to field level screening).
- Four lines of a mapping population of rice; 57, 94, 126, and 127 with high value of yield components and high drought index were identified.
- Yield trials of four gamma-ray induced mutants in the barley variety Baronesse background were completed and BNS-M3 selected for submission to the governmental agency for registration as a cultivar with the name: “KIZILKAYA-3”.
- Four erect chickpea mutant lines were derived under well watered (one mutant line) and drought conditions (three mutant lines).
- A gene: oxoglutarate-dependent dioxygenase (At3G13610.1) was identified as part of oxidative stress network in Arabidopsis.
- Mapping of 10 QTL related to salt tolerance and 20 QTL related to drought tolerance during seedling growth were analyzed in soybean.
- A putative salinity tolerant gene GmSKC1 in soybean was cloned and characterized.

These encouraging results will in fact, be put forward in the request for an extension of the CRP in order to fully complete some of the outstanding results, for publication and also dissemination of the various protocols developed.

Third Research Coordination Meeting on Molecular Tools for Quality Improvement in Vegetatively Propagated Crops including Banana and Cassava, D2.30.27, Vienna, Austria, 11–16 August 2008

Technical Officer: C. Mba

The third RCM was held in the Vienna International Centre (VIC), Headquarters of the International Atomic Energy Agency (IAEA). The shift of the venue - from the previously agreed upon Brazil - to Vienna was made in order to allow the participants to take part in the International Symposium on Induced Mutations in Plants which was held in the VIC the same week.

Eighteen participants took part in this RCM. They were from 17 research and development (R&D) institutions that in addition to the Joint FAO/IAEA Programme constitute this CRP. These participants comprised 12 centres of the National Agricultural Research Systems (NARS), Universities and the Brazilian Agricultural Research Corporation (Embrapa, its Portuguese acronym) from Bangladesh, Brazil (2), China, Cuba, Ghana, India, Indonesia, Kenya, Mexico, Nigeria and the Philippines; and one centre of the Consultative Group for International Agricultural Research (CGIAR), Bioversity International, Montpellier, France. There were also two participants from two Universities in the United Kingdom and one participant from the Czech Republic. In addition to the Scientific Secretary, another staff of the Joint Programme joined in the weeklong deliberations. The representative from the other participating CGIAR centre, the International Centre for Tropical Agriculture (CIAT, its Spanish acronym) was unavoidably absent.

In addition to the usual presentations and discussions of results and work plans, significant effort was invested during this RCM in critically assessing what had been achieved by each participant and determining what additional outputs could be reasonably expected in the remaining phase of the CRP by building upon the current status. The deliberations were guided by the need to carefully assess the workflow necessary for full data collec-

tion and to plan ahead; to identify potential bottlenecks; to use rapid screen methods initially and more complex methods only on specific clones of interest; to use workable rather than ideal approaches; and to consider in advance data analysis / statistics in advance of data collection.

The determinations on the road map were made by reviewing each project in the overall context of the CRP with the overarching goal of the CRP being the focus. The most striking feature of the meeting was the confidence with which all the participants have approached their individual projects over the past year; they have gained in experience and knowledge since the second RCM, which had provided all with the necessary background to proceed successfully with their work.

The fourth and final RCM for this CRP will be held in Brazil in 2010.

Group Scientific Visit to Austria, Czech Republic and Germany 16–20 August 2008

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

Participants visiting the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK, Gatersleben, Germany)

Under the regional TC project RER/5/013 on Evaluation of Natural and Mutant Genetic Diversity in Cereals Using Nuclear and Molecular Techniques, a group scientific visit on Genomics and Biotechnology for Crop Improvement was organized, with the participation of counterparts from Albania, Bulgaria, Kazkistan, The Former Yugoslav Republic of Macedonia, Republic of Moldova, Romania, Serbia, Ukraine, Uzbekistan and Turkey, led by Mr. Q.Y. Shu of the IAEA.

The group scientific visit was planned to provide counterparts with opportunities to observe the state of the art facilities and learn technologies that are used in germplasm characterization and utilization, to enhance their knowledge and generate ideas on research and management activities in their respective home institutes. The participants were able to interact with scientists from the following institutes:

- Department of Agrobiotechnology, IFA-Tulln (Tulln, Austria);
- Gregor Mendel Institute of Molecular Plant Biology (Vienna, Austria);
- Leibniz Institute of Plant Genetics and Crop Plant Research (IPK, Gatersleben, German);
- Crop Research Institute (CRI, Prague, Czech Republic);
- Agricultural Research Institute Kromeriz, Ltd (Kromeriz, Czech Republic);
- Institute of Experimental Botany (Olomouc, Czech Republic).

Participants discussing with Prof. J. Dolezel, Institute of Experimental Botany, Olomouc, Czech Republic

National Training Course on Tissue Culture Techniques and Their Applications, Freetown, Sierra Leone, SIL/5/007, 6–17 October 2008

Project Officer: Q.Y. Shu

This national training course was organized under the national technical cooperation project SIL/5/007 by the Government of Sierra Leone through the Ministry of Agriculture and Forestry; Rice Research Station Rokupr, with the assistance of the International Atomic Energy Agency. The purpose of the training course was to train plant breeders and researchers with knowledge, skills and applications of plant tissue culture techniques in plant breeding and propagation.

Twelve participants from various research institutes and universities in Sierra Leone attended the training course. Dr. S.M. Jain (Finland) and Dr. R.J.N. Rao (India) served as external lecturers.

IAEA/RCA Regional Training Course on Mutation Breeding Approaches to Improving Salinity, Drought and Heat stress Tolerance, RAS/5/045, Beijing, China, 13–22 October 2008

Technical Officer: Q.Y. Shu

The IAEA/RCA regional training course was organized by the International Atomic Energy Agency (IAEA) in cooperation with the Government of China through the Institute of Crop Sciences; Chinese Academy of Agricultural Sciences (CAAS). Dr. L.X. Liu served as the Course Director; Prof. P. Hollington (UK) lectured at the training course as an international expert; Prof. Z.B. Zhang (Chinese Academy of Science, CAS), and Prof. L.X. Liu and his colleagues from the CAAS gave most of the lectures and instructions.

Twenty trainees from Bangladesh, China, Republic of Korea, Malaysia, Myanmar, the Philippines, Sri Lanka, Thailand, and Vietnam attended the training course.

The training course consisted of lectures and practices on the following subjects:

- Advanced mutation techniques for crop improvement;
- Molecular plant mutation breeding: from laboratory to the field;
- Effects of environmental stresses (salt, drought, heat, etc.) on both soils and plants;
- Physiological and molecular genetic mechanisms of plant tolerance to salinity, drought and heat;
- Genetic diversity of plant tolerance to environmental stresses;
- A practical demonstration of new gene discovery for stress tolerance by TILLING technique;
- Molecular marker assisted crop breeding for stress tolerance;
- Assessment and measurement of soil salinity and drought;
- Evaluation of crop tolerance to salinity and drought;
- Approaches and strategies, and progress on stress tolerance breeding in major crop plants;
- Laboratory and field screening techniques for (mutant) crop tolerance to salinity and drought;
- Data analysis and interpretation.

Consultants Meeting on Evaluation of Natural and Mutant Resources for Increased Levels of Bioactive Components in Vegetable Crops and Potato, New Component of the Regional Project RER/5/013, Vienna, Austria, 19–21 November 2008

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

The improvement of quality traits in food crops is one of the most important goals in plant breeding and is gaining more and more attention for nutritional, health and marketing purposes. In 2006, the IAEA approved a new regional technical cooperation project on Evaluation and Increase of Natural and Mutant Genetic Diversity in Cereals Using Nuclear and Molecular Techniques, which aims at evaluating and increasing genetic diversity in major cereals using nuclear techniques, molecular genetics and biotechnological tools. For the 2009-2011 TC cycle, a second project on Evaluation of Natural and Mutant

Resources for Increased Phytonutrient Levels in Vegetable Crops and Potato was proposed. The project aims at a regional approach to develop strategies and tools to improve the efficiency of breeding technology towards high-added vegetable food production. During the project design stage between staff of the IAEA and counterparts, it was decided that this project be included in the existing project RER/5/013 as a new component with separate funding and participating counterparts for its activities, for the coming 2009 -2011 cycle.

The aim of the Consultants Meeting was to formulate the proposal for this new component of the TC Project, within the framework of the regional agreement for Europe. Specifically the meeting would i) identify the food crop(s) of importance, ii) identify the strategy for implementations (expert missions, training events, fellowships and equipment), iii) propose a feasible work plan and iv) recommend potential counterparts.

Status of Coordinated Research Projects

NEW CRP – Improving Nutritional Quality by Altering Concentrations of Enhancing Factors Using Induced Mutation and Biotechnology in Crops, D2.30.28

Technical Officer: Y. Lokko

Food security, nutrition and health are key issues in the national agenda of government planning in many countries in the world. Humans require more than 25 mineral elements. Recommended daily intakes and safe upper levels of many of these elements have been defined. The availability and intake of nutritious foods provides the required amount of calories, vitamins and minerals and ensures good health. In addition to forming the major components of human diets, providing the required calories and nutrients to sustain life, crop plants also contain most of the essential vitamins and either directly or indirectly, delivers many of the essential mineral elements to the human diet. These vitamins and minerals are required to prevent common micronutrient disorders. However, the major staple crops are often deficient in some of these vitamins and minerals and, in many areas of the world; the basic diet does not provide them in sufficient quantities. Thus, malnutrition, with respect to micronutrients like vitamin A, iron and zinc, affects over 40% of the world's population. It is estimated that, of the 6 billion people in the world, 60-80% are Fe deficient, over 30% are Zn deficient and certain social groups do not receive sufficient Ca and Mg in their diets. Thus, the Copenhagen Consensus 2004 concluded that providing sufficient dietary micronutrients was among the most important research priorities for advancing global welfare.

Methods used to enable humans to get sufficient vitamins and minerals in their diets include supplementation (food and tablets) or fortification of food or crops by fertilization. However, this has not been very successful, particularly in developing countries due to inadequate resources. A more sustainable approach is to cultivate genotypes that accumulate greater concentrations of vitamins and minerals in their edible tissues and/or have increased bioavailability of minerals (particularly when low in soils and fertilizers are expensive), by increasing the concentrations of promoter substances that enhance the uptake minerals by humans (*i.e.* carotenoids and tocopherols) and decreasing the concentrations of anti-nutrient compounds that inhibit the absorption of minerals (*i.e.* phytate and oxalates). Both promoter and anti-nutritional compounds are synthesized by the plant and their levels can be changed genetically.

Induced mutations are a proven tool in creating desirable genetic variability in plants that translate to enhanced accumulation of essential minerals; synthesis of precursors of vitamins; modified quantities and qualities of starch, proteins and oils as well as secondary plant metabolites that play critical roles in improving human health and nutrition.

The CRP will utilize efficient phenotypic screens and genotypic markers to trawl through mutant collections of selected model crops, to identify putative mutants in traits of interest for incorporation into breeding programmes. Both the resulting genetic resources and the methodologies for identifying them constitute the main expected outputs from this proposed CRP. It is expected that plant scientists will adopt the putative mutants and hence facilitate the processes for breeding for improved nutritional quality in staple crops. Additionally, the screening methodologies (phenotypic and molecular) that will be validated with model crops will be adapted to suit other crops and quality constraints.

Applications for participation in the CRP are currently being received and the first RCM is tentatively planned to be held in March or April 2009. Information relating to modalities for participation in this CRP and general information relating to the IAEA's CRP mechanism can be found at http://www-crp.iaea.org/.

NEW CRP – Isolation and Characterization of Genes Involved in Mutagenesis of Crop Plants

Technical Officer: Q.Y. Shu

Induced mutations have been widely used in plant breeding and more recently in plant functional genomics research, *i.e.* isolation of genes and determination of their function. The understanding of genetic control in plant mutagenesis, which is vital for the proper application and manipulation of mutation induction for enhancing genetic variation and plant breeding, is still very limited. This project aims at identifying and characterizing genes involved in mutagenesis in crop plants using recently emerging molecular and genomics tools, determining their function in response to treatment of different mutagens, and finding out the spectrum of mutations induced by various mutagens. Through this CRP, a Plant Mutagenesis Database, publicly accessible to all Member States, will be established, containing information on genes involved in DNA damage response and repair genes from a variety of plant species, as well as a list of mutants defective in these genes. Homologous genes involved in DNA repair and mutagenesis in crop plants will be characterized; their function will be determined using genetic variants produced through chemical and/or physical mutagenesis or other biological means. Some of the genetic variants will constitute valuable genetic resources for efficient mutation induction. Furthermore, the spectrum (the molecular genetic feature) of mutations induced by various mutagens will be investigated using high

throughput mutation screening technology platform. Based on the research findings, improved protocols for mutation induction and screening, as well as their application will be developed for breeding new varieties that are better adapted to climate change and produce more or/and better foods.

This CRP is waiting for Research Contract Proposals. Please send in your proposals for evaluation.

REANNOUNCEMENT – Enhancing the Efficiency of Induced Mutagenesis through an Integrated Biotechnology Pipeline, D2.40.12

Technical Officers: C. Mba and B. Till

Due to scarcity and paucity of valid proposals, we encourage you to have an interested look at this CRP project and send in your targeted proposals until the end of January 2009.

A programmatic strategy aimed at supporting the capacity of the Unit to network on thematic areas impacting directly on its ability to deliver solutions tailored to the needs of Member States has resulted in the development of a new CRP aimed at driving innovations. The subprogramme is in the process of empanelling the CRP, 'Enhancing the Efficiency of Induced Mutagenesis through an Integrated Biotechnology Pipeline'. The justification for the CRP, the expected outputs and the implementation mechanism are summarized in the excerpt from the project document below:

A combination of the imminent threats posed by global climate change and the challenges engendered by the ever more sophisticated demands for specific niche agricultural products dictate the imperative of 'designing' new crop varieties. These novel crop types must be adaptable to extreme and unusual weather conditions; be efficient users of nutrients; while on the other hand also meet the requirements for enhanced nutritional quality and possess those traits that confer added-value. A combination of these characteristics will attract premium prices and hence enhanced livelihoods for farmers. On account of these, current research in plant sciences is characterised by a sharp resurgence in the use of induced mutagenesis both for the upstream application of crop improvement and in the more basic work of discovery and elucidation of gene functions. This reflects the recognition of induced mutagenesis, especially through ionizing irradiation, as a safe-to-use, environmentally-friendly tool whose end results are devoid of controversies associated with comparable technologies. Induced mutagenesis effects subtle changes to the genetic make up (genome) of an individual while leaving the rest of the genome largely intact, making it a method of choice for introducing changes to otherwise elegant crop types. The downside of this resurgence has been the obvious lack of a commensurate improvement in the efficiency of delivery levels of the processes involved. This CRP proposes to address this through the assemblage, adaptation and interlacing of novel cellular and molecular biology techniques to achieve a seamless dovetailing of validated processes into a modular pipeline. Cellular and molecular biology techniques will address the bottlenecks imposed by the need to rapidly generate large mutant populations of suitable genetic backgrounds (homozygous for the mutation events, and devoid of chimeras); and by facilitating the direct querying of target genes for changes obviate the need for field trialling of large populations. Additionally, robust; cheap and easy to use analytical methods will be 'hooked' up to these novel methods to enhance efficiency of the delivery processes. The main outputs will be guidelines on how to integrate above suite of techniques into a seamless induced mutagenesis process. These will be based on selected crops of relevance to Agency's mandates and with differing biological systems and production constraints. With appropriate analytical tools that will be developed, estimation of unintended mutation events (that may be deleterious) will form part of the holistic package to accompany induced mutants as they are delivered to plant breeders for integration into crop improvement programmes.

Applications for participation in the CRP are currently being received and it is expected that the first RCM will be held later in the year. Information relating to modalities for applying for participation in this CRP and general information relating to the IAEA's CRP mechanism can be found at http://www-crp.iaea.org/.

Physical Mapping Technologies for the Identification and Characterization of Mutated Genes Contributing to Crop Quality, D2.30.24

Technical Officer: Y. Lokko

This CRP which aimed at addressing the problems of application of advanced molecular and mutation technologies for breeding value-added crops was initiated in 2003 based on the recommendations of a consultants meeting held in Vienna from 17 to 21 June 2002. The initial network participating in this CRP includes ten research contract holders from Argentina, Bulgaria, China (2), Czech Republic, Pakistan (2), Poland Ukraine and Vietnam and four agreement holders from Germany, Iceland, United Kingdom and United States of America.

The first RCM in this new CRP held from 31 March – 4 April 2003 at IAEA Headquarters in Vienna, Austria, was attended by 13 participants from Argentina, Bulgaria, China, Czech Republic, Germany, Iceland, Pakistan, Poland, Ukraine, United Kingdom and Vietnam to discuss the individual project activities, to adapt the work plans and to facilitate possible collaboration between the research teams. To ensure that a platform of key technologies is available to all participants at the time

of project initiation, a three-day workshop was held at the Agency's Laboratories in Seibersdorf. Eleven participants attended the workshop. Dr. P. Heslop-Harrison, University of Leicester, UK, and Dr. K. Anamthawat-Jonsson, University of Reykjavik, Iceland, participated as lecturers/advisors in the workshop, which had a strong emphasis on the practical aspects of FISH. Other techniques covered in the exercises included chromosome preparations from root tips of various species relevant to the CRP using the squashing techniques; labelling of rDNA and genomic probes using Alexa fluorochromes; hybridization of labelled probes to metaphase preparations; screening of slides using fluorescence microscopy, and analysis and evaluation of results. Since some of the participants already had good experience with FISH techniques, the workshop also functioned as a place for exchange of practical tips, which usually cannot be found in published papers.

