SEED INFO

Official Newsletter of WANA Seed Network

ICARDA
Science for Better Livelihoods in Dry Areas

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EDITORIAL NOTE

Seed Info seeks to stimulate information exchange and regular communication between seed staff in the Central and West Asia and North Africa (CWANA) region and beyond. Its purpose is to help strengthen national seed programs and thus improve the supply of high quality seed to farmers.

The West Asia and North Africa (WANA) Seed Network provides information on activities relating to global and/or regional cooperation and collaboration that facilitate the development of a vibrant regional seed industry. In this issue of *Seed Info*, we report on the international Workshop on Community Seed Production organized by the Food and Agriculture Organization of the United Nations (FAO) jointly with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Center for Agricultural Research in the Dry Areas (ICARDA), and Catholic Relief Services (CRS). One objective of the workshop was to obtain a better understanding of community seed production (CSP) practices worldwide by exchanging experiences from different regions. Another was to develop a roadmap and strategies for enhancing the uptake and effective implementation of CSP in developing countries. The workshop explored the scope, opportunities, and challenges in CSP and identified the critical points necessary for effective implementation. We also report on the Economic Cooperation Organization Seed Association (ECOSA) seed congress and business forum and seed courses conducted by the Seed Section of ICARDA to strengthen human resource development within the region.

In the **NEWS AND VIEWS** section, Niels Louwaars from the Dutch Seed Association, Plantum, presents an article entitled *Seed Legislation – Creating Space for Diversity*. The article highlights the need for and challenges in creating flexible legislation to create a diversity of seed systems using the European Union (EU) as an example. While in the past, the EU compulsory variety registration and seed certification system was geared towards more uniform standards and approaches, this notion is being challenged because of the diverse needs of the seed industry. The emergence of organic farming, the need for conservation of traditional varieties, renewed interest in local or regional products, etc. are issues that need to be accommodated within the new legislation. Other news in this section comes from regional and/or international organizations, such as the African Union, the International Seed Testing Association (ISTA), and the International Union for the Protection of New Varieties of Plants (UPOV).

The section on **SEED PROGRAMS** includes news from Ethiopia, Morocco, and Pakistan. From Ethiopia, we report on the progress of an ICARDA-EIAR (Ethiopian Institute of Agricultural Research) project entitled '*Rapid Deployment of Rust Resistant Wheat Varieties for Achieving Food Security in Ethiopia'*. This project, funded by the US Agency for International Development (USAID), is designed to deploy rust resistant wheat varieties rapidly. The project works with federal and regional agricultural research institutes, federal and regional public seed enterprises, private seed enterprises, farmers' seed associations, regional, zonal, and district Bureaus of Agriculture, and most importantly, farmers. There are also reports on the release of cereal and legume varieties by national agricultural research systems (NARS) from various countries. It is expected that the seed of these new high yielding and (a)biotic stress tolerant varieties will become available to farming communities at large thus increasing agricultural production and productivity and ensuring food and nutritional security in the respective countries.

The **RESEARCH** section of *Seed Info* captures information on adaptive research or issues relevant to developing seed programs in the CWANA region and beyond. This issue features an article entitled '*Effects of Different Moisture Content and Temperature on Storability of Pearl Millet Seeds'* by Manish K. Vijay, Sushil Pandey, and Chithra D. Pandey, from the National Bureau of Plant Genetic Resources, New Delhi, India. The paper discusses experiments on the storability of pearl millet seeds under varying moisture content and temperature. The results demonstrated that ultra-drying is an effective method for extending seed longevity during storage under ambient and medium-term conditions.

Seed Info encourages the exchange of information between the national, regional, and global seed industries. We encourage our readers to share their views and news through this newsletter. Your contributions, in Arabic, English, or French, are most welcome.

Happy New Year

Zewdie Bishaw, Editor

WANA SEED NETWORK NEWS

This section presents information on the WANA Seed Network, including network activities and reports from meetings of the Steering Committee and the WANA Seed Council.

International Workshop on Community Seed Production

The FAO, jointly with ICRISAT, ICARDA, and CRS, organized an international Workshop on Community Seed Production from 9–11 December 2013 in Addis Ababa, Ethiopia. Despite strong support for seed sector development in the 1970s/1980s to strengthen agricultural research centers, extension services, and public seed corporations, recent efforts to develop the private seed sector by AGRA-PASS (for example in Africa), on-farm seed saving is a well-established tradition among farmers in developing countries. They self-source about 80% of their annual seed needs for different reasons.

Convincing farmers to pay willingly for quality seed coming from the new private enterprises remains a formidable challenge. Moreover, private sector interests do not cover many of the food security crops of Africa and other continents. Farmers rely on local seeds of low-margin and high-volume crops, which are also expensive to transport and distribute. Such crops only attract the formal seed sector when subsidies are applied. The same holds for the seed supply for minor or neglected crops. The public sector, however, tries to fill this space in the seed system by responding to those seed needs not adequately met by private enterprises or where public sector efforts do not crowd out the potential for private sector profit; although this response is mainly for major food crops. In essence, both the public and private sectors cannot fulfill the entire seed needs of farmers, especially smallholders located in remote areas and having limited purchasing power.

Civil society – independent of the private sector and government – is playing a unique role in promoting and advocating CSP for the benefit of small farmers. In many instances, farmer groups, farmer associations, and other community-based institutions support seed related activities that are complementary to the public and private sectors. The CSP approach is being widely used to deliver seeds to small farmers although there is no clear definition or criteria for assessing success. Within this context, in 2012, the FAO commissioned a study by CRS reviewing the status and trends in CSP initiatives in order to devise an appropriate working definition, identify key criteria for success, and possible areas of improvement in different situations. An attempt was made to examine different aspects, such as variety selection, seed quality, and seed marketing, which are not fully understood or explained within the context of seed production at the community level.

The objective of the workshop was to obtain a better understanding of CSP practices worldwide by exchanging experiences from different regions; and developing a roadmap and strategies for enhancing the uptake and effective implementation of CSP in developing countries. This would contribute to improved and sustainable crop production, food security, and livelihoods, especially in rural farming communities. The workshop explored the scope, opportunities, and challenges in CSP and identified the critical points necessary for effective implementation.

Participants of community seed production workshop

The workshop brought together speakers or resource persons with a wide range of international expertise in CSP from different parts of the world. The sessions consisted of oral presentations, field visits, group work, and panel discussions. The workshop expected to establish a baseline for CSP in the different regions. It also sought to devise a roadmap with possible actions for establishing viable and constructive CSP programs in developing countries, including the essential role of women. The main issues arising from the workshop will

be compiled into an appropriate document or meeting report. It is expected that this document will provide an agreed definition of CSP and a road map for enhancing the uptake and implementation of CSP. Additionally it will contain key messages on issues related to CSP, which could be widely used as a guide in implementing relevant projects.

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Fifth ECOSA Seed Congress and Business Forum

The fifth ECOSA Seed Trade Congress was held 2−3 October 2013, in Bishkek, Kyrgyzstan. ECOSA is a regional seed association established by ECO member countries including Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, Turkey, and Uzbekistan. The FAO and ICARDA are observers of the Association.

The congress was held under the theme '*plant breeding and breeders' rights*'. The participants made presentations on research and development (R&D) in member countries and discussed the possibilities of introducing plant breeder's rights for supporting R&D in respective countries. During the meeting, it was decided to establish a working group, with one representative from each country, to prepare national and regional synthesis reports to be submitted to the ECO Secretariat. These reports would constitute the agenda for the ministerial summit of the member countries. The meeting also discussed how to enhance the role of the private sector in the seed industry of member countries.

Seed sector development is one of the most important areas in the ECO region and has tremendous potential for growth with an estimated annual seed trade of USD 27 million. The FAO and ICARDA are promoting harmonization of polices and legislation to achieve synergies and facilitate regional seed trade.

The representatives of Kyrgyzstan, Turkish Seed Union (TURKTOB), and the FAO made significant contributions in organizing the congress.