The progress and achievements made in line with the project objectives were reviewed during the second RCM held in Reykjavik, Iceland, 22-26 August 2005, and at the third RCM in Cordoba, Argentina, 19-23 March 2007. Each RCM provided an opportunity to further strengthen collaboration between the research teams, discuss and critically assess individual work plans, and recommend suitable changes where required.

Following the successful implementation of the CRP and the significant results obtained towards achieving the objectives of the project, the CRP was awarded an extension up to 31 Dec 2008, to complete the characterization of stable mutant lines for incorporation into germplasm enhancement and breeding programmes. The fourth and final RCM of the CRP was held from 11 to 15 August 2008 at the IAEA Headquarters in Vienna, Austria, in conjunction with the International Symposium on Induced Mutation in Plants (ISIMP).

The main crop species included in the CRP represented various botanical and genetic classifications such as diploids and polyploids, seed and vegetatively propagated, dicot and monocot, annual and perennial. The specific crops were *Musa* spp. (banana and plantain); *Oryza* sp. (wild and cultivated rice); rye, barley, wheat and their relatives; Perennial Triticeae; brassica; quinoa; sugar beet and relatives; *Capsicum* spp. (chili peppers (hot and sweet); *Lycopersicon esculentum* (tomato and relatives) and cotton. Value-added quality traits that were assessed within the CRP were: bread making (quinoa and lymegrass); fruit colour and shape (tomato and chili pepper); carotenes (tomato and chili pepper); anthocyanins (chili pepper and tomato); low phytic acid (rice); fibres (cotton); oils and fatty acids (brassica); amylose and starch (rice); cold tolerance (rice); salinity (rice); acidity (rice, rye, wheat); male sterility (chilli pepper and tomato); plant architecture (chilli pepper and tomato); and yield.

In addition to induced mutations used to generate the populations and tissue culture for propagation, the CRP employed a range of molecular and cytogenetic technologies to address the problem and provided the counterparts with the knowledge and skills on the use of these techniques. Key outputs from this CRP were:

- Quality-trait data generated by physical and genetic mapping associating molecular markers with induced mutants;
- Identified genes (including mutate genomic segments) associated with individual large insert clones (for example, BACs);
- Quantifying The effects of induction mutations on genome structure in tissue culture;
- Homology between the induced mutations and known genes in crops or model species identified;
- Newly characterized lines with physically mapped genes or chromosome segments entered into national breeding programmes for quality;
- Development and establishing of protocols in member states;
- Germplasm evaluation and assessment of existing biodiversity.

In addition, the contract holders are actively involved in dissemination of information emanating from the CRP to end-users through presentations at national and international meetings and publications in scientific journals.

For more information, see 'Past Events'.

Effects of Mutagenic Agents on the DNA Sequence in Plants, D2.40.11

Technical Officer: P.J.L. Lagoda

Modern science and technology advancements prompt IAEA to take operational and normative action in research on behalf of its Member States to ensure continuous excellence in advising and controlling the safe and informed use of nuclear techniques in biotechnologies applied to crop improvement. Analyzing acute DNA damage is a requisite to understand how mutation induction affects spontaneous mutation rates and contributes to genetic diversity. This is necessary to understand the effects of chronic DNA damage through mutagenic agents in crops, e.g. in order to define thresholds for environmental protection policies.

This Coordinated Research Project (CRP) aimed to understand the mechanism of mutation induction in plants and to quantify the types (base pair changes or deletions), frequencies (rates of change relative to mutagen dose) and patterns (induction of changes in different parts of the genome) of changes in DNA induced by a range of physical and chemical mutagens in a range of key crop plant species.

Different polymorphism screening methods were assayed (whole genome/transcriptome scans vs. mutation trap assays) using diverse monocotyledonous, dicotyledonous, diploid, polyploid, seed and vegetatively propagated crops (Banana, Barley, Cassava, Cowpea, Rice, Soybean, Tomato, Wheat) at the M0, M1, M2 and M3 level. Measurements of three parameters within mutation - rate, nature and pattern – produced publishable results (17 scientific publications so far). Results are being compiled, consolidated and validated. With current technologies it is unlikely that a single scanning tool will answer all the questions. Therefore, it is accepted that a combination of different DNA scanning approaches will be required, as was originally planned in this CRP. The measurements of frequencies and rates will accommodate a minimum effort approach able to provide statistically significant levels (number of individual per number of polymorphisms). In order to assay types and patterns of mutations, the approach is to maximize the screening effort. The ultimate number of individuals × polymorphisms assayed will depend on resources and the timeframe allocated.

This strategy opened up additional avenues, e.g. repair mechanism, epigenetic effects, spontaneous mutation rate, and mutation hotspots.

The CRP will stimulate work on functional genomics using radiation and other mutagenic agents by providing clear data on the action of particular mutagenic agents on DNA structure. This will enhance the discriminate use of mutation induction for research and development in agriculture. Further, this CRP will develop a knowledge base and foster collaboration and relationships with advanced research institutions that will encourage distribution and dissemination of basic information and genetic resources, and transfer knowledge and technologies between and among participating research groups, especially from developing countries, for their mutual benefit. Finally, the CRP will produce guidelines and publish methods on the effect of mutagenic agents on plant DNA sequence.

The knowledge obtained will assist Member States in enhancing crop breeding programmes through the application of targeted induced mutation, complementary genomic approaches and knowledge for the identification and selection of mutants of specific genes with the objective of increasing agricultural sustainability, food security and economic stability

This CRP was initiated in 2003. The first RCM was held in Vienna, Austria, 1–5 March 2004. The second RCM was held in Seoul, Republic of Korea, 14–18 November 2005. The third RCM took place in Stellenbosch, South Africa, 24–28 September 2007. This CRP will be completed at the end of 2008. A last RCM is tentatively projected for 2009, in order to compile results.

Pyramiding of Mutated Genes Contributing to Crop Quality and Resistance to Stress Affecting Quality, D2.30.25

Technical Officer: Q.Y. Shu

This CRP was initiated in 2004 and is expected to be completed in 2009. The project deals with several crop plant species, including some of the major staples (rice, barley, wheat), cotton, potato, and other less well-studied 'orphan' crops (okra and groundnut). The targeted traits represent a wide range such as yield and quality characters, as well as biotic and abiotic stresses that have an impact on crop quality. Good progress has been achieved in all of the target crops. Mutants and advanced breeding lines derived from mutants have been produced for most species under study. In some cases, where mutants are not available (*i.e.* potato), the natural diversity of the crop is being used to exploit naturally occurring variability. Mapping populations have been established for the genetic analysis of mutant phenotypes, and significant progress has been made in accurate localization of genes and QTLs for target traits. Moreover, there is a substantial development of other germplasm for breeding and further genetic analysis (*i.e.* NILs, RILs, advanced backcross lines, intogression lines).

A wide range of marker technologies (RAPD, AFLP, ISSR, SSR, SNP, MFLP, isozyme) are being used by the participants to tag and pyramid mutant genes including the use of multiplex marker technologies (*i.e.* multiplex SSR) in wheat and barley. Other advanced marker technologies, such as, eQTL, cDNA-AFLP, microarrays, and high-throughput SNP-based markers) are being exploited. Some groups (*i.e.* rice) are making good use of the available genome sequence data, and such resources should be proven useful for targeted marker development. Other groups are employing candidate gene approaches in attempts to isolate genes corresponding to target traits. Many publications have been generated from the participants of this CRP. Several new varieties derived from mutant lines will be available by the end of the project. Moreover, the project should produce many molecular and biochemical markers for use in plant breeding programmes. This project has made significant progress in pyramiding multiple genes (including mutated genes) and QTLs using molecular marker technologies.

Identification and Pyramiding of Mutated Genes: Novel Approaches for Improving Crop Tolerance to Salinity and Drought, D2.30.26

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 was held in Accra, Ghana, 6–10 November 2006.

The third RCM took place in Vienna, Austria, 11–16 August 2008 in conjunction with the International Symposium on Induced Mutations in Plants (ISIMP).

For detailed information, see 'Past Events'.

Molecular Tools for Quality Improvement in Vegetatively Propagated Crops Including Banana and Cassava, D2.30.27

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 took place in Thiruvananthapuram, Kerala, India, 5–9 February 2007.

The third RCM took place in Vienna, Austria, 11–16 August 2008 in conjunction with the International Symposium on Induced Mutations in Plants (ISIMP).

For detailed information, see 'Past Events'.

Assessment of Nutrient Uptake from Biofortified Crops in Populations from Developing Countries, E4.30.17

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 and last RCM will take place in Vienna, Austria, 12–15 August 2008 in conjunction with the International Symposium on Induced Mutations in Plants (ISIMP).

IAEA Coordinated Research Activities Web Site:

http://www-crp.iaea.org/html/forms.html

Coordinated Research Project Highlights

CRP on Effects of Mutagenic Agents on the DNA Sequence in Plants, D2.40.11

China - Research Contract No. 12609 (Effects of Mutagenic Agents on Genes Sequences Responsible for Amylose Content in Rice):

The IAEA-Zhejiang University Collaborating Centre for Mutant Germplasm Enhancement and Exploitation in Plants, Hangzhou, China, has developed dozens of novel mutant lines which have the potential to significantly increase the nutritional value of food and feed. Low phytate mutants could be used for breeding new crop varieties of rice, maize, soybean and barley, thus significantly enhancing the bioavailability of mineral micronutrients, such as Fe and Zn. In the meantime, feed based on low phytate maize, barley and soybean could reduce phosphorus pollution from large scale livestock production. Rice and wheat mutant lines with significantly increased resistant starch content (up to 4 fold) opened another important opportunity for diabetic patients to reduce their dependence on medicine through dietary intervention. Thus, in the framework of the CRP on Effects of Mutagenic Agents on the DNA Sequence in Plants, 'Yitang' rice high in resistant starch (RS) that is suitable as staple food for diabetes-affected people and 'Qukang' rice high in slowly digested starch (SDS) suitable for obesity-affected and weight-controlling people were commercialized, in 2008. High attentions were paid by government officials and diabetes patients.

Photo courtesy of Dr. D. Wu

Technical Cooperation Projects

Active Projects

Project Number	Title and Objective(s)	Technical Officer
AFG/5/003	Sustainable Increase in Crop Production in Afghanistan ***Objectives:*** To increase the productivity and production of crops through the development of improved nitrogen fertilizer and water management practices using nuclear and supportive biotechnologies. Phase I (2007-2008) will aim at refurbishing the national soil fertility laboratory and developing national capacities to provide fertilizer recommendations. In phase II (2009-2010), the laboratory will be upgraded and staff will be trained to conduct experimental work using nuclear techniques for improving water and nitrogen fertilizer management for wheat in target areas; recommendations on these will be formulated and disseminated to the farmers. In phase III (2011-2012), plant breeding programmes initiated in phases I-II will be developed on the basis of integrated soil-water-plant approaches using nuclear and supportive biotechnologies.	P.J.L. Lagoda in collaboration with Soil and Water Management Section
ALG/5/023	Protection of Date Palm Trees Against Bayoud Disease ***Objectives:*** Rehabilitation and development of date palm oasis using mutation induction in Algeria.	P.J.L. Lagoda
ALG/5/024	Improvement of Cereals for Tolerance to Drought and Resistance to Disease ***Objectives:*** To increase the cereal production (wheat and barley) by introducing at the farmer's level new high yield varieties tolerant to biotic and abiotic stresses.	P.J.L. Lagoda
ANG/5/006	Improvement of Food Crops Through Mutation Breeding and Biotechnology ***Objectives:*** To establish a national capacity to develop crop varieties with increased vitamin and mineral content and improved yield, quality, disease resistance and stress tolerance.	M. Spencer
BGD/5/026	Increasing Agricultural Production in the Coastal Area through Improved Crop, Water and Soil Management ***Objectives:*** To increase agricultural production in coastal areas through integrated and efficient management of crop, water, soil and land resources.	Q.Y. Shu
BOT/5/003	Mutational Improvement of Groundnut Varieties ***Objectives:*** Development of high yielding groundnut mutant varieties with high tolerance to abiotic stress.	Q.Y. Shu
CAF/5/003	Development of New Varieties of Cassava Through Mutation Breeding and Biotechnology Techniques ***Objectives:*** To develop manioc varieties with resistance to the African Cassava Mosaic Virus (ACMV) through mutation breeding and biotechnology techniques.	M. Spencer

Project Number	Title and Objective(s)	Technical Officer
CPR/5/017	Construction of Radiation-Induced Mutant Libraries and Function Analysis of Mutated Genes in Crop Plants ***Objectives:*** To establish large-scale screening of induced mutations using molecular high-throughput techniques for mutant germplasm characterization and construct-induced mutant libraries for new variety development, genomics, proteomics and mutational analysis of gene networks in order to increase the efficiency of nuclear irradiation-induced mutation breeding of major crops (especially rice and wheat) in China.	P.J.L. Lagoda
COS/5/027	Generation of Promising Strains of Beans Through Induced Mutations in Calluses and Seeds to Increase Competitiveness ***Objectives:*** To contribute to an increase in the competitiveness and productivity of beans by strengthening the National Programmes for Bean Improvement.	M. Spencer
ECU/5/023	Inducing Mutations in Agriculture with the Aid of Radiation ***Objectives:*** To improve varieties of maize, potato and barley using mutagenic techniques leading to an increase in the productivity of these subsistence crops.	M. Spencer/P.J.L. Lagoda
ERI/5/004	Improving Crop Productivity and Combating Desertification ***Objectives:*** To improve and sustain crop productivity through the development of efficient breeding, water and fertilizer management practices in arid and semi- arid areas in the eastern and western lowlands of the country.	P.J.L. Lagoda in collaboration with Soil and Water Management Section
GHA/5/032	Enhancing Production and Use of Cassava ***Objectives:*** To develop cassava varieties with high-quality starch, tolerance to African Cassava Mosaic Virus (ACMV), and excellent cooking quality; and to develop soil and nutrient management strategies in the sustainable production of cassava.	M. Spencer/Y. Lokko
INS/5/031	Mutation Breeding of Horticultural Crops ***Objectives:*** To develop commercially viable induced mutant varieties of horticultural crops such as cut flowers, garlic, and citrus by gamma irradiation; to increase farmers' income by growing better quality mutant varieties; and to create more employment opportunities.	M. Spencer
INS/5/035	Application of Nuclear Techniques for Screening and Improving Cash Crop Plants in Coastal Saline Lands ***Objectives:*** To improve crop productivity for sustainable agricultural development in coastal areas through crop genetic improvement and development of soil, water and nutrient management practices.	Q.Y. Shu
IRQ/5/015	Induction of Mutations in Crops Through *In Vitro* Culture ***Objectives:*** To develop mutants of crops with high yield and tolerance to salinity, drought and heat, using in-vitro techniques.	P.J.L. Lagoda
IRQ/5/017	Optimization of Land Productivity Through the Application of Nuclear Techniques and Combined Technologies ***Objectives:*** To improve use and efficiency of water and fertilizer and to establish criteria for optimum fertilizer dose and water salinity for sustainable crop production followed by an effective plant breeding programme for new cultivars and improved plant resistance techniques.	P.J.L. Lagoda

Project Number	Title and Objective(s)	Technical Officer
JAM/5/010	Plant Breeding and Diagnostics Technologies ***Objectives:*** To enhance capacities in crop improvement in Jamaica so as to increase food production using induced mutations and related biotechnologies.	Y. Lokko
MAR/5/018	Improvement of Banana and Tomato Varieties Through the Use of Nuclear Techniques for Mutation Induction and Biotechnology ***Objectives:*** Enhanced national capacity to develop varieties of bananas and tomatoes through mutation induction and biotechnology.	M. Spencer
MYA/0/007	Nuclear Science and Technology Training Centre (Currently a Human Development Project) ***Objectives:*** To establish a nuclear science and technology training centre for scientists, engineers, technicians, and graduate students in the field of nuclear science and technology; and to develop local human resources for application of nuclear techniques in various fields.	P.J.L. Lagoda
MYA/5/016	Development of Rice Varieties with Improved Iron Content/Bioavailability Through Nuclear Techniques ***Objectives:*** To combat iron deficiency through food based strategies.	P.J.L. Lagoda
NER/5/012	Improvement of the Productivity and Sustainability of Cowpea with Finger Millet ***Objectives:*** To develop improved drought-resistant lines and amelioration of soil and water management practices using nuclear, isotopic and mutation breeding techniques for cowpea.	M. Spencer
NIR/5/035	Adding Value to Root and Tuber Crops Through the Use of Mutation Induction and Biotechnologies ***Objectives:*** To improve crop productivity for sustainable agricultural development in coastal areas through crop genetic improvement and development of soil, water and nutrient management practices.	Y. Lokko
PAK/5/044	Improvement of Drought Tolerance in Chickpea Through Induced Mutations ***Objectives:*** To develop drought-tolerant and high-yielding desi chickpea mutants for the low-moisture chickpea growing areas in Pakistan through induced mutation.	M. Spencer
PER/5/028	Use of Nuclear Techniques to Improve Cotton Production ***Objectives:*** To improve cotton production, particularly that of short vegetative period, using nuclear and related techniques.	Y. Lokko
PER/5/030	Genetic Improvement of Quinoa and Kiwicha Using Mutation Induction and Biotechnology ***Objectives:*** To improve the national capacity to increase the yields and market competitiveness of quinoa and kiwicha.	Y. Lokko
PHI/5/029	Enhancing Agricultural Productivity Through Radiation Technology in Mindana ***Objectives:*** To develop new mutant varieties of fruit crops such as mangosteen and cashew with high yield, improved quality, short stature, early maturing, and non-seasonal; and to develop new rice mutant varieties with resistance to pests and tolerance to abiotic and biotic stresses through radiation-induced mutations and molecular techniques.	M. Spencer/Y. Lokko