Participants of ECO Seed Congress and Business Forum

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Workshop on Formulation of Seed Policy and Harmonization of Legislation

The FAO sub-regional office for Central Asia (FAO-SEC), in cooperation with ECOSA, the Ministry of Agriculture and Amelioration of the Kyrgyz Republic, and the Central Asia Seed Association, organized the regional workshop on the formulation of seed policy and harmonization of legislation on 1−3 October 2013 in Bishkek, Kyrgyzstan. The meeting was organized in parallel with the fifth ECOSA Seed Trade Congress and Business Forum and within the framework of the regional project *Seed Sector Development in Countries of the ECO*, funded jointly by the FAO-Turkey Partnership Program and ECO.

The project sought to develop seed policy in the ECO region. The FAO provides technical assistance to the development of seed policy strategy and development of the seed sector. The final goal is to enhance consistency with other national policies and plans for economic and rural development of the countries. Developing the legal framework and seed policy will improve food security by increasing production, enhancing regional trade, and exchanging germplasm and experience in breeding. The key players include ECO countries, Ministries of Agriculture, ECOSA, national seed trade associations, the public and private sectors, seed growers, seed processors, and seed dealers who are actively engaged in improving the sector.

The project framework includes the following:

- Evaluating the current situation in the seed sectors at the regional and national level
- Developing seed policy documents at the regional and country level and implementing arrangements
- Contributing to the development of the seed sector at a regional level.

The main discussion points during the meeting included:

- Government support for and facilitation of the fostering of interregional trade and developing joint projects in the agricultural and seed sectors
- Establishment of a plant variety protection mechanism to ensure breeder's rights and introduction of an adequate royalty collection system
- Address export/import constraints imposed by the current legislative framework, particularly of seeds from neighboring countries that are not in compliance with customs clearance procedures
- Develop a common variety registry similar to the Customs Union for Russia and Ukraine
- Sign a Memorandum of Understanding with the National Union of Plant Breeders and Seed Producers of the Russian Federation and the Seed Association of Kyrgyzstan.

Participants of policy formulation and harmonization of legislation workshop

Specialists responsible for the formulation of seed policy and harmonization of seed legislation from ECO member countries attended the workshop. About 100 participants, including representatives from government ministries from Afghanistan, Azerbaijan, Kyrgyzstan, Kazakhstan, Tajikistan, Turkey, and Uzbekistan and from the FAO, participated in the workshop.

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ICARDA Organizes Seed Courses

ICARDA organized a training course on Small Scale Seed Enterprise Development and Management 27 October−10 November 2013 in Amman, Jordan. Twenty-one participants from six countries (nine from Iraq, eight from Afghanistan and one each from Jordan, Morocco, Tunisia, and Sudan) participated in the course. Some of the participants are associated with seed production and marketing programs in their respective countries while one participant from Iraq is a farmer entrepreneur in the seed business. The course was supported by the Australian Centre for International Agricultural Research (for participants from Iraq), EU-IFAD (International Fund for Agricultural Development) (for participants from Jordan, Morocco, Sudan and Tunisia), and the Japanese International Cooperation Agency (for participants from Afghanistan).

The objective of the course was to train individuals supporting farmer-based seed production and marketing; providing them with theoretical knowledge and practical experience in the technical, managerial, financial, and commercial aspects of the seed business. The course was designed to cover two components of the training − small-scale seed enterprise development and management, and seed marketing.

During the first week, the participants were trained in the theoretical aspects of seed enterprise formation, preparation of business plans, different costs and benefits of the seed business, and assessing the financial viability of seed enterprises. The introductory topics covered five broad areas constituting the main elements of seed system analysis: (i) Institutional, organizational and managerial aspects; (ii) Technical aspects; (iii) Financial and commercial aspects; (iv) Economic, social and environmental aspects; (v) Seed systems and seed policy instruments. The practical exercises included during the first week were on the organizational structure of seed enterprises, preparing business plans, calculating

depreciation and present worth factors, and financial viability analysis of enterprises. The participants were grouped and each group prepared and presented a business plan for a proposed seed company.

The topics of the second week focused on seed marketing – market research, seed product portfolio analysis, strategies to be followed for seed pricing, distribution and promotion, market margins, and profitability analysis of a seed enterprise. The practical exercises included estimating processing and storage costs, and the profitability analysis of a seed enterprise.

Participants of the seed enterprise development and management course

The technical trips to Trust Seed Company at Dier Alla and the Mushagar research unit of the National Center for Agricultural Research and Extension (Jordan) were very useful. The company and research staff explained the breeding programs, seed processing, and the refrigerated storage facility. The seed company produces vegetable seeds (cucumber, eggplant, and tomato) and sells mostly to Morocco and Algeria.

Training was provided in appropriate techniques of seed system analysis and the economics of seed production and marketing to enable them to organize follow-up courses for farmer entrepreneurs. The participants were given practical exercises to help them understand the theory covered in the lectures.

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NEWS AND VIEWS

News, views, and suggestions relating to the seed industry are included in this section, which is a forum for discussion among seed sector professionals.

Seed Legislation – Creating Space for Diversity

Many countries have introduced national seed legislation based on the compulsory registration of varieties, compulsory certification of varietal identity and purity, and other seed quality standards. The Directives of the European Union, or the national seed laws of EU members, have been an important inspiration for similar laws in many countries. Now this standard practice is to change in its scope and objectives.

The EU is now reviewing its seed legislation and this review shows that regulating the seed market is not as straightforward as many would have thought. In principle, under the compulsory system, both registration – distinctness, uniformity and stability (DUS) – and performance – value for cultivation and use (VCU) – testing are required for commercialization of some crop varieties. However, the principles of variety registration and seed certification are implemented differently for different crops. The general rule is that both of these requirements (DUS and VCU) apply to the seed of most field crops, but for vegetable seeds only variety registration is required (not VCU); while for ornamental seeds neither of these tests is compulsory. This has been a common practice, based on a number of crop-based Directives. Now all of these Directives are merged into one Plant Reproductive Materials (PRM) regulation. Some challenges emerge, for example, with respect to pasture (lawn and sports field) grass seeds. These need to be certified, but might be considered ornamental. Similarly, several field and vegetable crop varieties, such as sunflowers and ornamental cabbages, are selected specifically for their ornamental use. How can one differentiate between these different crop varieties?

A more important debate has now emerged between the varietal needs of different cropping systems. Besides conventional production, there

is a growing trend towards organic production, and for the cultivation of regional and traditional products. Europe had already introduced the concept of 'conservation varieties' in order to comply with its international obligations for biodiversity conservation; allowing the marketing of seeds of old uniform varieties and landraces. Thus, the market has to allow for varieties that have been removed from the national list and even for non-uniform ones. However, it is to be strictly limited in terms of quantity and region of origin, and landraces had to undergo some form of description in order to identify them. This was necessary to avoid large quantities of untested seed entering the market, which would challenge the trust of the farmer in the formal seed sector.

In the present process of reforming the law, new demands are being tabled to allow for new 'varieties' of heterogeneous materials and to create space for the products of participatory and farmer-breeding. The description of such materials might be difficult because some farmers would like their materials to evolve with nature and their own continuous re-selection. This could also create opportunities for regular breeders, whose varieties are rejected because of a lack of uniformity or agronomic performance, to market their seed. This could challenge the whole seed regulatory system and oblige farmers to place their trust in a particular supplier as if there were no seed law at all.

The challenge for the EU Commission is, therefore, to create a legal space for the necessary exemptions while keeping the regular seed quality control scheme intact and reliable. This means that different regulations should be implemented on the ground. This challenge is very similar to that faced by policy makers in countries with large numbers of smallholder farmers and where a significant proportion of seed is provided by the informal sector. Appropriate demarcation of the different seed classes, such as regulated, less regulated, and unregulated, becomes important as is educating the farmers with respect to the seed classes. If the EU manages to create clear distinctions between regulated seed and heterogeneous, niche-market, or other exempted seed classes, other countries may be able to use such examples or learn from the experience. At the same time, the EU may want to learn from examples developed elsewhere on how to accommodate the diversity of seed systems in its regulatory reform.

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Pakistan Establishes Seed Academy to Strengthen Public-Private Partnership

In Pakistan, improving access to good quality seed is critical for sustainable agricultural growth and food security. The formal seed supply has remained around 20% of the total estimated seed requirement of various crops. The role of the private sector is increasing and the number of private seed companies now exceeds 700, of which five are multinationals. Many firms have started a seed business coupled with pesticides showing the potential of the seed business in the future. However, there is a limited number of trained personnel in the seed business and there is a dire need to strengthen its human resources.

During the international seed workshop, the establishment of the Pakistan Seed Academy as a platform for strengthening the public-private partnership in seed innovations was announced. The prime objective of the academy is to strengthen human resource development in seed science and technology. Within the academy, the University of Agriculture, Faisalabad (UAF) will work with Crop Life Pakistan, the Seed Association of Pakistan, the Federal Seed Certification and Registration Department, and the Department of Agriculture on the development of the seed industry. The UAF can play an important role in providing infrastructure and trained personnel to establish an ISTA accredited laboratory which private companies can use.

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AU-ASBP/FAST Training Workshop for Seed Analysts

During the eighth Ordinary Session of the African Union (AU) in January 2007, the African Seed and Biotechnology Program (ASBP) was adopted as the continental framework for the development of the seed sector in Africa. The Forum for Africa Seed Testing (FAST), created

in March 2011, seeks to enhance the development of a quality assurance system for the seed sector, thereby contributing to the implementation of the ASBP Component 4 and the Comprehensive Africa Development Program Pillars 2 and 4.

The AU-ASBP/FAST, in collaboration with the Seed Control and Certification Institute of Zambia, organized the first International Training Workshop for Seed Analysts 13−19 October 2013 to strengthen the capacity of the technical staff from seed testing laboratories and enable them to carry out routine analyses while ensuring quality assurance principles.

Seed analysts and resource persons from 17 countries in Africa (Botswana, Burundi, Cameron, Central African Republic, Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Côte d'Ivoire, Mauritania, Seychelles, South Africa, Somalia, Sudan, Uganda, Zambia, and Zimbabwe) attended the workshop. Both theoretical principles and practical applications in laboratory seed testing were emphasized.

The workshop covered several thematic areas including the following:

- Overview of seed policies and laws in African countries
- Principles and techniques of plant breeding and variety development
- Crop variety testing, release, registration, and breeder's rights protection
- Seed certification schemes and quality assurance
- Seed formation, development, maturation, and biochemistry
- Seed harvesting, processing, treatment, and storage
- Principles and practices of inspection of seed field and processing plants
- Principles and practices of seed sampling
- Techniques in purity analysis, moisture content determination, germination and seedling evaluation, seedling vigor, and tetrazolium test
- Principles and practice of seed health
- Maintenance of the basic equipment for a seed-testing laboratory.

This workshop proved very important, especially to those AU countries that are lagging behind in laboratory seed testing, as an instrument of seed quality control and certification. The need for good seed policies and seed laws was re-iterated; without these, the seed sector will remain stagnant. The workshop also motivated participants to review their seed systems, to identify gaps, and to suggest changes accordingly.

The workshop participants recommended the following:

- Laboratories which comply with the standards and norms of the ISTA should setup a quality assurance system, apply for ISTA membership, and work towards accreditation
- Future workshops should be planned to ensure that those who are trained pass on their training to relevant staff in member states collaborating with FAST, AU-ASBP, and FAO
- French, Spanish, Portuguese, and English translations of the materials should be available so that participants from these different linguistic backgrounds can be fully involved
- Focal persons for FAST already exist in 17 African countries. Other countries are encouraged to nominate their focal persons by contacting AU-ASBP in order to benefit from future training and capacity strengthening programs.

Participants of the FAST seed testing training workshop

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News from ISTA

ISTA Rules for Seed Testing 2014

The online International Rules for Seed Testing 2014 are close to being published on the Ingentaconnect web site. The pdf files of the

Rules 2014 have been sent to Ingentaconnect, and are being processed. The Rules 2014 are expected to be available online from Friday, 10 January 2014. Publication will be announced in the newsletter and on the home page of the ISTA web site. Until then, information updates will be posted at https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--396.html

ISTA accreditation

A new version of the document 'ISTA Laboratory Accreditation Standard' has been posted on the ISTA website and can be downloaded by following the link: https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--397.html. Similarly, a new version of the document 'ISTA Accreditation and Scope of Accreditation Policy' has been posted. The new document can be found at https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--398.html. All accreditation related documents can be downloaded from the following site free of charge: https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--399.html.

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News from UPOV

Law for the Protection of New Varieties of Plants of Bosnia and Herzegovina

The International Union for the Protection of New Varieties of Plants (UPOV) Council at its 47th ordinary session, held in Geneva 24 October 2013, decided that the Law for the Protection of New Varieties of Plants of Bosnia and Herzegovina was in conformity with the provisions of the 1991 Act of the UPOV Convention. Bosnia and Herzegovina is now in a position to deposit its instrument of accession to the 1991 Act of the UPOV Convention.

Ghanaian plant breeders' bill

The UPOV Council noted that the Ghanaian plant breeders' bill presented to the parliament incorporated the changes proposed in the decision of the Council of 1 November 2012. The Council agreed that the additional changes, made during the first reading of the bill by the Ghanaian parliament in June 2013, did not affect the substantive provisions of the 1991 Act of the UPOV Convention. Once the bill is adopted and the law is in force, Ghana will be in a position to deposit its instrument of accession to the 1991 Act of the UPOV Convention.

Statistics on plant variety protection

Fifty-six members of the Union now offer protection to all plant genera and species (cf. 53 in 2012), with 15 members offering protection to a limited number of plant genera and species. A new record of titles is in force – 99,409 recorded in 2012, – representing a 4.6% increase on the figure for 2011 (95,041). The UPOV Council noted that there had been a 1.1% increase in the number of applications for plant variety protection (13,867 in 2012; 13,714 in 2011). This corresponds to a 0.7% decrease in the number of applications by residents (8,751 in 2012; 8,813 in 2011) and a 4.4% increase in the number of applications by non-residents (5116 in 2012; 4901 in 2011). The number of titles granted decreased from 10,065 in 2011 to 9822 in 2012 (a decrease of 2.4%).

Cooperation in examination of new plant varieties

In 2013, the number of plant genera and species for which there were agreements between members of the Union for cooperation in the examination of DUS totaled 1997; there were 1991 in 2012.

Adoption of information and guidance documents

The Council adopted the following documents:

- Guidance for the Preparation of Laws based on the 1991 Act of the UPOV Convention (Revision)(document UPOV/INF/6/3)
- Explanatory Notes on the Definition of Breeder under the 1991 Act of the UPOV Convention (document UPOV/EXN/BRD/1)
- Explanatory Notes on Acts in Respect of Harvested Material under the 1991 Act of the UPOV Convention (document UPOV/EXN/HRV/1)
- Glossary of Terms Used in UPOV Documents (Revision) (document TGP/14/2)
- Guidance on the Use of Biochemical and Molecular Markers in the Examination of Distinctness, Uniformity and Stability (document TGP/15/1)

- Exchangeable Software (Revision) (document UPOV/INF/16/3)
- List of UPOV/INF-EXN Documents and Latest Issue Dates (Revision) (document UPOV/INF-EXN/5)
- List of TGP documents and latest issue dates (Revision) (document TGP/0/6).

All adopted documents are included in the UPOV Collection (see http://www.upov.int/upov_collection/en/).

UPOV Trilogy publication

The UPOV Trilogy publication compiles three events held in Geneva in 2011 and 2012:

- Symposium on Plant Breeding for the Future (2011)
- Seminar on Plant Variety Protection and Technology Transfer: the Benefits of Public-Private Partnership (2011)
- Symposium on the Benefits of Plant Variety Protection for Farmers and Growers (2012).

The Executive summary and the UPOV publication are available on the UPOV website at: http://www.upov.int/about/en/list_publications.html.