Project Number	Title and Objective(s)	Technical Officer
QAT/5/002	Developing Biosaline Agriculture in Salt-Affected Areas in Qatar ***Objectives:*** To develop biosaline agriculture in salt-affected areas in Qatar through: 1) sustainable utilization of saline groundwater and land resources, 2) introduction of salt-tolerant plant species, selected for their comparative advantages over others (as to water-using efficiency, greening of desert, forage and fodder use, etc.), 3) creating national capacities to utilize isotopic, nuclear and other modern techniques, and 4) transfer of the technologies to beneficiaries and end users.	P.J.L. Lagoda in collaboration with Soil and Water Management Section
RAF/5/049	Field Evaluation of Bayoud-Resistant Date Palm Mutants ***Objectives:*** To assist Algeria, Morocco, and Tunisia in producing date palm trees with improved fruit yield, short height, and resistance to Bayoud disease.	M. Spencer
RAF/5/056	Field Evaluation and Dissemination of Improved Crop Varieties Using Mutation Breeding and Biotechnology Techniques ***Objectives:*** To assist AFRA member states in the development and dissemination of improved mutation induced staple and market oriented crops.	M. Spencer
RAS/5/045	Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology (RCA) ***Objectives:*** The objectives of this project are to develop and transfer methodologies and technologies for the induction and identification of mutated genes contributing to important crop quality characters and stress tolerance to RCA Member States, and to develop improved breeding material using molecular marker-assisted selection.	Q.Y. Shu
RAS/5/048	Mutation Induction and Supportive Breeding and Biotechnologies for Improving Crop Productivity (ARASIA) ***Objectives:*** An improved regional partnership in the field of mutation induction to enhance breeding for food security and socioeconomic development.	P.J.L. Lagoda
RAS/7/014	Monitoring of Food Fortification Programmes Using Nuclear Techniques ***Objectives:*** The objectives of the project are twofold: 1) to evaluate and monitor the food fortification intervention programmes in five participating Member States, and 2) to develop rice mutants with low phytic acid from the country's high-yield rice varieties.	P.J.L. Lagoda
RER/5/013	Evaluation of Natural and Mutant Genetic Diversity in Cereals Using Nuclear and Molecular Techniques ***Objectives:*** 1) Genetic improvement of barley (*Hordeum vulgare*), pea (*Pisum sativum*), beans (*Phaseolus vulgaris* L.) and cotton through induced-mutations. 2) Animal nutrition and reproduction. 3) Vegetal physiology, soils and fertilizers applied to potatoes, barley and other crops.	Y. Lokko/Q.Y. Shu
SAF/5/008	Mutant Amaranth, Bambara Groundnut and Cowpea with Enhanced Abiotic Stress Tolerance ***Objectives:*** To screen, evaluate, and identify mutant amaranth, bambara groundnut and cowpea with enhanced abiotic stress tolerance, in collaboration with resource poor farmers.	Y. Lokko

Project Number	Title and Objective(s)	Technical Officer
SAF/5/010	Development of New Maize and Sorghum Germplasm with Enhanced Nutritional Content ***Objectives:*** To develop and characterize new maize and sorghum germplasm with enhanced nutritional value that are suitable for subsistence farming systems. To develop human capacity in the region to use mutation breeding to improve the nutrition of cereals.	Y. Lokko
SEN/5/030	Integrated Approach to Develop Sustainable Agriculture in Senegal ***Objectives:*** To screen, select and develop improved cowpea and sesame cultivars for nitrogen fixation and natural phosphorus uptake under drought conditions using mutation induction and biotechnologies.	M. Spencer in collaboration with Soil and Water Management and Crop Nutrition Section
SIL/5/007	Development of High-Yielding Rice Varieties for Low-Input Agriculture Systems Using Mutation Techniques ***Objectives:*** To develop high-yielding rice varieties adapted to low-input agriculture systems using mutation techniques in order to enhance the capacity for crop improvement, rice in particular, and increase food (rice) self-sufficiency in Sierra Leone.	Q.Y. Shu
SIL/5/009	Improving Sorghum Productivity Through Nuclear and Biotechnology ***Objectives:*** To assist in the development of new mutant lines of sorghum with increased yield and disease resistance.	Q.Y. Shu
SUD/5/030	Increasing productivity of Selected Crops Using Nuclear Related Techniques ***Objectives:*** To use nuclear techniques to expand production of established varieties in banana and wheat lines and to increase the productivity of new varieties in sugarcane and tomatoes in Sudan through introduction of new production packages (new variety, new cultivation technology and crop management system).	Q.Y. Shu
TUN/5/023	Radiation-Induced Mutations for Improvement of Cactus ***Objectives:*** To develop improved varieties of cactus by induced mutations, which are relatively high in nitrogen for use as feed for sheep and goats.	P.J.L. Lagoda
TUN/5/024	Development of Improved Strains of Olive Tree Through Mutation Breeding and Biotechnology ***Objectives:*** To develop a routine protocol for mass micropropagation of high yielding olive varieties.	P.J.L. Lagoda
TUR/5/023	Application of Nuclear and Gene-Based Biotechnology in Agriculture ***Objectives:*** To establish a biotechnology laboratory for molecular characterization of induced mutants and thus enhance the efficiency and widen the application of induced mutations in crop improvement, i.e. quality, yield, biotic stress and disease tolerance in Turkey.	Q.Y. Shu
URT/5/023	Enhancing Crop Productivity Through Radiation Technology ***Objectives:*** To develop improved varieties of basic crops such as rice, banana and barley through tissue culture, radiation-induced mutations and molecular techniques, and enhance the crop breeding capacity in United Republic of Tanzania.	Q.Y. Shu
UZB/5/004	Development of Mutant Cotton Breeding Lines Tolerant to Diseases, Drought and Salinity ***Objectives:*** To develop new mutant prebreeding cotton lines and enhance breeding capacities for resistance to the major fungal diseases, drought and salinity in Uzbekistan.	Y. Lokko/P.J.L. Lagoda

Project Number	Title and Objective(s)	Technical Officer
VIE/5/015	Enhancement of Quality and Yield of Rice Mutants Using Nuclear and Related Techniques ***Objectives:*** To further develop and extend improved mutant varieties and advanced mutant lines of rice for export and high-grade domestic consumption.	Q.Y. Shu
YEM/5/007	Use of Induced Mutations and *In Vitro* Culture for Improving Crops ***Objectives:*** To use radiation-induced mutation technology, in combination with modern biotechnology, to produce improved mutants of major crops that have higher yields and that can adapt to the changing climate and water resources.	P.J.L. Lagoda
YEM/5/008	Introduction of Gamma Ray Irradiation Techniques for Agriculture Purposes ***Objectives:*** To support the use of gamma ray irradiation techniques, such as mutation induction enhanced breeding, for service and applied research purposes.	P.J.L. Lagoda
ZAI/5/016	Mutation Techniques for Improving Nutritional and Medicinal Plants with a Curative Effect on Human Diseases and Alimentary Plants ***Objectives:*** To build the basis for a long-term national strategy to fight malaria and improve food security.	M. Spencer
ZIM/5/013	Development of Drought Tolerant and Disease Resistant Grain Legumes, Phase I ***Objectives:*** To develop drought and/or disease tolerant mutant grain legume varieties suitable for resource poor smallholder farmers in Zimbabwe.	Y. Lokko

IAEA Technical Cooperation Programme's Web Site:

http://www-tc.iaea.org/tcweb/default.asp

Activities at the Plant Breeding Unit, Seibersdorf

Introduction

The Plant Breeding Unit (PBU), through its activities, has continued to provide the laboratory components of the crop improvement activities of the Sustainable Intensification of Crop Production Systems (SICPS). These activities which have been anchored by technology development and adaptation, the provision of services and human capacity development have been tailored towards the development and dissemination of strategies that enhance efficiency in the use of induced crop mutations to generate resources for crop improvement and functional genomics. The outputs of the Unit's activities feed into the overall strategic underpinning of the profile of the activities being implemented in the SICPS subprogramme for the 2008–09 bienniums. Taken in concert, these subprogramme activities – spanning induced crop mutagenesis and optimization of the efficient use of natural resources (soil and water) by crops using nuclear techniques – are aimed at availing Member States of efficient tools for generating crops that thrive under harsh environmental conditions being caused by the continuously evolving climate change and variations, currently the most critical of crop production constraints. The Unit's activities, therefore, address the imperative of deploying tools and validated technologies that in fitting into the peculiar needs of Member States enhance national capacities to use induced crop mutagenesis to ameliorate crop production constraints.

We present below the highlights of PBU activities during the period, June to November 2008.

Technology Adaptation and Validation

As indicated in the preceding edition of this Newsletter, PBU has continued to use the three-commodity crop platform of banana, rice and cassava for adapting technologies to the circumstances of especially developing Member States. In addition to the routine use of cellular and tissue biology tools to facilitate the induction and detection of mutation events, the main thrust of the Unit's activities in the last six months has been the validation of methodologies for the use of the reverse genetics strategy, Targeting Induced Local Lesions IN Genomes (TILLING) and the related Ecotilling for the high throughput localization of induced and spontaneous mutations, respectively, by the identification of nucleotide polymorphisms. Also, transcriptome profiling was integrated in the suite of approaches for dissecting the molecular basis of the response to salinity by rice. The highlights are as follows:

Reverse Genetics

TILLING and Ecotilling work in the PBU laboratory continues to progress with most efforts going to banana and cassava. In banana, Ecotilling data collected from 48 accessions with eight target genes are currently being analyzed. DNA samples from approximately 800 EMS mutagenized plants have been prepared. Screening with 15 target genes has revealed a number of putative mutations. Preliminary estimations of mutation density are promising. For cassava, data have been collected and analyzed from screening five target genes with 17 wild type African accessions and 29 putative mutants with starch defects. Candidate haplotypes and gamma-induced DNA lesions have been identified. In addition, pilot scale screening of cassava DNA from Indonesia and Africa was completed suggesting that the PBU can effectively serve as a TILLING/Ecotilling screening facility for samples supplied from collaborators world-wide.

Technology Adaptation and Validation

A strategy involving a combination of two microarray strategies, the Affymetrix Gene Chip (arrayed with 51,279 rice transcripts) and a plant stress gene chip (spotted with over 3000 known stress inducible genes from several plant genomes, ARC, Seibersdorf) is being used to identify differentially expressed genes in response to exposure of rice putative mutants, resistant and susceptible wild types to salt. Additionally, other assays using the same experimental materials include quantitative real time reverse transcription polymerase chain reaction (RT-PCR) to estimate the expression profile levels; and complimentary DNA (cDNA) amplified fragment length polymorphism (AFLP) to detect polymorphisms in global gene expression amongst the test materials.

Supporting Human Capacity Development for Member States

The provision of training to scientists from mostly developing Member States forms a major part of our activities. Individual training activities are usually supported under the Technical Cooperation (TC) Programme of the Agency. Through this mechanism, young scientists participating in TC projects work in the Unit on own country objectives. The themes encompass aspects of induced crop mutations and the activities normally involve both cellular and tissue biology and molecular biology techniques. Four Fellows, Ms. Rana Ibrahem Elias (Syria); Ms. Parichart Sangkasa-AD (Thailand); Mr. Anatole Ndemapou (Central African Republic) and Ms Zainab Al

Hussain (Iraq) and one Intern, Mr. Danilo Gabriel Moreno (Ecuador) whose activities were highlighted in the previous edition of this Newsletter have completed their fellowships and returned to their home institutes.

In the past six months, six Fellows, affiliated to ongoing TC Projects, and three Interns joined the Unit. The table below provides an overview of their activities.

Individual Trainees in PBU since June 2008

Fellows

Name	Country	Area of Training	Period
Mr. Orane SAVAGE	Jamaica	• Induced mutations in vegetatively propagated crops (including *in vitro* mutagenesis); • Molecular marker-based mutant germplasm characterization.	2008-06-18 to 2008-12-11
Mr. Zia-u-l QAMAR	Pakistan	• Induced mutations facilitated in a seed propagated crop through doubled haploidy; • Efficient evaluation of large mutant population (including *in vitro* screening for salinity tolerance; • Use of molecular markers for germplasm characterization	2008-08-08 to 2009-02-08
Mr. Negusse Abraha RUSSOM	Eritrea	• Induced mutagenesis in seed propagated crops (Sorghum and pearl millet). • Use of ^{13}C (carbon isotope discrimination) for drought tolerance screening; • Molecular marker systems for genotyping	2008-08-11 to 2008-12-11
Mr. Mageb Abdo Ahmed SAEED	Yemen	• Use of a cobalt-60 source for inducing mutations in crops	2008-09-01 to 2008-11-30
Mr. Aime Diamuni NDOFUNSU	Democratic Republic of Congo	• Induced mutagenesis in *Musa* using efficient *in vitro* approaches; • Screening of putative mutants for disease resistance; • Use of molecular techniques for identification of mutation events.	2008-09-01 to 2009-01-31
Ms. Bibi Sabinaz TAGAULLY	Mauritius	• Induced mutagenesis in *Musa* using efficient *in vitro* approaches; • Screening of putative mutants for disease resistance; • Use of molecular techniques for identification of mutation events.	2008-09-01 to 2009-01-31

Interns

Name	Country	Area of Training	Period
Ms Kathrin FREYSTAETTER	Austria	• Molecular markers systems; • Estimation genetic diversity amongst elite African cassava accessions using SSR markers.	2008-09-01 to 2009-01-31
Ms. Marta BROZYNSKA	Poland	• High throughput detection of mutation events in *Musa* using TILLING.	2008-06-01 to 2008-09-31
Ms. Elizabeth UBANI	Austria	• Use of AFLP to establish baseline mutation levels in *in vitro* plantlets of *Musa*.	2008-06-01 to 2008-09-31

Scientific Visitors

Scientists come to the Unit for short periods of time, typically less than two weeks, under the auspices of on-going TC Projects or in the context of collaborative activities between their home institutes and the Unit. During the second half of 2008, four scientists visited the Unit under this category. The Scientific Visitors involved in TC Projects were:

- Ms. Anissa CHAARI, Researcher, Olive Tree Institute, Sfax, Tunisia, 30 June to 4 July 2008; TC Project TUN/5/024 titled *Development of Improved Varieties of Olive Tree Through Mutation Breeding and Biotechnology*.
- Mr. Bassam AL-SAFADI, Head, Plant Biotechnology Division, Atomic Energy Commission of Syria, 30 June to 4 July 2008; TC Project SYR/0/019 titled *Human Resource Development and Nuclear Technology Support.*

Scientists with ongoing collaborations with the Unit were:

- Mr. Laszlo SAGI, of the Katholieke Universiteit Leuven (KUL), Leuven, Belgium; 24 July and 20–21 November 2008, as part of the emerging network for the use of reverse genetics in uncovering mutations in genomes. KUL and the Unit participate in the Global Musa Genomics Consortium.
- Mr. Melaku GEDIL, Cassava Molecular Biologist, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria gained week-long hands on experience in TILLING procedures. This was under the auspices of the agreement between the Agency and IITA in the use of induced mutations for cassava improvement.

Direct Services in Support of Induced Mutations Activities in Member States

A number of member states lack critical capacities for the integration of induced mutations and the allied biotechnologies in crop improvement and germplasm management. Providing direct services to such member states in order to alleviate these constraints is at the core of the Unit's activities. The most common request has been the irradiation of plant propagules as a means for inducing the plants to mutate. In the second half of 2008, a total of 14 requests irradiation services were received from 12 member states. These were for a total of 97 varieties of 15 food crop species; one oil crop species; and seven species of ornamental plants. The number of requesting member states in this second half of the year reflects an increase of 140% over that of the first half of the year.