For further information about UPOV, please contact the UPOV Secretariat: tel: +41-22-338 9155; fax: +41-22- 733 0336; e-mail: upov.mail@upov.int; website: www.upov.int.

CONTRIBUTIONS FROM SEED PROGRAMS

In this section we invite national seed programs, projects, universities, and regional and international organizations to provide news about their seed related activities.

Rapid Deployment of Rust Resistant Wheat Varieties in Ethiopia

On-farm seed multiplication with farmers

Ethiopia is the largest wheat producer in sub-Saharan Africa with an area of 1.7 million ha and an annual production of over 3 million tonne. However, rusts have become major production constraints in recent years. ICARDA, in partnership with EIAR, is implementing a project entitled '*Rapid Deployment of Rust Resistant Wheat Varieties for Achieving Food Security in Ethiopia*'.

The project, funded by USAID, focuses on the rapid deployment of rust resistant wheat varieties. It is working with federal and regional agricultural research institutes; federal and regional public seed enterprises, private seed enterprises, farmer seed associations, regional, zonal, and district Bureaus of Agriculture, and, most importantly, farmers. The project focuses on rust resistant wheat varieties and supports:

- Identifying, fast track testing and release of new varieties
- Popularization and demonstration of new varieties and associated technologies
- Early generation accelerated seed multiplication (pre- and post-) of promising lines or released varieties (breeder, pre-basic, and basic seed)
- Large-scale accelerated certified seed multiplication linking to the public and/or private seed sector
- Targeted small-pack seed distribution and on-farm seed multiplication with smallholder farmers.

Apart from all these activities, one of the unique features of the project is the on-farm seed multiplication of rust resistant wheat varieties. The farmers are organized into clusters and provided with the seed of improved rust resistant varieties. With the support of development agents and the extension services of the *Woreda* Bureau of Agriculture, they engage in on-farm seed multiplication, popularization, and dissemination through formal and informal channels. Under this project, farmers in 45 Agricultural Growth Programs (AGPs) and non-AGPs in the important wheat producing *woredas* of Amhara, Oromia, Tigray, and the Southern Nations and Nationalities region were engaged in seed multiplication. The wheat varieties include Kakaba, Danda'a, Hoganaa, Shorima, Hulluka, Digalu, MadaWolabu, Tuse, Ude (Durum), and Yerer (Durum) released at the national level, Gassay, Menze, Sinkegna, and Tay released in the Amhara region, and Mekele-1 and Mekele-2 released in the Tigray region.

During the last three years, the project distributed 714 tonne of the seed of rust resistant wheat varieties for on-farm seed multiplication, to more than 16,767 farmers (nearly 8% women) in 45 districts of the four major wheat-growing regions. It produced about 17,024 tonne, which was shared through

informal seed exchange or seed sale through formal sector. This directly benefitted over 100,000 households. The amount is sufficient to plant close to 10% of the wheat area (113,493 ha). The estimated multiplier effect every year is enormous as the seed of new rust resistant varieties is spread by lateral diffusion from farmer to farmer, covering up to 80% of the wheat area in the target districts and with spill-over to neighboring districts. The average grain yield of rust resistant varieties on farmers' fields reached 3.5 tonne − ranging from 2.5 to 4.2 tonne. This is a consequence of using rust resistant varieties and associated technologies.

Several in-country training courses on awareness of wheat rusts and quality seed production were provided to national agricultural research systems (NARS), public/private sector seed producers, development and extension agents, and farmers. Moreover, the NARS were provided with infrastructure to strengthen/increase their capacity in the production and supply of quality seed of early generation.

On-farm seed multiplication supported by the USAID project − an outstanding wheat crop: Top (North Shoa) and bottom (Arsi) zones

In addition, the project distributed seed of rust resistant wheat varieties through technology out-scaling activities directly benefitting over 18600 household members.

The project also provided basic seed of rust resistant varieties to federal and regional public seed enterprises, emerging private seed companies, farmer seed association which further multiplies the seed and distribute to the farmers.

Popularization of rust resistant wheat varieties

The project also supported the popularization and demonstration of rust resistant wheat varieties using Farmer Training Centers and EIAR pre-scaling out activities and seed multiplication fields. Thousands of farmers became familiar with new rust resistant wheat varieties and the associated technologies to enhance production and productivity, thus contributing towards ensuring food security. One such example is the field day organized in Gimbichu *woreda* in East Shoa Zone.

Gimbichu *woreda,* in the central highlands is ideal for wheat production; it generally produces a surplus. However, 2010 was different as farmers were caught off-guard and unprepared and suffered a major setback with an infestation of yellow rust, which severely affected wheat production across the district. Farmers had to revert to other means to overcome production shortages, such as selling livestock.

In 2011, an ICARDA-EIAR project initiated an aggressive campaign to reach out to farmers, working closely with the *Woreda* Administration and Bureau of Agriculture. Farmers were provided with seed of newly released rust resistant varieties to multiply. In addition, the project also provided seed to local seed producers' associations operating at the district level. With favorable climatic condition in 2013, farmers are expecting a bumper wheat harvest bringing them back from the brink of devastation. Between 50 and 80% of the area is now planted to rust resistant varieties.

On 12 November 2013, the district organized a field day where stakeholders from the research institutes, public seed enterprises, development agencies, and extension services and senior administrators from the district and donor agencies participated. Field visits were made to activities supported by the project.

These included a Farmer Training Center (where new rust resistant wheat varieties, among others, were demonstrated), a Women's Seed Multiplication Group program, and the Hawwi Boru Seed Multiplication Group program (where new rust resistant wheat varieties were multiplied). Farmers explained and shared their experiences of the new rust resistant varieties and their expectations for the season.

The field day was followed by a general meeting of the stakeholders where the lessons learned were discussed. This meeting was followed by a panel discussion, and question and answer sessions led by EIAR, ICARDA, and the Bureau of Agriculture. At the end of the meeting, the Gimbichu District Administration and Bureau of Agriculture honored key stakeholders who had contributed to the agricultural transformation program. They presented them with 'Certificates of Appreciation'. Among the key stakeholders honored was ICARDA. Dr Zewdie Bishaw, who represented ICARDA during the field day, received the Certificate of the Appreciation.

Field day organized in Gimbichu Woreda: Women's Seed Producers Group (top) and stakeholders' discussion after the field day (bottom)

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Pakistan Organizes Seed Workshop

An international seed workshop on 'Seed Physiology, Production, and Management' was held 1−4 October 2013 at the UAF. The main purpose was to strengthen the capacity of the seed industry in Pakistan. Among the attendees were representatives of multinational seed companies (ICI, Pioneer, Monsanto, Syngenta, and Bayer Crop Sciences); the domestic public and private seed sectors; NARS (Ayub Agricultural Research Institute [AARI], National Agricultural Research Center, and Fodder Research Institute); and agricultural universities (University of Haripur, University of Sarghoda, Shaheed Benazir Bhutto University, and Pir Mehr Ali Shah Arid Agriculture University). Altogether, there were about 96 participants from 36 national and five multinational seed companies.

The workshop covered a wide range of topics from seed development to production, harvesting, processing, seed enhancements, seed storage and longevity, seed biotechnology, varietal identification, and detection of genetically modified organisms. A team of international and national experts from the University of Agriculture, AARI, National Institute for Biotechnology and Genetic Engineering, and the Ministry of National Food Security and Research delivered the lectures.

The workshop agenda comprised three technical sessions, each with three or four lectures from local and international seed specialists. After these technical sessions, the participants received hands-on practical training in seed sampling, purity analysis, viability (tetrazolium test), vigor (cold test), seed health testing, etc. according to the ISTA Rules for Seed Testing. Varietal identification, using DNA markers, was demonstrated at the Centre of Agricultural Biochemistry and Biotechnology laboratory and seed health testing at the laboratory of the Plant Pathology Department.

The Fulbright Program, the Endowment Fund Secretariat (US Department of Agriculture), Pakistan Science Foundation, and

the private sector – Crop Life Pakistan, ICI Pakistan, Emky Seeds, Sohni Dharti Seeds, Rachna Seeds, and Auriga Group of Companies – supported the workshop.

Participants of the international seed workshop

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Agricultural Cooperatives as Entry Point for a Farmer-based Seed Enterprise for Legumes

In Morocco, the public seed sector focused on cereal crops and in favorable environments. Consequently, subsistence-farming communities had limited access to quality seed of improved varieties for both cereals and legumes. Limited access to quality seed by smallholder farmers has significant effect on national food security as their production still covers a large proportion of the national requirements.

Under the Institut National de la Recherche Agronomique (INRA)-ICARDA-Office Chérifien des Phosphates Foundation (OCPE) project (Morocco) and EU-IFAD (West Asia and North Africa), ICARDA is working to establish a farmer-based seed enterprise for legume crops. As a result, discussions were held with farming communities and agricultural cooperatives were identified as potential local seed producers and suppliers, particularly for legumes. During the discussions, it was found that:

- All communities are organized as agricultural cooperatives, own land, are formally registered, have access to credits, and have established linkages to INRA and extension, which facilitate collective action
- Certified seed of improved legume varieties is limited and expensive. Mechanization problems, high cost of agricultural inputs, limited access to selective herbicides, etc. make legume production costs high and result in a low rate of return on investment
- High incidence of fusarium wilt, ascochyta blight, orobanche, leaf minor and bruchids are major constraints for legume production and productivity
- The high cost of agricultural inputs and the low bargaining power of smallholder farmers, forces farmers to sell their production at low prices.

To overcome these constraints, the project mobilized farmers to gain formal recognition as private entities undertaking a seed business. These village-based seed enterprises (cooperatives) would have access to:

- Quality seed of the new legume varieties from research
- Services from extension and seed certification entities to ensure seed quality
- Seed processing and storage facilities to maintain seed quality; credit facilities, and/or revolving funds from the project for inputs and operations
- Technical backstopping and training on crop management, post-harvest operations, and business management
- Linkages created with grain traders and other market outlets for better prices.

A member of the Al Hilal Al Widad Cooperative (left) giving his views on local seed business under EU-IFAD project

The two projects will support a maximum of one pilot VBSE in each of five project target sites. Each VBSE member will produce seed of a given crop based on his/her comparative

advantages arising from the characteristics of the land and cropping system, with on-farm supervision from the technical site coordinators of the project and the local extension and seed quality assurance services. Support to the VBSEs will take the form of provision of seed, inputs, supervision, seed processing and storage facilities, and training. The VBSEs may cover at least part of the investments through in-kind contributions. The five VBSEs are envisaged to have the capacity to produce 500 tonne of seed. Data on all inputs and operational costs will be collected for a simple analysis of profitability and to assess the sustainability of the enterprises.

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Varietal Releases for Cereals and Legumes – 2013

ICARDA breeders had yet another fruitful year in 2013. Several cereal and legume varieties were released from the productive partnerships between ICARDA and NARS across the globe. It is expected that seed of these new high yielding and (a)biotic stress tolerant varieties will become available to farming communities at large and increase agricultural production and productivity, thus ensuring food and nutritional security in the respective countries.

List of cereal and legume varieties released by NARS partners in 2013

Crop	Variety	Country
Bread wheat	Shisham Bagh 013	Afghanistan
	Dehdadi 013	Afghanistan
	Guhar	Afghanistan
	Koohdasht	Afghanistan
	Zagras	Afghanistan
Durum wheat	Lahan 3	Lebanon
	Berdawni	Lebanon
	Ghzayyel	Lebanon
Winter wheat	Tak-Ab	Iran
Barley	Balkh 013	Afghanistan
	Shamal 013	Afghanistan
Barley	Gudratli 48	Azerbaijan
	Garabakh33	Azerbaijan
Faba bean	Gora	Ethiopia
	Shendi	Sudan
	Marawi	Sudan
Chickpea	Rabat 013	Afghanistan
	Baghlan 013	Afghanistan
	Sultan	Azerbaijan
	FLIP97-7C	Lebanon
	FLIP97-706C	Lebanon
	Ghab5	Lebanon
	Hasanbey	Turkey
	Seckin	Turkey
	Arda	Turkey
Lentil	Binamasur-7	Bangladesh
	Dembi	Ethiopia
	IPL316	India
	VL Masoor 516	India
	Boulifa	Tunisia
	Bozok	Turkey
	Gümrah	Turkey
	Karagül	Turkey
	Tigris	Turkey

RESEARCH NOTES

This section contains short communications on practical research or relevant information on agriculture or seed science and technology.

Effects of Different Moisture Content and Temperature on Storability of Pearl Millet Seeds

Manish K. Vijay, Sushil Pandey and Chithra D. Pandey[1]

Abstract

Seeds of two pearl millet genotypes, PUSA 443 and PUSA 415, were dried to 7, 5, and 3% moisture content (mc) and stored in medium-term storage (8°C) and ambient condition (25−28°C), for different storage periods (1, 3, and 6 month). After storage, germination and vigor parameters were tested at regular intervals. The results showed that the pearl millet genotypes maintained a higher percent germination when dried to 3% mc, followed by those dried to 5 and 7% mc, than the control (10.5% moisture). The electrical conductivities (ECs) of ultra-dry (3% mc) seeds and the control seed showed similar differences. The

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results clearly indicate that mcs of 3 and 5% are beneficial in maintaining the vigor of pearl millet seeds. The results also indicated that pearl millet seeds can be dried to a mc of 3−5% and stored safely at the ambient temperature. Therefore, ultra-drying is suggested as an effective method for extending seed longevity under ambient and medium-term storage conditions.

Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a very important millet crop of India grown on an area of 8.7 million ha with a production of 10.1 million tonne. India is considered a secondary center of origin for pearl millet with many distinct genotypes growing throughout the country. Pearl millet is gaining importance for food, feed, and fodder security in drought prone areas and is expected to play an important role in dry lands and regions adversely affected by climate change.

Pearl millet seeds are harvested at a high mc (15−18%) and need to be dried to 5−7% before storage to maintain their viability. The longevity of seeds depends on the amount of water they contain and the temperature under which they are stored. In general, the lower the moisture content, the longer the longevity (Harrington, 1972). However, there is a limit to which orthodox seeds can be dried; further drying resulting in no additional benefits. Ultra-dry seed storage is a technique for decreasing the seed moisture content to less than 5% and storing it at ambient temperatures. However, drying seed beyond the critical moisture content can be detrimental to viability and this critical level of mc varies among species (Hu *et al.*, 1998).

The present study was carried out to determine the optimum moisture content to which pearl millet seed can be dried and to investigate to what extent the seed quality parameters are affected by the different moisture contents of the genotypes stored at different temperatures.

Materials and methods

The experimental material consisted of two pearl millet genotypes, PUSA 415 and PUSA 443. The seeds of two genotypes were dried in a silica gel to reduce the moisture content to 7, 5, and 3%. Each group of seeds was kept inside a muslin cloth bag and placed over an activated silica gel to achieve the desired moisture content. The desiccators were made moisture proof by sealing with silicon wax and kept at ambient conditions. The seeds, kept in different desiccators, were weighed after an interval of 4−5 days. The moisture content was calculated using the following formula (Rao *et al.*, 1994):

Final seed weight = Initial weight of seeds × (100-Initial moisture content)/(100-Target moisture content)

The final moisture content was determined at a high constant temperature method as per ISTA Rules (ISTA, 2011). When the moisture content reached the required target, the seed lot in each moisture category was divided into two parts, packed in laminated aluminum foil packets, hermetically sealed, and stored at a room temperature ranging between 22 and 25°C until the end of the whole drying process. At the end, the seed lots were divided into two sets. One set was stored at ambient conditions (25−28°C) and the other at medium-term storage (8 ± 1°C) conditions. After storage, the seeds were assessed for viability, vigor, and EC.