The requests are broken down thus:

Gamma Irradiation Services Provided for Member States by PBU (May to November 2008)

Member State	Crop Species
Slovakia	2 species of *Amaranthus*
Yemen	Wheat, Durum wheat, Barley, Lentil, Fanugreek (paddar), Common beans
Tunsia	Olive
Germany	Ornamental plants (*Euphorbia* and *Hypericum, Begonia* spp); *Beta vulgaris*,
Eritrea	Sorghum, pearl millet
Seneral (a CGIAR centre)	Rice
Romania	Wheat
Former Republic of Macedonia	Wheat, Triticale, Barley, rapeseed (*Brassica napusoleifera*).
Sweden	Ornamental sedge plants – 3 species of *Carex* and 1 species of *Cordyline*
Jordan	Barley
Kenya	Common beans
Madagascar	Rice and Maize
Colombia (a CGIAR centre)	Common beans
United Kingdom	Wheat

Plant Breeding Unit's Staff Travel to the Member States

Staff of the PBG Unit made the following duty travels during the second half of 2008:

Mr. C. Mba, Unit Head, travelled to city of Ghent, Belgium during the week of 21 to 25 July 2008 in order to, as co-coordinator, participate in the First Scientific Meeting of the Global Cassava Partnership. This meeting brought together over 300 key cassava R&D stakeholders from all over the world to review the status of ongoing national and international cassava-related work. The themes covered during the meeting included donors' perspectives for the improvement of the crop; presentations of the highlights of ongoing multi-stakeholder projects; and the state of knowledge for science and technology interventions for the crop's genetic improvement and enhancement of productivity and competitiveness. An important component of the meeting was priority setting for

activities in order to achieve a critical mass of counterparts addressing each identified cassava production constraint in concerted manners. Major donors reinforced their commitment to supporting cassava R&D. The consensus was that the improvement of quality traits and disease resistance were the production constraints that required elevated levels of interventions (beyond what is currently applicable) in order to guarantee the crop's food security role and ensure the achievement of its emerging role as cash earner for farmers and end-users in tropical countries, including Member States of the Agency. Also identified as requiring more robust support was the development of genomics tools and genotype-independent unicellular regeneration systems for more efficient genetic improvement strategies for the crop. All these accord with ongoing Agency-supported activities relating to cassava.

Mr. C. Mba, Unit Head, on invitation from the Management of the Generation Challenge Programme (GCP) of the Consultative Group on International Agricultural Research (CGIAR), travelled to Bangkok, Thailand in order to participate in the Programme's Annual Research Meeting (ARM) which was held at the Rama Gardens Hotel from 16 to 20 September 2008. The ARM is the mechanism of the GCP of the CGIAR for reviewing results of implemented activities and planning for future activities. Taking part in the meeting and playing the role of host for one of the brainstorming sessions, "Induced crop mutants: Vital genetic and genomics resources" conducted in the format of the World Café session, was a veritable opportunity for the staff member to gain fresh perspectives on the topical issues for international agricultural research and development that are relevant to the work of the Agency. Clearly, synergies exist between Agency activities and this global network; these synergies are worthy of exploiting to achieve greater visibility and hence impact for related Agency activities. The existence of these synergies identified in both the mechanisms and thematic areas for intervention in member states' activities relating to sustainable agriculture validate in very eloquent terms the Agency's work. Greater collaboration with this global network and similar initiatives is recommended for the Agency.

Mr. B. Till, Plant Molecular Biologist, visited the Institute of Plant Sciences, University of Bern, Switzerland 13 to 14 October 2008 to present a lecture on the TILLING and Ecotilling activities at the PBU. Staffs of the PBU and this Institute are establishing a collaborative initiative that will extend the use of these reverse genetic strategies to 'orphan crops' that are part of the food security dynamics of developing Member States.

Highlights

International Symposium on Induced Mutations in Plants (ISIMP), Vienna, Austria, 12–15 August 2008

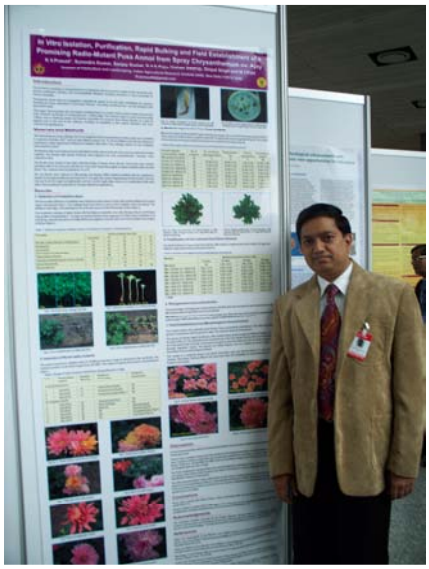
Mr. W. Burkart (centre), Deputy Director General, Head of the Department of Nuclear Sciences and Applications, IAEA, delivering his Opening Remarks (left: Dr. R. Phillips, right: Mr. Qu Liang, Director, Joint FAO/IAEA Division)

On the 80th anniversary of mutation induction in crop plants, the International Symposium on Induced Mutations in Plants (ISIMP), organized by the International Atomic Energy Agency (IAEA) and the United Nations Food and Agriculture Organization (FAO) through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, was held in the Vienna International Centre, 12-15 August 2008.

Dr. R. Phillips delivering the keynote speech at the opening session. Also sitting in the front row (from left to right) Mr. Q.Y. Shu (Scientific Secretary), Mr. W. Burkart (DDG/IAEA), Mr. Q. Liang (Director, Joint FAO/IAEA Division), Mr. S. Pandey (Director, Plant Production and Protection, FAO), Mr. P.J.L. Lagoda (Section Head, Plant Breeding and Genetics, Joint FAO/IAEA Division).

The symposium was opened by the Deputy Director General of the IAEA, Mr. W. Burkart, and with welcome remarks by Dr. S. Pandey, on behalf of the Director General of the Food and Agriculture Organization. Dr. R. Phililips (United States of America) delivered the keynote speech "Expanding the boundaries of gene variation for crop improvement", and Mr. P.J.L. Lagoda provided the audience with information about the role of the FAO/IAEA Joint Programme.

The symposium was then continued in two plenary sessions, 10 concurrent sessions and one workshop, with 122 oral and about 252 poster presentations. Approximately 500 representatives from 82 Member States of the IAEA and FAO, and nine international organizations/institutions attended the symposium, with a good balance between the private and public sector, and developing and developed Member States.



A delegate from India presenting his poster

The symposium was closed with a scientific summary by Dr. T. Ishige (Japan) and remarks by Ms. A.M. Cetto, Deputy Director General, Department of Technical Cooperation, IAEA. Ms. Cetto stressed the importance of agriculture by quoting the remarks made by Pandit Jawarlal Nehru, the great former Prime Minister of India that "Everything else can wait but not agriculture". She said that this remark remains relevant today and there is no short term magic formula to solve the world's food problems. We must take advantage of all possible modes of intervention and action. Nuclear technology will continue to play an essential role in strengthening conventional breeding through induced mutations and efficiency enhancing biomolecular technologies.

The Proceedings Book of the symposium is being edited and will be published in the near future; there are still a few spare copies of the Book of Abstracts available upon request.

List of Oral Presentations

Speaker	Designating Member States/Organization	Title of Paper
R. Phillips	USA	Expanding the Boundaries of Gene Variation for Crop Improvement
P.J.L. Lagoda	FAO/IAEA	Networking and Fostering of Cooperation in Plant Mutation Genetics and Breeding: Role of the FAO/IAEA Programme
M.C. Kharkwal	India	Role of Induced Mutations in World Food Security
U. Lundqvist	Sweden	Eighty Years of Scandinavian Barley Mutation Research and Breeding
J.N. Rutger	USA	The Induced *sd1* Mutant and Other Useful Mutant Genes in Modern Rice Varieties
H. Nakagawa	Japan	Induced Mutations in Plant Breeding and Biological Researches in Japan
S.F. D'Souza	India	Mutation Breeding in Oilseeds and Grain Legumes in India: Accomplishments and Socio-economic Impact
E. Frison	Bioversity International	Making the Most of Agrobiodiversity to Improve Livelihoods
A. Druka	UK	Genetics of the Induced and Natural Phenotypic Variation in Cultivated Barley
T. Komatsuda	Japan	A Mutant Homeobox Gene Created Six–rowed Spike in Barley Domestication
B. Keller	Switzerland	Allele–mining and Natural Diversity in Wheat Powdery Mildew Resistance Genes
P.D. Chen	China	Irradiation-induced Wheat-alien Translocation Lines and their Application in Wheat Breeding
P. Si	Australia	Induced Mutation in Narrow-leafed Lupin Improvement: An Example of Herbicide Tolerance
E. Guimaraes	FAO	The Global Partnership Initiative for Plant Breeding Capacity Building (GIPB)
L.A. Burdenyuk-Tarasevych	Ukraine	Results of Utilization of Chernobyl Radio Mutant in Breeding Programs of *Triticum Aestivum* L.
E. Nehnevajova	Switzerland	Sunflower Mutants with Improved Growth and Metal Accumulation Traits Show a Potential for Soil Decontamination
D.Y. Yu	China	Construction and Characterization of Mutant Populations in Soybean
K. Riha	Austria	Recombination, Extrachromosomal DNA and Genome Stability
A. Levy	Israel	Complex Patterns of T-DNA Integration: Homologous, Non-homologous and "Semi-homologous"
B. Hohn	Switzerland	Influences of the Environment on Plant Genome Dynamics
A. Britt	USA	Genetic Requirements for Resistance and Response to Photonic vs. HZE Ionizing Radiation
H. Puchta	Germany	Role of Human Disease Genes for the Maintenance of Genome Stability in Plants
Y.J. Hua	China	DNA Repair Mechanisms of the Extremely Radioresistant Bacterium *Deinococcus radiodurans*

Speaker	Designating Member States/Organization	Title of Paper
J. Juchimiuk – Kwasniewska	Poland	Molecular Cytogenetics in an Assessment of DNA Damage and Repair Processes
B. Po	China	The Enhanced Genomic Instability was Induced by Alpha Particle and Low–energy Ion Irradiation in Somatic Cells of *Arabidopsis thaliana*
V. Manova	Bulgaria	Genomic and Gene–specific Induction and Repair of DNA Damage in Barley
R. Hurrell	Switzerland	Public Health Significance of Micronutrient Deficiencies
H. Bouis	HarvestPlus	Overview of the HarvestPlus Biofortification Programme
L. Davidsson	IAEA	Human Nutrition at the IAEA – Applications for Evaluating Biofortification
C. Hotz	HarvestPlus	From Harvest to Health: Evaluating the Impact of Biofortified Staple Food Crops
P. Beyer	Germany	Application of Biotechnology for the Production of Biofortified Staple Food Crops: The Golden Rice Case
K.M. Jamil	Bangladesh	Efficacy of Beta-carotene Rich Sweet Potato to Improve Vitamin A Status of Bangladeshi Women – Preliminary Results
I. Egli	Switzerland	Effects of Bean Polyphenols on Iron Absorption in Humans
J. L. Rosado	Mexico	The Contribution of Zinc Biofortified Wheat to Meeting Zinc Requirements Among Women in Mexico
R.P. Sharma	India	Unravelling Signalling Circuits Regulating Tomato Root Development Using Induced Mutations
I. Szarejko	Poland	Identifying Root System Genes Using Induced Mutants in Barley
G. Taramino	USA	Toward Understanding the Genetic Network Controlling Maize Root Architecture
T. Kuromori	Japan	Systematic Phenotype Analysis of *Arabidopsis Ds*-tagged Mutants to Unravel Gene Functions in Abitoic Stress Response as well as Growth and Development
C.D. Li	Australia	Development of Acid Soil/Aluminium Tolerant Barley Variety through Marker-assisted Selection and Mutation
F. Bassi	Italy	Making the Most of the Hexaploid wheat (*Triticum aestivum* L.) Genome: Usage of Gamma Ray Mutants for High Throughput Positional Cloning
T. Gechev	Bulgaria	Mutational Analysis to Dissect Oxidative and Abiotic Stress in *Arabidopsis thaliana*
M.C. González-Cepero	Cuba	Development of Salinity Tolerant Rice Varieties Using Biotechnological and Nuclear Techniques
A. Pareek	India	Raising Mutants and Transgenic *Oryza sativa* L. for salinity Stress Tolerance Using Gamma Irradiation and RNAi Tools
J.A. de Ronde	South Africa	Evaluation and Characterization of Mutant Cowpea Plants for Enhanced Abiotic Stress Tolerance
D.S. Kim	Korea, Rep. of	Antioxidant Response of an Amino Acid Analog Resistant Rice Mutants
A.A. Cheema	Pakistan	Induction and Evaluation of Low Phytic Acid Mutants in Basmati Rice
S. Taprab	Thailand	Breeding of Low Phytic Acid Rice in Thailand/421

Speaker	Designating Member States/Organization	Title of Paper
C.B. Bui	Vietnam	Development of Rice (*Oryza Sativa* L.) with Low Phytic Acid
T.H. Tai	USA	Cloning and Characterization of the Rice Low Phytic Acid 1 Gene
X.H. Xu	China	Development, Characterization and Gene Mapping of Low Phytate Mutations in Rice
V. Raboy	USA	Induced Mutation Facilitated Genetic Studies of Seed Phosphorus
S.K. Rasmussen	Denmark	Biosynthesis and Deposition of Seed Phytate and its Impact on Mineral Bioavailability
Y. Nakamura	Japan	Revealing of Complex System of Starch Synthetic Metabolism in Higher Plants Using Rice Mutants
D.X. Wu	China	Developing Mutant Rice High in Resistant Starch Fighting for Diabetes-affected People
D. von Wettstein	USA	Mutants Pave the Way to Wheat and Barley for Celiac Patients and Dietary Health
Y.B. Xu	CIMMYT	Maize Mutant Opaque2 and the Improvement of Protein Quality through Conventional and Molecular Approaches
J.M. Fernández–Martínez	Spain	Mutation Breeding for Oil Quality Improvement in Sunflower
L. Munck	Denmark	The Multiple Use of Barley Endosperm Mutants in Plant Breeding for Quality and for Revealing Functionality in Nutrition and Food Technology
N. Tomlekova	Bulgaria	Creation and Evaluation of Valuable Tools for Pepper Breeding through Induced Mutagenesis
F.-J. Zhao	UK	Mechanisms of Arsenite Uptake in Rice: Studies Using Rice Mutants
H. Hirochika	Japan	Activation of Transposable Elements for Mutation Induction
L. Stoilov	Bulgaria	Restriction Endonucleases as a Tool for *In Vivo* Induction of Chromosomal and DNA Damage in Barley Genome
L.X. Liu	China	Achievements and Perspectives of Crop Space Breeding in China
A. Tanaka	Japan	Establishment of Ion Beam Breeding Technology
H.Y. Feng	China	Mutagenic Mechanism on Ion Implantation of Plants
S. Toki	Japan	Site–directed Mutagenesis in Plants via Gene Targeting
C.Q. Cai	USA	Zinc Finger Nuclease–mediated Gene Targeting in Plants
A. Lyznik	USA	Locus-specific Mutations Induced by Homing Endonucleases in Maize
A.R. Prina	Argentina	Genetically Unstable Mutants as Novel Sources of Genetic Variability: the Chloroplast Mutator Genotype in Barley as a Tool for Exploring the Plastid Genome
B.J. Till	IAEA	Global TILLING Projects
D. Facciotti	USA	TILLING: a New Tool in a Plant Breeders Toolkit
V. Talamè	Italy	TILLING with TILLMore
S. Gottwald	Germany	TILLING in Two-rowed Spring Barley: Mutation Frequencies and Phenotypes
T. Nishio	Japan	Application of TILLING to Gamma-ray-irradiated Rice and Use of Silent Mutations for Tracing Farm Products

Speaker	Designating Member States/Organization	Title of Paper
T. Tabone	Australia	ddSNP: A Rapid Method for Mutation Detection in Polyploid Genomes
L.S. Lee	Australia	EMAIL – a Highly Sensitive Tool for Specific Mutation Detection in Plant Improvement Programs
T.H. Tai	USA	A TILLING Resource for Japonica Rice
E. Cuppen	Netherlands	Genome–wide TILLING: From Gene–based to Organism–based Screens
S.H. Lee	Korea, Rep. of	DNA Sequence Analysis of Induced Mutants in Soybean
D. Rigola	Netherlands	High Throughput Mutation Discovery Using KeyPoint™ Technology
T.L. Wang	UK	Driving Forward in Reverse
N. Roux	Bioversity International	The Role of Mutation Techniques and Genomics for Banana and Plantain (*Musa* spp.), Major Staple Crops in the Tropics
S.K Datta	India	A Report on 36 Years Practical Work on Crop Improvement Through Induced Mutagenesis
E.S. Louzada	USA	Citrus Improvement Using Mutation Techniques
S. Nagatomi	Japan	Mutation Breeding of Chrysanthemum by Gamma Field Irradiation and *In Vitro* Culture
C. Mba	IAEA	Enhancing Genetic Diversity through Induced Mutagenesis in Vegetatively Propagated Plants
S.Y. Kang	Korea, Rep. of	Mutation Breeding and Characterization of the Gene Transcripts Responsible for Changes in the Flower Color of Chrysanthemum Mutated by a Gamma Irradiation and *In Vitro* Tissue Culture
H. Ceballos	Colombia	Induction and Identification of Useful Mutations for Root Quality Traits in Cassava
B. Al-Safadi	Syrian Arab Republic	Induction, Isolation and Selection of Potato Mutants Resistant to Late Blight Disease and Tolerant to Salinity Using *In Vitro* and DNA Marker Techniques
K.E. Danso	Ghana	Application of Induced Mutation Techniques in Ghana: Impact, Challenges and the Future
A.S. Nair	India	Molecular Characterization of Somatic Mutation in *Musa acuminata* 'Red'
R. Ibrahim	Malaysia	Gamma Irradiation Induced Mutation for the Improvement of Josapine Pineapple Against Bacterial Heart Rot Disease and Improved Fruit Quality
L.J.C.B. Carvalho	Brazil	Natural Genetic Variation in Cassava (*Manihot esculenta* Crantz) Landraces as a Tool for Gene Discovery
S.M. Jain	Finland	Prospects of Induced Mutations and Biotechnology in Vegetatively Propagated Crop Improvement
I. Bartkowiak–Broda	Poland	Mutation Techniques for Oilseed Crop Breeding in Poland (Representative of EUCARPIA)
S. Tan	USA	Developing Herbicide-tolerant Crops from Mutations
D. Landau-Ellis	USA	Marker Assisted Backcrossing to Incorporate Two Low Phytate Alleles into the Tennessee Soybean Cultivar 5601T
H. Kitano	Japan	Functional Analysis of Induced Semidwarf Mutations and Application to Rice Breeding