Four replicates of 50 seeds were tested for germination in moistened rolled paper at 25 ± 1°C using a germinator. A final count was taken on day nine and the number of normal seedlings was expressed as percent germination. The seedling lengths (cm) of ten randomly selected seedlings were measured. The seedlings were dried in a hot air oven for 24 hours at 80°C and their dry weight was measured (mg). From the results of the standard germination test, the vigor index was calculated as follows (Adbul-Baki and Anderson, 1973):

Vigor Index = Germination % x Seedling length (cm)

For the EC tests, 50 seeds were soaked in a beaker, containing 50 ml de-ionized water and kept at 25°C. The EC of the seed leachate was measured using a digital conductivity meter after 24 hours and expressed as µsiemen/cm/g of seed. The data from the laboratory experiments were analyzed statistically by adopting a factorial completely randomized design technique (Panse and Sukatme, 1985). The data, recorded as percentages, were transformed to the respective angular (arcsine) value before subjecting them to statistical analysis. Differences between means were tested for significance using least significance difference tests (LSD).

Results and discussion

In general, seeds are harvested at high mc and need to be dried before storage. Moreover, seeds lose viability and vigor during processing and storage mainly because of high seed mc (>18%). Several experiments using different species have shown that longevity may be improved if seeds are dried to 5-7% mc for safe storage.

In the present study, seeds were dried to different moisture levels and initial germination and vigor values recorded immediately before storage at different temperatures (germination of PUSA 415 was 77% and PUSA 443 was 95%). The results of germination tests after six months of storage showed a significant effect of mc and temperature on seed viability (Table-1). Seeds dried to 3% mc resulted in the highest germination percentage in both genotypes stored at 8°C. The reduction from the initial germination was only 6% in PUSA 415 (from 77 to 73 %) and about 4% in PUSA 443 (from 96 to 92%). In contrast, seeds stored at ambient condition (25−28°C) and at 10.5% mc (control) had the lowest germination percent. Seeds stored with 5 and 7% mc maintained high germination, irrespective of the storage temperature.

The results showed that the optimum moisture content for pearl millet to ensure maximum viability is between 3 and 5%, while the storage of seed with more than 7% mc had reduced seed viability. Chai *et al.* (1998) reported that the optimum mc for sesame was between 1.8 and 2.5%, for flax 3.2%, and for soybean between 4.3 and 5%. Hu *et al.* (1998) found the optimum mc was 4% for millet. Similar results for ultra-dry storage, which maintained the quality of the seeds and also improved storability, have been reported for lettuce and sunflower (Eills *et al.,* 1995), onion (Zhu *et al.,* 2001), and radish (Mukesh *et al*., 2011). However, there have been reports of significant differences in the responses of different species to ultra-dry technology, optimum mc, and storage.

The consequences of seed aging and deterioration during storage are most conspicuously manifested through changes inseed viability.There remains the possibility that even after seed germination the seedlings may not maintain their vigor and succumb to stress during the growth period. In the present study the seedling length showed significant differences among the genotypes stored at different mcs and ambient conditions (Table 2). PUSA 415 had the highest reduction in seedling length of 38% (from 26 cm to 16 cm) when a control seed sample at 10.5% mc was stored for one to six months. Similarly, in PUSA 443 the reduction in seedling length was 41% (from 30 cm to 18 cm) when a control seed sample at 10.5% mc was stored for one to six months. The least reduction in seedling length were observed in PUSA 415 and PUSA 443 seed samples stored at 3% mc. A similar pattern was also observed for the seedling dry weight and vigor index (Table 2). The seed sample stored at 8°C showed a minimal and gradual decline for these traits as the storage period increased. A similar decrease in seedling vigor index with aging has been reported for wheat, chickpea, and soybean (Agarwal and Kharlukhi 1985) and in naturally aged seeds of sunflower (Pallavi *et al.* 2003).

Poor membrane structure and the leakage of cells are usually associated with deterioration, low vigor, and poor germination. In the present study, the leaching of electrolytes increased with the duration of storage, irrespective of the genotypes (Table 3). The maximum increase in EC of the seed leachate was observed in the controls for PUSA 415 (from 237.2 to 516.5; 117% increase) and PUSA 443 (from 168.7 to 326.4; 93% increase) when the seed was stored for one to six months. The minimum increase in EC was observed in the ultra-dried seeds at 3% mc (61% in PUSA 415 and 36% in PUSA 443) and the result was at par with seed sample of 5% mc. This indicates that seed membrane degradation increased with an increase in mc and storage temperature. However, the amount of leachate varied with the genotype. Kalpana and Rao (1997) also reported that accelerated aging of pigeon pea resulted in a loss of viability and increased leakage of solute. A similar result was reported by Singh and Dadlani (2003) for soybean seeds stored under ambient conditions.

Table 1: Effects of different moisture content on germination (%) of pearl millet genotypes

Genotype	Seed storage regimes		Germination (%)		
	Seed mc	Temperature	Storage period in months		
	(%)	(°C)	1	3	6
PUSA 415	10 (control)*	Ambient	75.21(60.17)	68.28(55.75)	57.40(49.28)
	7	Ambient	78.21(62.20)	71.28(57.62)	65.34(53.96)
		8±1	78.21(62.20)	73.26(58.89)	69.30(56.38)
	5	Ambient	77.22(61.52)	74.25(59.54)	71.28(56.38)
		8±1	77.40(61.64)	74.42(59.65)	72.44(58.36)
	3	Ambient	77.22(61.52)	73.26(58.89)	72.27(58.25)
		8±1	77.22(61.52)	74.25(59.54)	73.26(58.89)
PUSA 443	10 (control)*	Ambient	95.04(77.21)	91.08(72.67)	84.15(66.57)
	7	Ambient	94.05(75.95)	89.10(70.76)	85.14(67.36)
		8±1	94.43(76.40)	90.46(72.05)	85.49(67.64)
	5	Ambient	95.43(77.70)	93.44(75.20)	91.45(73.04)
		8±1	95.43(77.70)	94.43(76.40)	92.44(74.09)
	3	Ambient	96.29(78.96)	93.31(75.05)	92.31(73.95)
		8±1	96.29(78.96)	94.30(76.24)	92.31(73.95)

Source	CD at 5%
Genotype (G)	0.22
Seed storage regimes (S)	0.42
Storage period in months (D)	0.27
G X S	0.59
G X D	0.38
S X D	0.72
G X S X D	N.S.

* Control sample maintained at between 10 and 10.5% mc during storage; Figures in parenthesis are arcsine values; CD – critical difference; N.S. – not significant

Table 2: Effects of moisture content and temperature on quality and storability of pearl millet genotypes

Genotype	Seed storage regimes		Seedling length (cm)			Seedling dry weight (g)			Vigor index		
	Seed mc	Temperature	Storage period (months)			Storage period (months)			Storage period (months)		
	(%)	(°C)	1	3	6	1	3	6	1	3	6
PUSA 415	10 (control)*	Ambient	26.08	20.87	16.15	0.0463	0.0425	0.0332	1982	1441	937
	7	Ambient	28.33	22.82	18.99	0.0422	0.0387	0.0358	2238	1643	1253
		8 ± 1	28.33	25.76	21.55	0.0422	0.0404	0.0396	2238	1906	1509
	5	Ambient	28.48	24.68	20.08	0.0477	0.0412	0.036	2221	1851	1446
		8 ± 1	28.54	25.96	23.47	0.0478	0.0467	0.0415	2226	1947	1714
	3	Ambient	28.6	24.44	21.71	0.0478	0.0451	0.0395	2231	1809	1585
		8 ± 1	28.6	26.31	22.41	0.0478	0.0462	0.0454	2231	1974	1659
PUSA 443	10 (control)*	Ambient	30.64	23.98	18.04	0.0616	0.0484	0.0384	2941	2206	1533
	7	Ambient	31.48	26.84	21.3	0.0612	0.0524	0.042	2991	2416	1832
		8 ± 1	31.61	29.29	25.04	0.0614	0.0541	0.0429	3003	2666	2153
	5	Ambient	33.37	28.84	24.34	0.063	0.053	0.0468	3204	2712	2240
		8 ± 1	33.37	25.58	22.99	0.063	0.0553	0.0503	3204	2431	2138
	3	Ambient	31.64	28.93	26.07	0.0595	0.0547	0.0517	3070	2720	2425
		8 ± 1	31.64	29.48	27.23	0.0595	0.0573	0.0525	3070	2801	2532

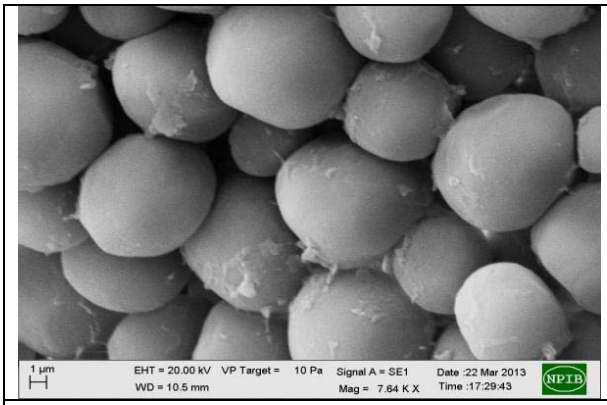
Source	CD at 5%	CD at 5%	CD at 5%
Genotype (G)	0.07	0.01	6.457
Seed Storage regimes (S)	0.14	0.02	12.08
Storage duration in months (D)	0.096	0.01	7.908
G X S	0.2	0.01	17.084
G X D	0.13	0.01	11.184
S X D	0.25	0.01	20.923
G X S X D	0.35	0.02	29.589

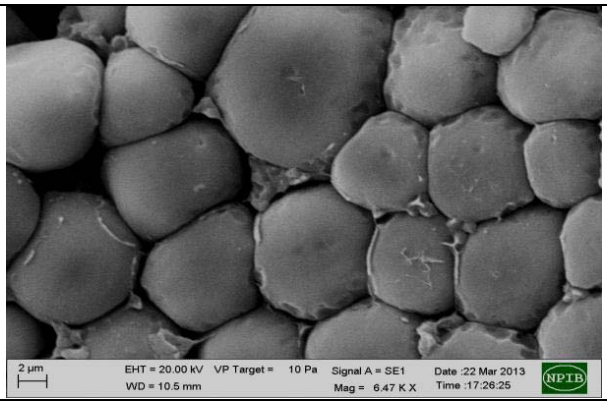
* Control sample maintained at between 10 and 10.5 % mc during storage

Table 3: Effects of moisture content and storage temperature on seed leachate of pearl millet genotypes

Genotype	Seed storage regimes		EC (µsiemen/cm/g seed)		
	Seed mc	Seed mc	Seed storage (month)		
	(%)	(°C)	1	3	6
PUSA 415	10 (control)	Ambient	237.2	371.9	516.5
	7	Ambient	230.7	305.1	469.3
		8 ± 1	230.7	251.1	316.8
	5	Ambient	227.3	352.7	455.4
		8 ± 1	227.9	287.0	311.2
	3	Ambient	235.2	281.2	320.2
		8 ± 1	235.2	257.4	292.2
PUSA 443	10 (control)	Ambient	168.7	260.6	326.4
	7	Ambient	170.3	251.5	326.7
		8 ± 1	171.0	192.8	258.5
	5	Ambient	164.3	240.2	300.2
		8 ± 1	164.3	161.0	280.3
	3	Ambient	151.0	190.6	274.0
		8 ± 1	151.0	156.8	234.3

Source	CD at 5%
Genotype (G)	0.898
Seed storage regimes (S)	1.68
Storage duration in months(D)	1.1
G X S	2.376
G X D	1.555
S X D	2.91
G X S X D	4.115





Micro-morphological studies using scanning electron microscope showing endospermic starch granules in ultra-dried seeds maintained high structural integrity (left) compared to seeds stored at ambient mc (right)

Conclusion

The study showed that storing seeds with a mc of 10% or more reduced seed viability because of high mc; it causes the seeds to deteriorate faster. Therefore, it is suggested that the optimum mc for pearl millet to ensure prolonged viability is between 3 to 5%.

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MEETINGS AND COURSES

Announcements of national, regional, or international meetings, seminars, workshops, and training courses appear in this section. Please send in announcements of relevant events organized in your country for inclusion in the next issue.

Conferences

Indian Seed Congress 2014

The India Seed Conference 2014 will be held 18−19 February 2014 in Gujarat, India. India has a seed industry worth USD 2 billion. It contributes 13.7% to GDP and directly affects the livelihoods of 630 million people in the country. It is emerging as the sixth largest seed economy in the world, with an impressive 20% annual growth in the seed market. The National Seed Association is organizing its annual seed congress 18−19 February 2014 in Gujarat, India. For more information please contact the organizers at the National Seed Association of India, e-mail: isc2014@nsai.co.in; website: www.nsai.co.in.

AFSTA Congress 2014

The AFSTA Congress 2014 will take place 4−7 March 2014 in Tunis, Tunisia. For more information, kindly contact: AFSTA Secretariat at afsta@afsta.org.

2014 ISF World Seed Congress

The 2014 ISF World Seed Congress will take place 26−28 May 2014 in Beijing, China. For

more information visit: www.worldseed 2014.com.

ISTA Annual Meeting 2014

The ISTA Annual Meeting 2014 will be held 16–19 June in Edinburgh, Scotland. For more information, please visit: www.seedtest.org.

IFLRC VI and ICLGG VII

This is a joint conference of the sixth International Food Legumes Research Conference (IFLRC VI) and seventh International Conference on Legume Genetics. It will be held 7–11 July 2014 in Saskatoon, Canada. The conference includes a scientific program and opportunities for networking among participants. The scientific program includes plenary sessions on important disciplines, such as genomics, molecular breeding, human nutrition, trait improvements, agronomy, and physiology. The combined interests of ICLGG and IFLRC span the spectrum from basic legume science through consumer-driven applications. An underlying theme of the conference is to explore scientific avenues to increase demand for legumes in a high-value market chain worldwide. This joint meeting of IFLRC and ICLGG represents a unique opportunity to advance this goal. For more information, kindly visit the link http://knowpulse2.usask.ca/iflrc-iclgg/.

Courses

ICARDA courses

ICARDA organizes both short- and long-term courses in thematic areas related to its research portfolio on biodiversity and integrated gene management, integrated water and soil management, diversification, and intensification, and socioeconomics and policy research. For more information on ICARDA's annual training program, contact Dr Iman El-Kaffas, Head, Capacity Development Unit, ICARDA, Amman, Jordan; e-mail: i.el-kaffas@cgiar.org.

UPOV course

Distance learning course DL-205

Online registration for the UPOV distance learning program 'Introduction to the UPOV System of Plant Variety Protection under the UPOV Convention' is from 5 May to 8 June 2014. Online registration is available from 3 February to 31 March 2014. The categories of participants are as follows:

- *Category 1:* Government officials of UPOV members endorsed by the relevant representative to the UPOV Council *(No fee)*
- *Category 2:* Officials of observer states or inter-governmental organizations endorsed by the relevant representative to UPOV Council *(one non-fee paying student/state or inter-governmental organization; additional students: CHF 1000/student)*
- *Category 3:* Others (*Fee: CHF 1000).*

Please note that registration of participants in categories 1 and 2 must be accompanied by an endorsement from the representative to the UPOV Council of the UPOV member or observer, as appropriate, formally nominating the participant. Detailed information on course content and online registration is available at: http://www.upov.int/resource/en/dl205_training.html.

ISTA training workshops

ISTA Quality Assurance Workshop to be held 12–16 May 2014 in Depok, Indonesia. This workshop will present and discuss the basic principles of quality management. It will focus on the needs of seed testing laboratories that wish to comply with the ISTA Accreditation Standard and prepare to achieve and maintain ISTA Accreditation.

Registration is possible until 15 March 2014. More detailed information on the workshop can be found on the following website: https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--402.html.