Speaker	Designating Member States/Organization	Title of Paper
L.J. Qiu	China	A Dwarf Mutant Related to BR–deficiency in Soybean (*Glycine max*)
E. Julio	France	Targeted Mutation Breeding as a Tool for Tobacco Crop Improvement
D. Gruszka	Poland	Expression of Sequences Responsible For Brassinosteroid Metabolism in Barley Mutants
Z. Sagel	Turkey	The Improvement of TAEK-Sagel Chickpea (*Cicer arietinum* L.) Mutant Variety in Turkey
Y.Y. Barve	India	Development of *B. Napus* Canola Quality Varieties Suitable for Indian Agro–climatic Conditions by Induced Mutations
F.J. Yuan	China	Identification and Characterization of Two Low Phytic Acid Soybean Mutants
M.A.J. Parry	UK	Exploiting Mutagenesis for Wheat Improvement
H.-J. Koh	Korea, Rep. of	A *UGPase 1*-blocked Male Sterility Mutant and its Possible Use in Hybrid Seed Production of Rice
L. Gómez-Pando	Peru	Barley (*Hordeum vulgare*) and Kiwicha (*Amaranthus caudatus*) Improvement by Mutation Induction in Peru/345
Y.L. Jia	USA	Understanding the Molecular Mechanisms of Rice Blast Resistance Using Rice Mutants
S.T. Kajjidoni	India	An Innovative Way of Developing an Improved Variety Utilizing both Gamma Rays Induced and Recombinational Variability in Blackgram (*Vigna mungo* L. (Hepper))
J. Leitao	Portugal	Towards the Isolation of a Mutated Gene Conferring Resistance to Powdery Mildew in *Pisum sativum* L.
P.J. White	UK	Induced Mutations Affecting Root Architecture and Mineral Acquisition in Barley
M.Q. Vinh	Vietnam	Current Status and Research Direction of Induced Mutation Application to Seed Crops Improvement in Vietnam
Y.J. Wu	China	A Novel Dominant Semidwarf Mutant and its Plant Height Revertants Induced with Ion Irradiation in Rice (*Oryza sativa* L.)
P.M. Gresshoff	Australia	Mutational and Functional Genomic Analysis of Systemic and Local Regulation of Legume Noduclation
B. Meyers	USA	The Use of Mutants for Dissecting and Understanding Plant Small RNAs and their Functions
K.H. Engel	Germany	Metabolite Profiling of Induced Mutants of Rice and Soybean
M. Hansson	Sweden	A Microarray Approach to Identify Genes Known only by their Mutant Phenotype
M. Talon	Spain	Genomics Meets Induced Mutations in Citrus: Identification of Deleted Genes through Comparative Genomic Hybridization
P.J. Facchini	Canada	Mutagenesis as a Functional Genomics Platform for Pharmaceutical Alkaloid Biosynthetic Gene Discovery in Opium Poppy
L. Munck	Denmark	From Discovery of High Lysine Barley Endosperm Mutants in the 1960-70ties to New Holistic Spectral Models of the Phenome and of Pleiotropy in 2008
G. Rowland	Canada	The Effect of Plants with Novel Traits (PNT) Regulation on Mutation Breeding in Canada

Speaker	Designating Member States/Organization	Title of Paper
Q.Y. Shu	IAEA	Turning Plant Mutation Breeding into a New Era: Molecular Mutation Breeding
T. Ishige	Japan	Plant Mutagenesis in Genomics Era: Opportunities and the Way Forward (Summary of the Symposium)

Various Comments of Appreciation from Participants

Algeria

Djenadi Chafika: "I thank the organiser for the excellent organisation and the high scientific quality of the Symposium."

Australia

Chengdao Li: "Congratulate you for the successful symposium!"

* * *

Ping Si: "A simple note to say thank you very much. The conference was good and I enjoyed it greatly."

Brazil

Luiz Carvalho: "Thank you … for all your assistance in our magnificent conference in Vienna."

Bulgaria

Tsanko Gechev: "Let me thank you again for inviting me to the wonderful and very successful symposium in Vienna."

* * *

Nasya Tomlekova: "The organization of the symposium was perfect, really perfect!!!"

China

P.D.Chen: "Thank you and the IAEA/FAO joint division for inviting us to the international symposium. The symposium was a great success due to your excellent organization, we learned a lot from the meeting."

* * *

Lijuan Qiu: "It was a good meeting, which provided a lot of information. Many Chinese scientists exhibited their work to the world with your help. We are proud of your successful organization. Congratulations for your excellent work!"

Colombia

Hernan Ceballos: "Let me first congratulate you and IAEA for the success of a very interesting and productive Symposium. I came back with renewed ideas on additional applications and potential projects."

Denmark

Lars Munck: "Thank you for a splendid success of your mutation symposium. I feel 40 years younger!"

* * *

Søren K. Rasmussen: "Congratulations with excellent symposium!"

France

Rajbir Sangwan: "Symposium and workshop: Excellent with great participants and speakers…and we came out with some nice recommendations and future work plan…"

Germany

Ortrun Kalb: "Thank you very much for organizing this symposium. It was very interesting for me to participate in it."

India

M.C. Kharkwal: "I certainly would like to write this paper and get it included in the Proceedings book…The symposium was quite successful and the credit goes to you and your team."

* * *

Sarvjeet Singh: "I congratulate you and your team for excellent arrangements for the successful conduct of the symposium."

* * *

Amit Sharma: "I herewith send my thanks for nice hospitality in the symposium."

* * *

Asha Nair: "Let me congratulate you for organizing this international seminar in an excellent manner."

* * *

S.T. Kajjidoni: "It was good symposium by any standard considering coverage of topics, technical quality of papers, number of crops, number of persons attended and depth of technical discussions. I am very much impressed with quality of presentations and adherence to the timings."

* * *

K.V. Prasad: "The technical sessions at the conference were really useful and I hope that I could use them in my research and teaching. I must appreciate you and your team members for drawing a very exhaustive canvas of topics from basic to applied aspects of mutation breeding. The entire proceedings were well planned and executed with precision."

* * *

Salej Sood: "I would like to congratulate you and your team for a very well organized symposium on induced mutations in plants. The symposium was a good platform to meet mutation breeders/ molecular biologists to meet and discuss the science. The symposium was a great success."

Japan

Shigeki Nagatomi: "The IAEA Symposium was very informative and enjoyable for me. I appreciate your great assistance and cooperation."

* * *

Yasunori Nakamura: "I would like express my great thanks for your invitation to the FAO/IAEA Symposium, and say congratulations on the great success of the international meeting. I enjoyed attending the Symposium, and learned many things from the breeding science such as tilling and phytic acid. I was also impressed by the fact that many Chinese young scientists presented their vigorous activities."

Korea, Republic of

Si-Yong Kang: "I would like to say thanks to you for your nice organization of the FAO/IAEA Symposium. I think it was very interesting to me and so great and perfect symposium."

* * *

Hee-Jong Koh: "It was a really wonderful symposium. So many participants, valuable presentations and posters, and well-organized sessions."

Mexico

Eulogio de la Cruz Torres: "Thanks a lot for all your support before and during the exceptional International Symposium on Induced Mutations in Plants."

Moldova, Republic of

Liuba Coretchi: "On behalf of the Academy of Sciences of Moldova Republic and National Agency for Regulation of Nuclear and Radiological activities I would like to thank …for qualitative organization of II Coordination meeting and also the ISIMP."

Netherlands

Diana Rigola: "I want to thank you for the excellent organization and quality of the Symposium that I enjoyed very much.

New Zealand

Ranjith Pathirana: "Thanks for a very stimulating symposium."

Nigeria

Morufat Oladimeji: "Thank you, once again for organizing such a fulfilling conference."

Poland

Malgorzata Zalewska: "Thank you very much for a splendid conference!"

Spain

José M. Fernández-Martínez: "I congratulate you for the excellent organization of the symposium."

Slovakia

Gustav Murin: "Many thanks for you help that made our participation very enjoyable and bring a new value for our future work."

Sweden

Udda Lundqvist: "I want to thank for the success of the wonderful and interesting Symposium. It was a pleasure for me to listen to all the different papers and many new ideas."

Switzerland

Barbara Hohn: "Thank you for having organised this highly interesting mutagenesis meeting in Vienna. We all enjoyed it very much, we learned a lot of new, interesting things and met old and made new friends."

Thailand

Peeranuch Jompuk: "The conference is very nice and I got a lot of information about plant mutation."

Turkey

Ihsan Tutluer: "On the behalf of my colleagues, I would like to congratulate you for an excellent work about Symposium"

United Kingdom

Martin AJ Parry: "Thank you for arranging such an interesting meeting. I really enjoyed participating in it and was stimulated and encouraged by the number of new cultivars emerging from mutagenesis."

* * *

Mike Gale: "Just a word of thanks for your kind hospitality and all your hard work to put last week's conference together. I thoroughly enjoyed the science and the opportunity to meet up with old friends."

United States of America

Diter von Wettstein: "I like to congratulate you to the most successful meeting with some 370 presentations. I enjoyed the wide international presentations and to learn how many nations IAEA has involved and stimulated in mutation research. I wish you further success in your activities and programs."

* * *

Neil Rutger: "Congratulations on a superbly organized Symposium! You did a wonderful job. I thoroughly enjoyed the event, as I am sure everyone else did."

* * *

Charles Cai: "The conference was a great success! Very well organized with a lot of interesting topics covered."

United States of America

Siyuan Tan: "The symposium was very successful. I learned a lot from the symposium and enjoyed the presentations, posters, and conversations with meeting participants and IAEA employees very much."

Vietnam

Mai Quang Vinh: "I come back from ISIMP meeting in Vienna with fruitful results; I appreciate to you, all your staff who organize the meeting very well, thank you for everything."

WARDA/CGIAR

Karim Traore: "I would like to take this opportunity to thank you very much for everything you did in order to facilitate my participation to the meeting. I am back to Senegal since Saturday night. The journey was excellent and the meeting was perfectly organized."

Zimbabwe

Prince Matova: "I would like you to know that the event was very fruitful to me and as young as I am, it really gave an insight, a new look and a wider vision of what I am supposed to pursue and work on so as to achieve the common goals of our partnership."

Announcements

International Conference on Plant Abiotic Stress Tolerance, Vienna, Austria, 8–11 February 2009

The interest of scientists in this Conference has turned out to be so overwhelming, that we have had to select a new, larger venue to host all participants interested in attending the meeting: (http://www.univie.ac.at/stressplants/Venue.html). However, despite a larger venue, spaces are **still limited to 460 attendees** so please be sure to register soon to ensure that you don't miss this exciting meeting!!

View all meeting information online at http://www.univie.ac.at/stressplants/

XXI Conference on Maize and Sorghum Breeding in the Genomics Era, Bergamo, Italy, 21–24 June 2009

For more information, visit:

http://www.eucarpia.org/First_announcement_Maize.pdf

AgriGenomics World Congress, London, England, 2–3 July 2009

AgriGenomics is the detailed study of the genetic makeup of plants and how all the genes work together to produce the crop. Recently there has been great interest in genetically engineering plants to optimize yields and their use in bio-fuels. There is also focus on the alteration of certain genes to increase plant resistance towards disease and infection. So, now is a good time for scientists, business people, bio-ethicists and patent experts from around the globe to come together and catch up with the latest developments in this fast expanding field.

The conference will focus primarily on the following subjects:

- Gene silencing in plant species
- Genomics of plant development
- The use of microarrays and bioinformatics
- Plant cytogenetics
- Genomics for stress tolerance
- Growth optimization for food and biofuels
- Recent advances in plant resistance to disease

For more information visit:

http://www.selectbiosciences.com/conferences/AGWC2009/

The World Soybean Research Conference VIII, Beijing, China, 10–15 August 2009

The Chinese Academy of Agricultural Sciences and Crop Science Society of China are pleased to jointly host WSRC VIII on August 10-15, 2009 in Beijing, China. An excellent opportunity will be provided for participants from various regions of the world to share the latest global progress of science and technology in soybean research. Traditional areas where papers will be presented include soybean germplasm, genetics and breeding, molecular biology and biotechnology, physiology and crop production, crop protection, soybean storage and processing, soybean product and use, global demand / trade / strategy.

The conference organizers are expanding the conference to include 'Soybean Industry Forum' to 'Discuss and Develop a Global Blueprint for a Safe, Secure, and Sustainable Supply of Soy for Food, Feed, Fuel, and Fiber'.

Apart from the scientific exchange and Soybean Industry Forum, we will also showcase new varieties, new products, new technologies and latest publications. Furthermore, post conference tours to soybean farms and processing plants in China and the scenic and/or cultural sites will feature your tour in China with both academic atmosphere and ancient cultural immersion of China. The Organizing Committee of WSRC VIII sincerely welcomes the soybean experts and entrepreneurs to be involved in the conference planning, academic exchange and achievement exhibition. And we believe that WSRC VIII will be an unprecedented landmark in WSRC history under our joint effort.

For more information, visit:

http://www.wsrc2009.cn/en/jianjie.asp

Second World Congress of Agroforestry (WCA2), Nairobi, Kenya, 23–28 August 2009

The objective of the Congress is to share lessens and experiences by assessing opportunities to leverage agroforestry in promoting sustainable land use worldwide.

The Congress will serve as a forum for researchers, educators, practitioners and policy makers from around the world to share new findings, explore new opportunities, strengthen partnerships and engage with communities of practice.

For more information visit:

www.worldagroforestry.org/wca2009

23rd EUCARPIA Symposium – Colorful Breeding and Genetics, Leiden, the Netherlands, 31 August–4 September 2009

For more information, visit the Symposium website:

http://www.ornamentalbreeding.nl/

International Banana Symposium: Global Perspectives on Asian Challenges, Guangzhou, China, 14–18 September 2009

ProMusa, in collaboration with the Guang Dong Academy for Agricultural Sciences (GDAAS), the International Society for Horticultural Science (ISHS) and Bioversity's Banana and Plantain Regional Network for Asia and the Pacific (BAPNET), has the pleasure to announce this Symposium.

For more information, visit the Symposium website:

http://www.promusa.org/symposium_2009/home.html

Australian Postharvest conference and Managing Quality in Chains, Napier, New Zealand, 15–19 November 2009

For more information, visit the Conference website:

www.postharvestpacifica.org.nz

Publications

Recent Staff Peer Reviewed Papers

Genomics of Banana and Plantain (*Musa* spp.), Major Staple Crops in the Tropics

Roux, N., Baurens, F.C., Doležel, J., Hribová, E., Heslop-Harrison, J.S., Town, C., Sasaki, T., Matsumoto, T., Aert, R., Remy, S., Souza, M. and Lagoda, P.J.L.

In Genomics of Tropical Crop Plants (Moore, P. and Ming, R. Eds.). Plant Genetics and Genomics: Crops and Models Vol 1.:83-111

Abstract

This chapter on *Musa* (banana and plantain) genomics covers the latest information on activities and resources developed by the Global Musa Genomics Consortium. Section 4.1 describes the morphology of the plant, its socio-economical importance and usefulness as an experimental organism. Section 4.2 describes the complexity of *Musa* taxonomy and the importance of genetic diversity Section 4.3 details the genetic maps which have recently been developed and those that are currently being developed. Section 4.4 presents the five BAC libraries which are now publicly available from the Musa Genome Resource Centre and can be distributed in various forms under a material transfer agreement. Section 4.5 gives an overview of cytogenetics and genome organization, showing that the genus *Musa* has a quite high proportion of repetitive DNA; the discovery of the first para-retrovirus integrated in the genome makes it unique. Section 4.6 explains the first attempts to sequence the genome by BAC end sequencing, whole BAC sequencing, and reduced representation sequencing. Section 4.7 validation using gene trapping, mutation induction and tilling techniques, as well as genetic transformation. Section 4.8 draws overall conclusions. This chapter demonstrated that by organizing the Global Musa Genomics Consortium (currently comprising 33 member institutions from 23 countries), duplication of effort can be minimized and the results of *Musa* genomics research are rapidly made accessible to taxonomists, breeders and the biotechnology community.

(2008) ISBN 978-0-387-71218-5 (Print), 978-0-387-71219-2 (Online)

Recent Staff Articles Published in Scientific Journals

Gene identification and allele-specific marker development for two allelic low phytic acid mutations in rice (*Oryza sativa* L.)

Zhao, H.J., Ren, X.L., Liu, Q.L., Wu, D.X. and Shu, Q.Y.

Molecular Breeding 22:603-62

Abstract

Phytic acid (PA, myo-inositol 1,2,3,4,5,6-hexa*kis*phosphate) is an important anti-nutritional component in cereal and legume grains. PA forms of phosphorus (P) and its salts with micronutrient cations, such as iron and zinc, are indigestible in humans and non-ruminant animals, and hence could affect food/feed nutritional value and cause P pollution of ground water from animal waste. We previously developed a set of low phytic acid (LPA) rice mutants with the aim to increase their nutritional quality. Among them, one line, *i.e., Os-lpa*-XQZ-1 (hereafter lpa 1-2), was identified to have a mutation allelic to the KBNT lpa 1-1 mutation (hereafter lpa 1-1), which was already delimited to a 47-kb region on chromosome 2. In this study, we searched the candidate gene for these two allelic LPA mutations using T-DNA insertion mutants, mutation detection by CEL I facilitated mismatch cleavage, and gene sequencing. The TIGR locus LOC_Os02g57400 was revealed as the candidate gene hosting these two mutations. Sequence analysis showed that the lpa 1-1 is a single base pair substitution mutation, while lpa 1-2 involves a 1,475-bp fragment deletion. A CAPS marker (LPA1_CAPS) was developed for distinguishing the lpa 1-1 allele from lpa 1-2 and WT alleles, and InDel marker (LPA1_InDel) was developed for differentiating the lpa 1-2 allele from lpa 1-1 and WT ones. Analysis of two populations derived from the two mutants with wild-type varieties confirmed the complete co-segregation of these two markers and LPA phenotype. The LOC_Os02g57400 is predicted to encode, through alternative splicing, four possible proteins that are homologous to the 2-phosphoglycerate kinase reported in hyperthermophilic and thermophilic bacteria. The identification of the LPA gene and development of allele-specific markers are of importance not only for breeding LPA varieties, but also for advancing genetics and genomics of phytic acid biosynthesis in rice and other plant species.

(2008)

Recent Staff Articles Presented at a Meeting

Molecular mutation breeding: Modern variety breeding for present and future needs

Lagoda, P.J.L., Mba, C., Shu, Chikelu Mba, Shu, Q.Y., Afza, R., Till, B., Spencer, M. and Lokko, Y.

Presented at the 18th EUCARPIA General Congress (9-12 September 2008), Valencia, Spain

Abstract

Induced crop mutation strategies have, since the seminal article of Stadler (1928), in the past over 50 years played a major role in the development of superior crop varieties. With over 2700 officially released crop mutants in more than 170 plant species, translating into a tremendous economic impact valued in billions of dollars and tens of millions of cultivated hectares. The Joint FAO/IAEA Programme has for over 40 years been promoting the efficient use of mutation techniques as a complementary tool for developing superior crop varieties. The Joint FAO/IAEA Programme through research coordination provides a global platform for scientists to work on common induced crop mutagenesis related themes. Through the Technical Cooperation Project mechanism of the IAEA, direct technical input and guidance have been provided to scientists, especially in the Least Developed Countries (LDC) of the world and have contributed immensely to capacity building and the development of mutant crop varieties that address specific production constraints. The Joint FAO/IAEA Programme has a training, service and research and development (R&D) unit dedicated exclusively to induced crop mutagenesis at the IAEA Laboratories in Seibersdorf, Austria. In addition to the traditional roles of supporting capacity building in LDC member states of both FAO and IAEA, the R&D activities of this laboratory component addresses the enhancement of the efficiency of processes related to induced crop mutagenesis. This paper while presenting an overview of the contributions of induced mutagenesis to sustainable agricultural productivity also posits that the technology has great potentials for adding value to high yielding, stable crop varieties through the development of hardy variants that being adaptable to extreme abiotic stresses are important for addressing the constraints of climate change. Also, through the subtle modification of quality traits in otherwise good varieties, induced crop mutants enrich the crop germplasm useful for mitigating micronutrient deficiencies and meeting the requirements of niche industries. We also present the status of work on the use of a suite of integrated bio-/molecular technologies in enhancing the efficiency levels of induced crop mutagenesis. The paper highlights the central role of cellular biology in the rapid production of histonts as well as the innovative adaptation of the reverse genetics technology, Targeting Induced Local Lesions IN Genomes (TILLING) as a methodology for the high throughput detection of mutation events and hence significant reductions in the sizes of mutant populations for field trials. Reports on TILLING will include progress on the development of platforms for under-researched vegetative crops like banana and cassava. Perspectives for the future direction for the application of induced crop mutagenesis both as crop improvement and functional genomics tools are also provided.

References

Ahloowalia, B.S., Maluszynski, M. and Nichterlein, K. 2004. Global impact of mutation-derived varieties. Euphytica 135:187-204.

Shu, Q.Y. and Lagoda, P.J.L. 2007. Mutation Techniques for Gene Discovery and Crop Improvement. Mol. Plant. Breed. 5:193-195.

Stadler, L.J. 1928. Mutations in Barley Induced by X-Rays and Radium. Science 68:186-187.

(2008)

Non-IAEA Publications in the Field of Plant Breeding and Genetics

Marker-Assisted Selection - Current Status and Future perspectives in Crops, Livestock, Forestry and Fish

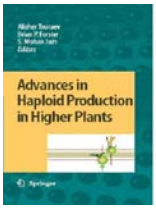
Edited by E. Guimarães, J. Ruane, B. Scherf, A. Sonnino and J. Dargie

The 494-page book is organized into six sections: an introduction to marker-assisted selection (MAS), in chapters 1-2; case studies of MAS in crops (including cassava, common beans, cotton, forage crops, maize, tomato and wheat), in chapters 3-9; case studies of MAS in livestock (including dairy cattle, goats, poultry and sheep), in chapters 14-15; case studies of MAS in fish and shellfish, in chapters 16-17; and the final section is devoted to a selection of non-technical issues relevant to applications of MAS in developing countries, such as national research capacities and international partnerships, economic considerations (chapters 18-22).

http://www.fao.org/docrep/010/a1120e/a1120e00.HTM

Advances in Haploid Production in Higher Plants

Edited by A. Touraev, B.P. Forster and S.M. Jain



Abstract

The discovery of haploid haploid Datura plants in 1964 initiated excitement in plant breeding and genetics communities. Recent years have witnessed a resurgence of activities especially in developing protocols, identifying genes and mechanisms and large scale commercial take up. The identification of controlling genes have driven functional genomic studies which now dovetail with studies in gene expression, metabolism and changes in cell ultra-structure. Worldwide take up by plant breeders has been no less impressive, and valuable

haploid technologies are increasingly patent protected. The intense activity in haploid research has also resulted in unexpected findings with novel applications. The core of this book is based on the international symposium on "Haploidy in Higher Plants III", (Vienna 2006), which attracted top international experts in the field. Other invited contributions have been included to provide a rounded view of activities. The book covers topics in: Historical overviews; basic biology, genetics, Biotechnology, breeding and novel applications as well as in mutation breeding. It therefore will appeal to undergraduate students, researchers and small and large scale commercial biotechnology companies.

Due 24 November 2008

(2009) ISBN 978-1-4020-8853-7

Hardcover

Publications within Coordinated Research Projects (CRPs) as of 2004

Effects of Mutagenic Agents on the DNA Sequence in Plants

Martin N., Ruedi E.A., LeDuc R., Sun F.-J. and Caetano-Anollees G. (2007). Gene-interleaving patterns of synteny in the Saccharomyces cerevisiae genome: are they proof of an ancient genome duplication event? Biology Direct 2: 23.

Sun F.-J., Fleurdepine S., Bousquet-Antonelli C., Caetano-Anollés G. and Deragon J.-M. (2007). Common evolutionary trends for tRNAderived SINE RNA structures. Trends in Genetics 23: 26-33.

Ceballos H., Sánchez T., Morante N., Fregene M., Dufour D., Smith A.M., Denyer K., Pérez J.C., Calle F. and Mestres C. (2007). Discovery of an Amylose-free Starch mutant in cassava (Manihot esculenta Crantz). Journal of Agricultural and Food Chemistry 55(18): 7469-7476.

Shu X.L., Jia L.M., Gao J.K., Zhao H.J., Wu D.X. (2007). Metabolite profiling of rice high in resistant starch. Journal of Agricultural and Food Chemistry, Accepted.

Shu X.L., Gao J.K., Jia L.M., Song Y.L., Wu D.X. (2007). The influence of chain length of amylopectin on resistant starch in rice (Oryza sativa L.). Starch, Accepted.

Shu X.L., Jiao G.A., Fitzgerald M., Yang C.Z., Shu Q.Y., Wu D.X. (2006). Starch structure and digestibility of rice high in resistant starch. Starch, 58(8): 411-417

Yang C.Z., Shu X.L., Zhang L.L., Wang X.Y., Zhao H.J., Ma C.X., Wu D.X. (2006). Starch properties of mutant rice high in resistant Starch. Journal of Agricultural and Food Chemistry 54(2): 523-528

Ceballos H., Fregene M., Lentini Z., Sánchez T., Puentes Y.I., Pérez J.C., Rosero A. and Tofiño A.P. (2006). Development and Identification of High-Value Cassava Clones. Acta Horticulturae 703:63-70.

Kwasniewski M. and Szarejko I. (2006). Molecular cloning and characterization of β-expansin gene related to root hair initiation in barley. Plant Physiol. 141: 1149-1158.

Caetano-Anollés G. (2005). Genome size evolution in the grasses. Crop Science 45:1809-1816.

Caetano-Anollés G. (2005). Grass evolution inferred from chromosomal rearrangements and geometrical and statistical features in RNA structure. Journal of Molecular Evolution 60:635-652.

Galvez H.F., Narciso J.O., Opina N.L., Canama A.O., Colle M.G., Tongson E.J.U., Latiza M.A., Caspillo C.L., Bituin J.L., Tiongco R.L., Frankie R.B. and Hautea D.M. (2005). Towards allele mining of bacterial wilt disease resistance gene in tomato. The Philippine Journal of Crop Science vol. 30 supplement no. 1, pp.65.

Sánchez T., Chávez A.L., Ceballos H., Rodriguez-Amaya D.B., Nestel P. and Ishitami M. (2005). Reduction or delay of post-harvest physiological deterioration in cassava roots with higher carotenoid content. Journal of the Science of Food and Agriculture 86(4): 634-639.

Kodym A, Brunner H, Afza R, Rakotoarisoa N, Arias F.J.Z and Forster B.P (2005). Sensitivity Test For Mutation Production By Seed Irradiation.

Caldwell D.G, McCallum N, Shaw P, Muehlbauer J.G, Marshall D.F and Waugh R. (2004). A structured mutant population for forward and reverse genetics in Barley (*Hordeum vulgare* L.) The Plant Journal vol: 40, 143-150.

Van der Vyver C., Kunert K.J. and Cullis C. (2004). Detection and characterization of a labile DNA region in the tobacco genome using representational difference analysis. Annals of Botany, 2004, submitted.

Szarejko I. (2003). Anther culture for doubled haploid production in barley (L.). In: Maluszynski M., K.J. Kasha, B.P. Forster and I. Szarejko (Eds). Doubled Haploid Production in Crop Plants. A Manual, Kluwer Acad. Publ., Dordrecht, pp. 35-43.

Szarejko I. (2003). Doubled haploid mutant production. In: Maluszynski M., K.J. Kasha, B.P. Forster and I.

Szarejko (Eds). Doubled Haploid Production in Crop Plants. A Manual, Kluwer Acad. Publ., Dordrecht, pp. 351-362.

Maluszynski M., Szarejko I. and Kasha K.J. (2003). Published protocols for other crop plants. In: Maluszynski M., Kasha K.J., Forster B.P. and Szarejko I. (Eds). Doubled Haploid Production in Crop Plants. A Manual, Kluwer Acad. Publ., Dordrecht, pp. 309-336.

Guzy-Wróbelska J. and Szarejko I. (2003). Molecular and agronomic evaluation of wheat (*Triticum aestivum* L.) doubled haploid lines obtained through maize pollination and anther culture methods. Plant Breeding 122 (in press)

Shoaib A., Migdadi H., Guzy-Wróbelska J., Janiak A. and Szarejko I. (2003). Genetic diversity in the Middle East barley and wheat landraces and cultivars using AFLP markers. In: Zwierzykowski Z., M. Surma, P. Kachlicki (Eds.), Application of Novel Cytogenetic and Molecular Techniques in Genetics and Breeding of the Grasses, Institute of Plant Genetics PAS, Poznan, (in press)

Maluszynski M., Szarejko I. and Maluszynska J. (2003). Mutation techniques. In: Encyclopedia of Applied Plant Sciences. Elsevier Science, Oxford, (in press)

Vorster J.B., Kunert K.J. and Cullis C.A. (2002). Use of representational difference analysis for the characterization of sequence differences between date palm varieties. Plant Cell Rep 21: 271-275.

Ceballos, H. (2002). La yuca en Colombia y el Mundo. In (H.Ceballos and B. Ospina, eds.) La Yuca en el Tercer Milenio. CIAT, Cali, Colombia.

Hautea D.M., Blatero C.H. and Galvez H.F. (2001). Evaluation of AFLP, SSR and RGA markers in Philippine crops for mapping and diversity studies. In: "Mutation Techniques and Molecular Genetics for Tropical and Subtropical Plant Improvement in Asia and the Pacific Region:, report of an FAO/IAEA Seminar held in Makati City, The Philippines, 11-15 October 1999. Reproduced by IAEA, Vienna, Austria, IAEA-SR-210/26 89:92 (limited distribution).

Maluszynski M., Szarejko I. and Maluszynska M. (2001). Induced mutations in wheat. In: The World Wheat Book. Bonjean, A.P. and W.J. Angus (Eds.) Lavoisier Publishing, Londres. pp.939-977.

Maluszynski M., Gustafson P., Maluszynska J. and Szarejko I. (2001). Advanced breeding for germplasm enhancement and yield improvement. In: Yield Gap and Productivity Decline in Rice Production, FAO, Rome, pp. 191-224

Nawrot M., Szarejko I. and Maluszynski M. (2001). Barley mutants with increased tolerance to aluminum toxicity. Euphytica 120 (3): 345-356

Maluszynski M., Szarejko I., Bariga P. and Balcerzyk A. (2001). Heterosis in crop mutant crosses and production of high yielding lines using doubled haploid systems. Euphytica 120 (3): 387-398

Forster B.P (2000) Mutation genetics of salt tolerance in barley: An assessment of Golden Promise and other semi-dwarf mutants.

Cullis C.A. and Kunert K.J. (2000). Isolation of tissue culture-induced polymorphisms in bananas by Representational Difference Analysis. Acta Hort 530:421-428.

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

Tomlekova N., Grozeva S. and Rodeva V. (2006) AFLP polymorphism in tomato after gamma-rays callus mutagenesis. Ecology and Future, 3: 30-34.

Tomlekova N., Atanassova B., Marinova D., Baralieva D. and Ribarova F. (2006) Study on the Variability of Lycopene and ß-carotene Content in Tomato (*Lycopersicon esculentum* Mill.). Acta Horticulturae (in press).

Tomlekova N., Todorova V. and Daskalov S. (2006) Creating variation in pepper (*Capsicum annuum* L.) through induced mutagenesis, Plant Science (in press).

Tomlekova N., Todorova V., Daskalov S. and Denev I. (2006) Biochemical evaluation of increased beta-carotene levels in pepper mutants. Proceedings of 3rd Central European Congress on Food, 22-24 May 2006, Sofia, Bulgaria, (in press).

Tomlekova N. (2006) Molecular characterization of interspecific tomato (Lycopersicon) hybrids. Proceedings of 3rd Central European Congress on Food, 22-24 May 2006, Sofia, Bulgaria (in press).

Tomlekova N. (2006). Development of molecular markers for F1 tomato hybrids. Ecology and Future, 4: (in press).

Hasterok R., Wolny E., Hosiawa M., Kowalczyk M. Kulak-Ksiazczyk S., Ksiaczyk T., Heneen W. and Maluszynska J. (2006) Comparative Analysis of rDNA Distribution in Chromosomes of Various Species of Brassicaceae. Annals of Botany 97: 205-216.

Scaldaferro M.A., Seijo J.G., Acosta M.C., Barboza G.E., Ducasse D.A., and Moscone E.A. (2006) Genomic characterization of the germplasm in peppers (*Capsicum* - *Solanaceae*) by fluorescent in situ hybridization. - Plant Science 43 (4): 291-297.

Identification and Pyramiding of Genes Contributing to Crop Quality Characters and Quality-Affecting Tolerance

Badigannavar A.M. (2008) Genetic diversity among the gamma ray induced mutants of groundnut, *Arachis hypogaea* cultivar, TAG 24. J. Oilseeds Res. 25: 13-18.

Badigannavar A.M. and Mondal S. (2008) Integration of mutation with recombination breeding for genetic improvement of cultivated groundnut (*Arachis hypogaea* L.). Abstract. Third International Conference of the Peanut Research Community on Advances in *Arachis* through Genomics and Biotechnology (AAGB-2008). 4-8 November 2008 ICRISAT, Hyderabad, India. Pp: 5.

Bao J.S., Xie J.K., Hu B.L. (2008) Isolation and characterization of mutants from *indica* rice 93-11 and Guanluai (*Oryza sativa* L.) induced by gamma irradiation. In: Abstracts of FAO/IAEA International Symposium on Induced Mutations in Plants, 12-15 August 2008, Vienna, Austria, P19.