ISTA Workshop on Tree and Shrub Seeds from the Mediterranean Basin: Development of Test Methods to be Introduced into the ISTA Rules, 19–21 May 2014, Madrid, Spain. This workshop will analyze the current situation of the species of Mediterranean trees and shrubs in ISTA Rules and promote the development of protocols to ensure the quality of the seed of these species. Participants will learn the characteristics and reproduction strategies of Mediterranean species. The management of these species and their current status in the ISTA Rules will be covered. Registration is possible until April 15, 2014.

More information on the workshop can be found on the following website: https://www.seedtest.org/stream/nl-l---1--%40a3a28d620689--384.html.

ISTA Workshop on Seed Sampling and Quality Assurance in Seed Sampling 23–26 June 2014 in Edinburgh, Scotland, The objective of the workshop is to provide an overview of seed sampling and seed sampling related aspects of quality assurance in relation to a range of species. The workshop will offer a forum to discuss seed sampling in general as well as the opportunity to address specific questions related to sampling methodologies. The training will focus on practical exercises, providing an opportunity to use different sampling equipment and will include practices for the evaluation and examination of seed samplers.

Registration is possible until May 15, 2014. More information on the workshop can be found on the following website: https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--403.html.

ISTA Seed Health Testing Workshop, 4–7 September 2014, Poznan, Poland. The subjects of the workshop are the diseases of economically important crops (barley, flax, pea, soybean, cabbage, and carrot). There will be lectures on seed-borne diseases, followed by hands-on practical work focused on recognizing fungal pathogens on seeds and based mostly on various incubation methods. Registration is possible until 30 March 2014. More information on the workshop can be found on the following website. https://www.seedtest.org/stream/nl-l---1--%40a3a28d620689--385.html.

For the latest information on all upcoming ISTA events, please consult the ISTA website: https://www.seedtest.org//stream/nl-l---1--%40a3a28d620689--404.html.

LITERATURE

Books, journal articles, and other literature of interest to readers are presented here. Please send information on agriculture-related publications – seed, policy, regulation, and technology – to the Editor for inclusion in *Seed Info.*

Books

Wongtschowski, M., J. Belt, W. Heemskerk and D. Kahan. 2013. The Business of Agricultural Business Services: Working with Smallholders in Africa

Royal Tropical Institute (KIT) Publishers/FAO, ISBN 978-9-46022-236-8 (Pb); 192 pp; Price: EUR 25 or free to download; website: www.kitpublishers.nl.

Most African smallholder farmers are now planning to sell at least part of their output, thus enabling them to move to a more commercial footing. This demands much more than the production advice traditionally given by extension services. Marketing strategies, business planning, help with contracts and standards, and links to buyers and credit are increasingly vital. The supply of such services will underpin agricultural development in the coming years. In describing and discussing the experiences of 12 business service providers from across Africa, this new book addresses some fundamental questions on sustainability, accountability, and inclusiveness. Having discussed both supply-driven and market-driven approaches to providing business services, the authors propose a new 'needs-driven' approach, which will overcome the shortcomings of the other two. Practitioners working in value chain and enterprise development, development partners who finance projects, and policymakers will find this book useful for orienting their support to the agricultural sector.

Ruane, J., J.D. Dargie, C. Mba, P. Boettcher . 2013. Biotechnologies at Work for Smallholders

FAO; ISBN 978-9-25107-877-8; 209 pp; free to download; website: www.fao.org

The challenges in tackling and eliminating food insecurity and malnutrition are substantial, but not insurmountable, say the authors of this new publication from the FAO. The key, they believe, lies in empowering the millions of smallholder producers and landless workers to improve agricultural productivity and engage in markets. In attempting to achieve this, agricultural biotechnologies have considerable potential. Using 19 case studies, the authors describe the practical realities and experiences of

taking biotechnology research and applying it to smallholder production of banana, cassava, rice, livestock, and shrimp in different parts of the world. A range of technologies are included, from artificial insemination to cutting-edge techniques involving DNA-based methodologies, but not genetic modification. In India, for example, researchers used DNA markers to develop flood-tolerant rice with the potential to yield 1−3 t/ha more than existing genotypes. The use of DNA-based diagnostic tools in Cameroon quickly allowed veterinary authorities to diagnose outbreaks of *peste des petits ruminants*, a highly contagious viral disease affecting goats and sheep. The book concludes by calling for greater national and international efforts to bring agricultural biotechnologies to smallholder producers in developing countries, increased sharing of genetic resources, techniques, and expertise across national and international borders, and for the involvement of smallholders at all stages of the process.

Patil, R. T. and S. Mangaraj. 2013. Processing Technology for Food Legumes

*Satish Serial Publishing House; ISBN: 9789381226612; 676 pp; Price: USD 158.30; website: www.*kkagencies.com

Legumes are the most important food crops. The vast amount of knowledge, developed through R&D over the last 15 years, on processing of this crop has not been presented previously in the form of a comprehensive book. In this book, an attempt is made to compile concise information, knowledge, and skill about legume processing and use for food, feed, and nutraceuticals. Production and use of appropriately fortified legumes and their derivatives help to improve human, animal, and soil health. Legumes are rich in protein. They also have an abundance of complex carbohydrates, a high fiber content, and the ability to lower serum cholesterol in humans. They are low in fat and provide minerals and phytochemicals.

The book discusses:

- The role of legumes in human health
- The origin and production of legumes
- Nutritional quality
- Anti-nutritional factors
- Their remedial measures
- Health benefits
- Engineering properties
- Primary processing
- Legume fortified processed products
- Bakery and extruded items
- Pulse mill modernization
- Emerging technologies for legume processing and use.

The book would be useful to students, teachers, researchers, food manufacturers, policy makers, and to all those who are interested in better health. It also looks at the opportunities for establishing rural industries for their primary and secondary processing, including value added products. Thus, it would be useful as reference material for entrepreneurs.

New Journals

Compost Science and Utilization

Compost Science and Utilization is a quarterly peer-reviewed journal that focuses on the science and engineering of compost production, compost product quality, and the use of composted materials. Topics include compost microbial ecology, novel feed stocks, odor reduction and control, contaminant issues and their mitigation, compost analysis techniques, plant disease suppression using composts, compost fertility, composting as part of integrated bio-refineries, pathogens and composting, compost and soil quality, composting as a tool to address climate change, and other topics. For more information visit the website at http://www.tandfonline.com/toc/ucsu20/current#.UrLs7F7xvIUi.

Agriculture and Food Security

Agriculture and Food Security is a peer-reviewed open access journal that addresses the challenge of global food security. It publishes articles within the field of food security research, with a particular focus on research that may inform more sustainable agriculture and food systems that better address local, regional, national, and/or global food and nutritional insecurity. The journal considers cutting-edge contributions across the breadth of relevant academic disciplines, including agriculture, ecology, environment, nutrition, socioeconomic sciences, public health, and policy. For more information visit the website at http://www.agricultureandfoodsecurity.com/.

Websites

http://www.seedtest.org
Founded in 1924, with the objective of developing and publishing standard procedures in the field of seed testing. ISTA is inextricably linked with the history of seed testing. The website will provide you with information about ISTA and its membership, technical committees, accreditation, and publications.

Newsletters

Seed Testing International (ISTA News Bulletin)
Seed Testing International is distributed to 2500 subscribers worldwide. The magazine contains the president's report, articles on association news, updates on Rules development, method validation, and accreditation. It also presents scientific papers of applied seed science. It updates you on training and education programs, both upcoming activities and reports from past training courses, workshops, and seminars. It provides information about new publications. Through its various topics, it provides an insight into seed testing issues at the regional and international level. The ISTA publishes *Seed Testing International* bi-annually in April and October.

Note to subscribers

Subscribers are encouraged to play a proactive role in making this newsletter a useful platform for information exchange. Contributions are most welcome on the broad areas of seed system development, meetings, courses and electronic conferences, books and reviews, websites of special relevance to the seed sector, funding opportunities, requests to other readers for information and collaboration, and feature articles or discussion issues brought by subscribers. The Editor always welcomes suggestions on format and content, sent by e-mail to z.bishaw@cgiar.org