Bao J.S. (2008) Unlocking naturally occurring variation fro starch quality by gene-tagged markers in rice. In: Abstracts of FAO/IAEA International Symposium on Induced Mutations in Plants, 12-15 August 2008, Vienna, Austria, P196.

Bao J.S., Jin L., Xiao P., Sun M., Corke H. (2008) Starch physicochemical properties and their associations with microsatellite alleles of starch-synthesizing genes in a rice RIL population. Journal of Agricultural and Food Chemistry, 56 (5): 1589-1594

Boonsirichai K., Phadvibulya V., Adthalungrong A., Srithongchai W. and Puripunyavanich V. (2008) Genetics of the Radiation-Induced Yellow Vein Mosaic Disease Resistance Mutation in Okra. FAO/IAEA International Symposium on Induced Mutations in Plants. 12-15 August2008. Vienna, Austria. p. 149.

Phadvibulya V., Boonsirichai K., Adthalungrong A. and Srithongchai W. (2008) Selection for Resistance to Yellow Vein Mosaic Virus Disease of Okra by Induced Mutation. FAO/IAEA International Symposium on Induced Mutations in Plants. 12-15 August 2008. Vienna, Austria. p. 148.

Boonsirichai K. and Phadvibulya V. (2008) Development of DNA markers for the yellow vein mosaic disease resistance in okra. TINT Magazine 4: 7-10 (in Thai).

Mondal S., Sutar S.R. and Badigannavar A.M. (2008) Comparison of RAPD and ISSR marker profiles of cultivated peanut genotypes susceptible or resistant to foliar diseases. J. Food Agric. Environ. 6(2): 181-187.

Mondal S., Badigannavar A.M. and D'Souza S.F. (2008) Mutational origin of genetic diversity in cultivated groundnut (*Arachis hypogaea* L.). Abstract. International Symposium on Induced Mutations in Plants. 12-15 August 2008 IAEA, Vienna, Austria. Pp: 22.

Mondal S. and Badigannavar A.M. (2008) Identification of SSR marker for resistance to late leaf spot in cultivated groundnut (*Arachis hypogaea* L.). Abstract. 5th International Crop Science Congress (ICSC), April 13-18, 2008, Jeju, Republic of Korea. Pp: 266.

Badigannavar A.M. and Mondal S. (2007) Mutation experiments and recent accomplishments in Trombay groundnuts. IANCAS Bulletin Vol. VI (4): 308-318.

Badigannavar A.M. (2007) Inheritance of flower colour mutant in groundnut. Indian J Genet. 67 (3): 266-267.

Lacape J.-M., Dessauw D., Rajab M., Noyer J.L. and Hau B. (2007) Microsatellite diversity in tetraploid Gossypium gene pool: assembling a highly informative genotyping set of cotton SSRs. Molecular breeding, 19:45-58

Lancon J., Pichaut J.-P., Djaboutou M., Lewicki S.D., Viot C. and Lacape J.-M. (2007) Use of molecular markers in participatory plant breeding: assessing the genetic variability in cotton populations bred by farmers. Annals of Applied Biology, 152:113-119

Mondal S., Badigannavar A.M., Kale D.M. and Murty G.S.S. (2007). An induced dominant seed coat colour mutation in groundnut. Indian J Genet. 67 (2): 177-179.

Li C.D., Lance R., Tarr A., Harasymow S., Gupta S., Cakir M., Jones M.G.K., and Appels R. (2006) Marker assisted breeding in barley: the winners and the losers. 13th Australian Plant Breeding Conference, New Zealand.

Guo R.X., Sun D.F., Tan Z.B., Rong D.F. and Li C.D. (2006) Two Recessive Genes Controlling Thermo-photoperiod Sensitive Male Sterility in Wheat. Theoretical & Applied Genetics, 112: 1271-1276.

Guo R.X., Sun D.F., Tan Z.B., Rong D.F. and Li C.D. (2006) Inheritance of Thermo-photoperiod Sensitive Male Sterility in Wheat. Australian Journal of Agricultural Research, 57:187-192.

Gill R, Li C., Appels R., Falk D. and Lance R. (2006) Mapping and development of a marker system for use in male sterile facilitated recurrent selection in Barley (*Hordeum vulgare*). 13th Australian Plant Breeding Conference, pp 164, Christchurch, April 2006, New Zealand.

Li C., Lance R., Tarr A., Harasymow S., Gupta S., Cakir M., Jones M.G.K. and Appels R. (2006) Marker assisted breeding in barley: the winners and the losers. 13th Australian Plant Breeding Conference, Christchurch, April 2006, New Zealand.

Kim, H.S., Suh S.J., Baek S.B., Kim J.G., Kim D.H., and Kim S.J. (2005) Molecular mapping of barley yellow mosaic virus disease resistance. Korean J. of Crop Science. Vol. 50. Suppl. 1.: 198-199. (Abstract).

Manasievska-Simic S., Angelov I., Ivanovska S., Gjorgovski I., Simeonova E., Ivanovski M. and Jankulovska M. (2006) Relationship between HMW glutenin subunits and 1B/1R translocation in wheat cultivars. Cereal Research Communications (in press).

Manasievska-Simic S., Angelov I., Ivanovska S., Simeonova E., Ivanovski M. and Jankulovska M. (2006) Quality of Macedonian Soft Wheat Cultivars I. HMW Com-

position. XI Symposium on Biotechnology. Proceedings. 285-291. Vol. 11. (11-12), Book I. Cacak, 3-4 March.

Simeonovska E. Application of wheat induced mutations and selection of mutant lines in M2 and M3 generation on the basis of quality and productive features. Doctoral Thesis.

Shen X., Zhang T., Guo W., Zhu X. and Zhang X. (2006) Mapping QTLs with main effects, epistatic effects and QTL × environment interaction for fiber and yield traits in RILs of Upland cotton. Crop Sci. 46: 61-66.

Shen X., Guo W., Zhu X., Yuan Y. and Zhang T. (2007) Genetic Mapping of Quantitative Trait Loci for Fiber Quality and Yield Trait by RIL Approach in Upland Cotton. Euphytica, DOI 10.1007/s10681-006-9338-6.

Bao J. *et al.* (2006) Analysis of genotypic diversity in the starch physicochemical properties of nonwaxy rice: Apparent amylose content, pasting viscosity, and gel texture. Starch: 58:259-267.

Bao J.S., Corke H. and Sun M. (2006) Microsatellites, single nucleotide polymorphisms and a sequence tagged site in starch-synthesizing genes in relation to starch physicochemical properties in nonwaxy rice (*Oryza sativa* L.). Theor Appl Genet, 113, 1185-1196.

Bao J.S., Corke H. and Sun M. (2006) Nucleotide diversity in starch synthase IIa and validation of single nucleotide polymorphisms in relation to starch gelatinization temperature and other physicochemical properties in rice (*Oryza sativa* L.).Theor Appl Genet, 113, 1171-1183.

Toyota, K., *et al.* (2006) Expression profiling of starch metabolism-related plastidic translocator genes in rice. Planta 223: 248-257.

Toyota K., Tamura M., Ohdan T. and Nakamura Y. (2006) Expression profiling of starch metabolism-related plastidic translocator genes in rice. Planta 223: 248-257.

Fujita N., Yoshida M., Asakura N., Ohdan T., Miyao A., Hirochika H. and Nakamura Y. (2006) Function and characterization of starch synthase I using mutants in rice. Plant Physiol. 140: 1-15.

Boonsirichai K., Puripunyavanich V., Phadvibulya V., Adthalungrong A. and Srithongchai W. (2006) Comparison between the DNA fingerprints obtained from the yellow vein mosaic disease tolerant Okra mutants and their parental variety. 44th Kasetsart University Annual Conference, 30 January - 2 February 2006, Bangkok, Thailand. Book 1, pp: 547-555.

Mondal S., Badigannavar, A.M., Kale, D.M. and Murty, G.S.S. (2006) Induction of genetic variability in a disease resistant groundnut breeding line. 2nd National Plant Breeding Congress, March 1-3 2006, Tamil Nadu Agricultural University, Coimbatore, India (Abs.) pp: 83-84. (Best Poster Award).

Mondal S., Sutar S.R., Badigannavar A.M. and Murty G.S.S. (2006) Genetic diversity in cultivated groundnut revealed by Inter Simple Sequence Repeat markers. Abstract. BARC Golden Jubilee and DAE-BRNS Life Sciences Symposium 2006 (LSS - 2006) on Trends in Research and Technologies in Agriculture and Food Sciences, December 18-20 2006, BARC, Mumbai. pp: 93.

Blenda A., Scheffler J., Scheffler B., Palmer M.B., Lacape J.-M., Yu J., Jesudurai C., Jung S., Muthukumar S., Yellambalase P., Ficklin S., Staton M., Echelman R., Ulloa M., Saha S., Burr B., Liu S., Zhang T., Fang D., Pepper A.E., Kumpatla S.P., Jacobs J., Tomkins J.P., Cantrell R.G. and Main D. (2006). CMD: A cotton microstallite database resource for Gossypium genomics. BMC Genomics, 7:132.

Identification and pyramiding of mutated genes: novel approaches for improving crop tolerance to salinity and drought

Ozbas M.O. and Cagirgan M.I. (2006) Variation in morpho-physiological traits in barley genotypes selected by carbon isotope discrimination for a high and low water use efficiency. *Gene-Plant-Crop Relations; Scale and Complexity in Plant Systems Research*, Wageningen, Netherlands, 23-26 April 2006.

Gadjev I., Vanderauwera S., Gechev T.S., Laloi C., Minkov I.N., Shulaev V., Apel K., Inzé D., Mittler R. and Van Breusegem F. (2006) Transcriptomic footprints disclose specificity of reactive oxygen species signaling in *Arabidopsis*. Plant Physiology (accepted).

Brini F., Hanin M., Lumbreras V., Irar S., Pagès M., and Masmoudi K. (2006) Functional Characterization of DHN-5, a dehydrin showing a differential phosphorylation pattern in two Tunisian durum wheat (*Triticum durum* Desf.) varieties with marked differences in salt and drought tolerance *Plant Science* 172: 20-28.

Brini F., Hanin M., Mezghani I., Berkowitz G.A. and Masmoudi K. Overexpression of wheat Na+/H+ antiporter *TNX1* and H+-pyrophosphatatase *TVP1* improve salt and drought stress tolerance in *Arabidopsis thaliana* plant (in press).

Pareek A., Singh A., Kumar M., Kushwaha H.R., Lynn A.M. and Singla-Pareek S.L. (2006) Whole-Genome Analysis of *Oryza sativa* Reveals Similar Architecture of Two-Component Signaling Machinery with Arabidopsis**.** Plant Physiology 142:380-397.

Moustafa R.A.K. and EL-Gendy R.W. (2006). Breeding for drought tolerance in barley following hybridization between a high yielding mutant line and local varieties. Eighth Arab Conference on the Peaceful Uses of Atomic Energy. Amman, 3-7 December 2006 (in press).

Molecular characterization of mutated genes controlling important traits for seed crop improvement

Carneiro N.P., Guimarães C.T., Lana U.G.P., Lana J.G.P. and Paiva E. (2004). Characterization of genes expressed in the maize endosperm Indian Bol II mutant. XXV Brasilian Nacional Congress of Maize and Sorghum - CD ROM.

Spetsov P., Ruseva T.S., Belchev I., Daskalova N. (2004) Development and investigation of initial breeding material obtained by crossing common wheat *T. aestivum* with Aegilops species. II. Biological characterization of amphiploids, Res. Commun. of USB, branch Dobrich, vol.6 (1): 20-28 [www.geocities.com/fcr-abstracts/2004-Sp.htm].

Spetsov P., Hsam S.L.K., Zeller F.J. and Daskalova N. (2004) Increased resistance to powdery mildew and leaf rust in *Triticum aestivum* x *Aegilops variabilis* cross by gamma irradiation (submitted to Field Crops Research).

Oh C.S., Choi Y.H., Lee S.J., Yoon D.B., Moon H.P., Ahn S.N. (2004) Mapping of quantitative trait loci for cold tolerance in weedy rice. Breeding Sci. 54: 373-380.

Oh C.S., Lee S.J., Yoon D.B., Suh J.P., Ahn S.N. (2004) QTLs for domestication-related and agronomic traits in temperate Japonica weedy rice. Korean Journal Breeding 36: 20-30.

Kim M.Y., Van K., Lestari P., Moon J.-K. and Lee S.-H. (2005) SNP identification and SNAP marker development for a GmNARK gene controlling supernodulation in soybean. Theor. Appl. Genet. (in press, online published).

Van K., Kim K.-S., Ha B-K, Jun T.-H., Jang H.-J., Kim M.Y. and Lee S.-H. (2005) Molecular marker characterization of a supernodulating soybean mutant SS2-2. Korean J. Breeding (in press).

Rutger J.N., Raboy V., Moldenhauer K.A.K., Bryant R.J., Lee F.N. and Gibbons J.W. (2004) Registration of KBNT lpa 1-1 low phytic acid germplasm of rice. Crop Sci. 44: 363.

Rutger J.N. and Bryant R.J. (2004) Registration of aromatic se rice germplasm. Crop Sci. 44: 363-364.

Rutger J.N., Moldenhauer K.A.K., Gravois K.A., Lee R.N., Bryant R.J. (2004) Registration of six semidwarf mutants of rice. Crop Sci. 44: 364-366.

Rutger J.N., Moldenhauer K.A.K., Gravois K.A., Lee F.N., Norman R.J. and Bryant R.J. (2004) Registration of five induced semidwarf mutants of rice. Crop Sci. 44: 1496-1497.

Rutger, J.N., Moldenhauer K.A.K., Gibbons J.W., Anders M.M. and Bryant R.J. (2004) Registration of LGRU ef early flowering mutant of rice. Crop Sci. 44: 1498.

Rutger J.N., Bryant R.J., Moldenhauer K.A.K. and Gibbons J.W. (2004) Registration of goldhull low phytic acid (GLPA) germplasm of rice. Crop Sci. 44: 1497-1498.

Eizenga G.C., Lee F.N., Jia Y. (2004) Identification of blast resistance genes in wild relatives of rice (*Oryza* spp.) and newly introduced rice (*O. sativa*) lines. p. 29-36. In R.J. Norman. J.F. Meullenet and K.A.K. Moldenhauer (eds.), B.R. Wells rice research studies 2003. Univ. Arkansas, Agric. Exp. Stn. Res. Series 517.

Kumar A., Jain A., Sahu R.K., Shrivastava M.N., Nair S., Mohan M. (2005) Genetic analysis of resistance genes for the rice gall midge in two rice genotypes. Crop Sci (in press).

Jain A., Ariyadasa R., Kumar A., Srivastava M.N., Mohan M., Nair S. (2004) Tagging and mapping of a rice gall midge resistance gene, Gm8, and development of SCARs for use in marker-aided-selection (MAS) and gene pyramiding. Theor Appl Genet 109:1377-1384.

Rajyashri K.R. and Mohan M. (2004) Gene pyramiding: A transgenic approach to enhancing resistance durability in plants. In Transgenic Crop Protection: Concepts and Strategies, O. Koul and G.S. Dhaliwal (eds.) pp. 219-260 Science Publishers Inc., Enfield, USA.

Coimbra J.L.M., Carvalho F.I.F. de, Oliveira A. Costa de, Silva J.A.G., Lorencetti, C. (2005) Comparison between chemical and physical mutagens in oat populations.Ciência Rural, Santa Maria -RS, v. 35, n. 1 (in press). In Portuguese with English abstract.

Silva J.A.G., Carvalho Fernando I.F. de, Oliveira A. Costa de, Marchioro V.S., Lorencetti C., Benin G., Schmidt D., Hartwig I. (2004) Correlations and path analysis to identify characters associated to plant stature and aluminum tolerance in double-haploid wheat under hydroponics. Revista Brasileira de Agrociência, Pelotas, v. 10, n. 4, p. 419-425. In Portuguese with English abstract.

Coimbra J.L.M., Carvalho F.I.F. de, Oliveira A. Costa de, Chocorosqui V., Guidolin A.F. (2004) Criation of genetic variability for the character vegetative cycle in oat: artificial hybridization versus induced mutation. Revista Brasileira de Agrociência, Pelotas, v. 10, n. 2, p. 159-166. In Portuguese with English abstract.

Coimbra J.L.M., Carvalho F.I.F. de, Oliveira A. Costa de, Guidolin A.F. (2004) Criation of genetic variability for the character plant stature in oat: artificial hybridization versus induced mutation Revista Brasileira de Agrociência, Pelotas, v. 10, n. 3, p. 273-280. In Portuguese with English abstract.

Vieira E.A., Castro C.M., Oliveira, A. Costa de, Carvalho, F.I.F. de, Zimmer P.D., Martins L.F. (2004) Genetic structure of annual ryegrass (*Lolium multiflorum*) populations estimated by RAPD. Scientia Agricola, Piracicaba, v. 61, n. 4, p 407-413.

Coimbra J.L.M., Carvalho F.I.F. de, Oliveira A. Costa de (2004) Genetic variability in populations of oat induced

by chemical and physical mutagenic agents. Crop Breeding and Applied Biotechnology, Viçosa, v. 4.

Lannes S.D., Zimmer, P.D., Oliveira, A. Costa De; Carvalho, F.I.F. de, Vieira E.A., Magalhães Jr. A., Kopp M.M., Freitas F.A. de. (2004) *In vitro* regeneration of rice anthers of irrigated rice (*Oryza sativa* L.) and mapping of associated QTL. Ciência Rural, Santa Maria, v. 34, n. 5, p. 1355-1362. In Portuguese with English abstract.

Silva J.A.G., Carvalho F.I.F. de, Oliveira A. Costa de, Silva S.A., Marchioro V.S., Lorencetti C., Benin G., Schmidt D., Hartwig I. (2004) Doublé-haploid wheat with potential for aluminum tolerance and sensitivity to gibberellic acid in hydroponic culture. Revista Brasileira de Agrociência, Pelotas, v. 10, n. 1. In Portuguese with English abstract.

Coimbra J.L.M., Carvalho F.I.F. de, Oliveira A. Costa de. (2004) Use of induced mutation and artificial crosses for increasing genetici variability for the character vegetative cycle in oats. Revista Científica Rural, Bagé - RS. In Portuguese with English abstract.

Mutational analysis of root characters in annual food plants related to plant performance

Martínez A.E., Franzone P.M., Aguinaga A., Polenta G., Murray R., Prina A.R. (2004) Nuclear gene controlling seminal root growth response to hydroponic cultivation in barley. Environmental and Experimental Botany 51(2): 133-144.

Forster B.P., Ellis R.P., Moir J., Talamè V., Sanguineti M.C., Tuberosa R., This D., Teulat-Merah B., Ahmed I., Mariy S.A.E.E., Bahri H., El Ouahabi M., Zoumarou-Wallis N., El-Fellah M. and Ben Salem M. (2004) Genotype and phenotype associations with drought in barley tested in North Africa. Annals of applied Biology 144: 157-168.

Ozbas M.O. and Cagirgan M.I. 2004. Variability and Interrelationships for Root Traits in a Subset of Induced Barley Mutant Collection. Cereal Res. Commun. 32(1):119-126.

Çagirgan M.I., Özbas M.O., Heng L. and Afza R. (2005) Genotypic Variability for Carbon Isotope Discrimination in the Mutant and Improved Lines of Barley. Isotopes in Environment and Health Studies (in press)

Jackson L.E. (2005) Soil biology: root architecture and growth. Encyclopedia of Soils in the Environment. Elsevier Ltd. Pp. 411-421.

Martínez A., Landau A., García P.T., Polenta G., Arias M.C., Murray R., Pensel N. and Prina A.R. (2005) Two Mutants Affecting Adaptative Responses to Abiotic Stresses in Barley Seedlings. Czech J. Genet. Plant Breed. 41 (1): 1-10.

Cabrera Lejardi M., Gutiérrez L., Pérez C., Lago E., Pérez M., Mendoza M.J., Díaz M. and Marrero S. (2004) Caracterización fisiológica de radiomutantes de trigo. En: Taller Fisiología Vegetal y Bioquímica. Congreso Científico del INCA (14: 2004, Nov. 9-12, La Habana). Memoria CD-ROM, ISBN 959-7023-27-X.

Gutierrez L., Cabrera Lejardi M. y colaboradores (2004) Algunas consideraciones para el cultivo del trigo en Cuba. En: Taller Alternativas para la producción Agrícola. Congreso Científico del INCA (14: 2004, Nov 9-12, La Habana). Memoria CD-ROM, ISBN 959-7023-27-X.

Cabrera Lejardi M., Gutiérrez L, Pérez C. Lago E., Pérez M., Mendoza M.J., Díaz M. and Marrero S. (2004) Tolerancia de radiomutantes de trigo a la sequía y salinidad. En: Convención Trópico (2004, Abril 4-8, La Habana). Memoria CD-ROM, ISBN 959-7167-02-6.

Gutierrez L., Cabrera Lejardi M. y colaboradores (2004) El cultivo del trigo en Cuba, un siglo de trabajos. En: Convención Trópico (2004, Abril 4-8, La Habana). Memoria CD-ROM, ISBN 959-7167-02-6.

List of Plant Breeding and Genetics Section's Publications

Plant Mutation Reports

Year	Edition	Contents (a sampling of the papers are listed below):	Reference No.
2007	Vol. 1, No. 3	• Mutation breeding and genetics in Korea • Genetic enhancement of groundnut • Virus resistant banana • Ion beams implantation on wheat • Trombay mutant groundnut varieties • Lodging tolerant rice variety	ISSN 1011-260X
2006	Vol. 1, No. 2	• 30 years rice mutation breeding and genetics • Mutant groundnut varieties in Bangladesh • Shortening durum wheat plants • Seedless mutant sweet orange • Colorful chrysanthemum mutations • Radiosensitivity of cassava *in vitro* culture	ISSN 1011-4289
2006	Vol. 1, No. 1	• Rice mutation breeding in China • Long grain aromatic rices and induced mutations • Significant contribution of mutation techniques to rice breeding in Indonesia • Use of induced mutants in rice breeding in Japan • Katy deletion mutant populations • Rice mutation breeding in Vietnam	ISSN 1011-260X

Mutation Breeding Newsletter and Reviews

Year	Edition	Contents (a sampling of the papers are listed below):	Reference No.
2005	No. 1	• High yielding mutants in cotton • Drought resistant tomato • Groundnut resistant to foliar diseases • Lodging resistant glutinous rice • First ever oilseed mustard mutant	ISSN 1011-260X

Mutation Breeding Review (published until 2004)

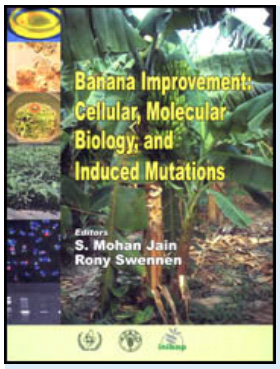
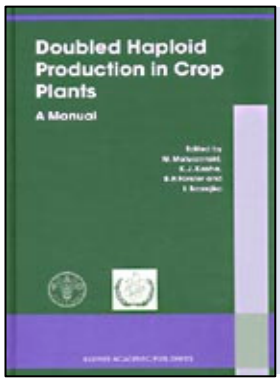
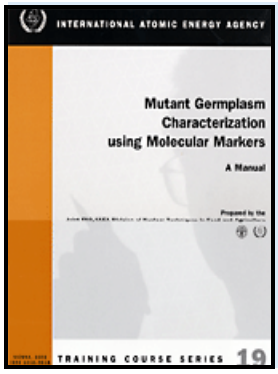
Year	Edition	Title	Reference No.
2004	No. 14	Officially released mutant varieties in China	ISSN 1011-2618
2001	No. 13	Grain legume cultivars derived from induced mutations, and mutations altering fatty acid composition	ISSN 1011-2618
2000	No. 12	Officially released mutant varieties – The FAO/IAEA database	ISSN 1011-2618

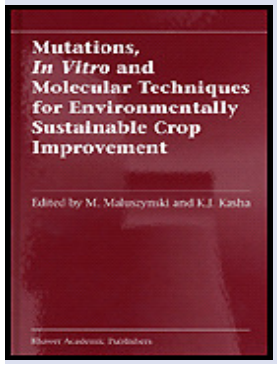
Year	Edition	Title	Reference No.
1999	No. 11	Oilseed cultivars developed from induced mutations and mutations altering fatty acid composition	ISSN 1011-2618

Mutation Breeding Newsletter (published until 2003)

Year	Edition	Title	Reference No.
2003	No. 46	Index Issue No. 21-44	ISSN 1011-260X
2001	No. 45	Issue No. 45	ISSN 1011-260X
1999	No. 44	Issue No. 44	ISSN 1011-260X

Books

Year	Edition	Title	Book Cover	Reference No.
2004		Banana Improvement: Cellular, Molecular Biology, and Induced Mutations		ISBN 1-57808-340-0
2003		Doubled Haploid Production in Crop Plants – A Manual		ISBN 1-4020-1544-5
2002	Training Course Series No. 19	Mutant Germplasm Characterization using Molecular Markers – A Manual		ISSN 1018-5518

Year	Edition	Title	Book Cover	Reference No.
2002		Mutations, *In Vitro* and Molecular Techniques for Environmentally Sustainable Crop Improvement		ISBN 1-4020-0602-0

Technical Documents

Year	Type of Publication	Title	Reference No.
2006	IAEA-TECDOC-1493	Mutational analysis of root characters in food plants	ISBN 92-0-103106-8 ISSN 1011-4289
2004	IAEA-TECDOC-1384	Low cost options for tissue culture technology in developing countries	ISBN 92-0-115903-X ISSN 1011-4289
2004	IAEA-TECDOC-1426	Genetic improvement of under-utilized and neglected crops in low income food deficit countries through irradiation and related techniques	ISBN 92-0-113604-8 ISSN 1011-4289
2003	IAEA-TECDOC-1369	Improvement of new and traditional industrial crops by induced mutations and related biotechnology	ISBN 92-0-101603-4 ISSN 1011-4289
2001	IAEA-TECDOC-1195	Sesame improvement by induced mutations	ISSN 1011-4289
2001	IAEA-TECDOC-1216	Induced mutations in connection with biotechnology for crop improvement in Latin America	ISSN 1011-4289
2001	IAEA-TECDOC-1227	*In vitro* techniques for selection of radiation induced mutations adapted to adverse environmental conditions	ISSN 1011-4289
2001	IAEA-TECDOC-1253	Radioactively labeled DNA probes for crop improvement	ISSN 1011-4289
1998	IAEA-TECDOC-1010	Application of DNA based marker mutations for improvement of cereals and other sexually reproduced crop plants	ISSN 1011-4289
1998	IAEA-TECDOC-1047	Use of novel DNA fingerprinting techniques for the detection and characterization of genetic variation in vegetatively propagated crops	ISSN 1011-4289
1997	IAEA-TECDOC-951	Improvement of basic food crops in Africa through plant breeding, including the use of induced mutations	ISSN 1011-4289
1996	IAEA-TECDOC-859	Use of mutation techniques for improvement of cereals in Latin America	ISSN 1011-4289
1995	IAEA-TECDOC-800	*In vitro* mutation breeding of banana and plantains	ISSN 1011-4289
1995	IAEA-TECDOC-809	Improvement of root and tuber crops in tropical countries of Asia by induced mutations	ISSN 1011-4289
1994	IAEA-TECDOC-781	Mutation breeding of oil seed crops	ISSN 1011-4289

How to order IAEA Publications

Orders and request for information may be addressed directly to:

Sales and Promotion Unit

International Atomic Energy Agency

Wagramer Strasse 5

P.O. Box 100

A-1400 Vienna

Austria

Telephone: +43 1 2600 22529 (or 22530)

E-mail: **sales.publications@iaea.org**

Web site: **http://www-pub.iaea.org/MTCD/publications/publications.asp**

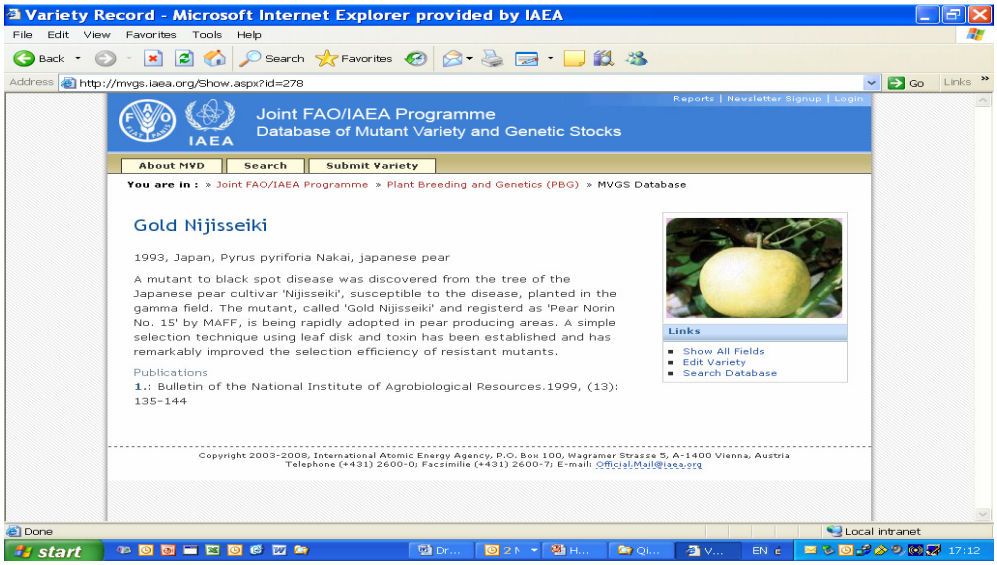
New FAO/IAEA Database of Mutant Varieties and Genetic Stocks

Welcome to our new FAO/IAEA Database of Mutant Varieties and Genetic Stocks! At the moment, we just completed construction of the part for Mutant Variety Database, which is still in the process of information updating. We will add the other part for Mutant Genetic Stocks in due time. The new database has improved over the FAO/IAEA Mutant Variety Database in many ways. We are working to make the new database as the global information source of mutant varieties and mutant genetic stocks, as well as activities and events related to plant mutation breeding and research.

The key feature of the database is that you can register your mutant varieties from your desktop. For this purpose, you need first register an account; then you will be authorized to submit or edit a mutant variety.

We would greatly appreciate your support by registering your mutant variety in our database. Once the variety is registered, it will have its own 'homepage' (see below). Therefore, you can use it as an important platform to showcase your new varieties (The introduction of this variety may be shown in local language).

Please visit the website http://mvgs.iaea.org and send us your valuable suggestions and comments regarding the structure and content of this database. Please also send us other information, related to plant mutation breeding and mutant varieties, genetic stocks; we may post them on the website.



YOU MAY STILL SEND US INFORMATION ON YOUR MUTANT VARIETY AND WE WILL UPLOAD THEM INTO THE SYSTEM, IF IT IS DIFFICULT FOR YOU TO DO SO.

IMPORTANT!

AUTHOR'S GUIDELINES FOR MANUSCRIPT SUBMISSION TO PLANT MUTATION REPORTS

Articles will be indexed and abstracted in CABI!

Scope

Plant Mutation Reports (PMRs) publishes (mini) reviews, short communications and complete research papers in all areas of plant mutation research which focuses on mutagenesis, mutation induction, mutant characterization, and mutant applications. It also publishes description papers on mutant germplasm and mutant varieties. Papers on social-economic impact analysis of induced mutations and mutant varieties are also accepted.

Style

The manuscript should be concisely written with the following sections:

Title page

- Title: the title should be as short as possible, but should contain adequate information regarding the contents.
- Authors: Initials of given name followed by full family name.
- Affiliation(s)/Address(es):
- Email address: the corresponding author's email address should be given.

Abstract and Keywords

A brief and informative summary of the paper not exceeding 150 words. Optional for short communications. Each paper should have 3-5 keywords.

Main text

- Review articles may be organized according to their specific requirements.
- Research articles should include: Introduction, Materials and Methods, Results (and) Discussion (this could be combined for Short communications).
- New mutant germplasm should include a short description of initial material used and the mutagen and doses applied; selection process; mutated characteristics and its genetic and agronomic analysis. Description of mutant variety should, in addition, include its performance in yield trials for varietal release and the releasing committee, when applicable.

Acknowledgements

- Acknowledgements of grants, support etc, should follow the text and precede the references.

References

The literature references should be cited either as John (1990) for single author paper, John and Johnson (2000) for papers with two authors, or John *et al.* (2000) for papers with more than two authors throughout the text, and alphabetically listed in the Reference following the style shown below:

- Periodicals: Shamsuzzaman K.M. and Shaikh M.A.Q. (1991) Early maturing and high seed yielding chickpea mutant. Mut Breed Newslett 37: 4-5.
- Books (edited by someone other than author of article): Maluszynski M. (1990) Gene manipulation in plant improvement. In: Gustafsson J.P. (ed), Induced Mutations in Plant Improvement. Plenum press, New York. Pp239-250.
- Books (identical author and editor) van Harten A.M. (1998) Mutation Breeding, Theory and Practice. Cambridge University Press, Cambridge, U.K. pp. 237-240.

Figures and Tables

- All tables and figures, e.g. photographs, graphs and diagrams should be referred to as either 'Table' or 'Fig.' and be numbered consecutively (1, 2, etc.) in the text.
- In tables, footnotes are preferred over long explanatory material in the heading or table body. Such explanatory footnotes, identified by superscript letters, should be placed immediately below the table.
- Do not use boxes; use horizontal lines only. Figures and tables should be placed on separate pages.

Units and symbols

The standard SI units and symbols should be used throughout (www.scenta.co.uk/tcaep/science/siunit/index.htm).

Publication

This is a biennial publication of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture of the International Atomic Energy Agency, Vienna, Austria.

Submission

Electronic submission through email is encouraged. Before a permanent address is set for this, you may submit it to the IAEA's official email address: Official.Mail@iaea.org.

IAEA International Atomic Energy Agency

Plant Breeding and Genetics Newsletter

No. 22 January 2009

The PBG Newsletter is prepared twice a year by the Plant Breeding and Genetics Section, Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf.

International Atomic Energy Agency
Wagramer Strasse 5, P.O. Box 100,
A-1400 Vienna, Austria

Printed by the IAEA in Austria,
January 2009

08-48425