# SEED INFO

Official Newsletter of WANA Seed Network

ICARDA
Science for Better Livelihoods in Dry Areas

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## EDITORIAL NOTE

*Seed Info* aims to stimulate information exchange and regular communication among 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 **WANA Seed Network** provides information on activities relating to global and/or regional cooperation and collaboration to facilitate the development of a vibrant regional seed industry. In this issue of *Seed Info*, we report on the regional seed courses organized by the International Center for Agricultural Research in the Dry Areas (ICARDA) and the activities of the FAO sub-Regional Office for Central Asia's (FAO-SEC) project *Seed Sector Develoment in Countries of the Economic Cooperation Organization.*

In the **NEWS AND VIEWS** section, Niels Louwaars from the Dutch Seed Association writes about *Royalty Payments and Collection on Farm Saved Seed.* While the payment of a royalty in the certified seed use is widely accepted and included in the seed price, such payment for on farm-saved seed (FSS) of protected varieties remains a contentious issue between farmers and seedsmen in several countries. The provisions of FSS were changed at the 1991 UPOV Convention. The new rules explicitly allow farmers to use FSS of selected crops, and explicitly outlaw sales of such seed to others. It also extends the breeders' rights to the harvested material providing further options of collecting end-point royalties as a levy on the harvested product, with some exceptions for small-scale farmers. Royalty payment on FSS is now an established norm in some countries as a fair contribution for use of seed of protected varieties and practiced under different arrangements. The article highlights the basis of royalty payments on FFS and elaborates on the mechanisms for its enforcements and collections in different countries. Other news in this section comes from Ethiopia, Kenya, and Pakistan, as well as regional and/or international organizations, such as the International Seed Testing Association and International Union for the Protection of New Varieties of Plants (UPOV). In Ethiopia, a quality declared seed scheme is introduced. In Kenya, a new online tool for informing farmers on seed selection is introduced, and from Pakistan, the on-going efforts to reform and update the seed regulatory framework are presented, including the amendment of Seed Act 1976 and the enactment of new laws on plant variety protection and biosafety.

The section on **SEED PROGRAMS** presents news from Bangladesh, Ethiopia, Kazakhstan, Syria, and Tunisia on the release of new improved varieties of wheat, barley, chickpea and lentil by respective national agricultural research systems from the productive partnerships with ICARDA. Bangladesh continues with its successful lentil revolution with the release of micro-dense varieties rich in iron and zinc. Ethiopia is a major producer of cool season food legumes and wheat in sub-Saharan Africa but diseases remain major challenges for crop production. The report includes the release of a rust resistant lentil variety by Debre Berhan Agricultural Research Center and rust resistant wheat varieties for the highlands by Sinana ARC and for irrigated areas by Werer ARC.

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 '*Impacts of Ultra-drying on Molecular and Ultra- structural Profile of Pearl Millet Genotypes'* by Vijay et al. from the Division of Seed Science and Technology of the Indian Agricultural Research Institute, India. The paper discusses the effects of different drying methods and moisture content on changes observed at the molecular and ultrastructural levels in pearl millets. Four different drying methods, namely silica gel, saturated salt of lithium chloride, concentrated sulfuric acid, and seed dryer were used and their effects analyzed. The results indicate that seeds can be dried safely up to 3% mc without affecting viability and structural integrity. Drying also increases the storability of the genotypes.

*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.

### ICARDA Organizes Seed Courses

ICARDA continues to provide short-term and long-term seed courses to strengthen the capacity of the human resources of the national seed sector through special projects. These regional and national courses bring together staff from the various sub-sectors of the national seed system.

### Community-based Seed Production and Marketing in Ethiopia

*Introduction*

ICARDA is currently implementing two projects aimed at improving the deployment of malt barley, faba bean, and chickpea varieties, as well as advancing the technologies for sustainable food and nutritional security and the market opportunities in the highlands of Ethiopia with the funding from the USAID. Both projects involve scaling out improved technologies, farmer-based seed production, and marketing, currently being implemented in four regional states of Amhara, Oromia, SNNPR, and Tigray. The second course on community seed production and marketing was organized in collaboration with the Amhara Regional Agricultural Research Institute, from 1-2 August 2015 at Bahir Dar, Ethiopia.

*Course objectives and contents*

The course was aimed at raising awareness of available faba bean, chickpea, and malt barley technologies and introduced the framework of community-based seed production within the technological scaling-out activities of the two USAID supported projects.

The course was designed to be participatory and interactive. Every lecture was delivered by resource persons and followed by practical experience-sharing discussions. It ensured that the trainees understand and gain practical knowledge from the discussion on each of the thematic areas of the presentations. Presentations and guidelines on seed production and storage of faba bean were made available to trainees, famers, and other partners at district level as reference and training materials.

The major emphasis of the course was to impart available knowledge of malt barley, faba bean, and chickpea technologies and their application. Community based seed production, marketing, and scaling up technologies all combined facilitate implementation. Available options for rhizobia treatment of faba bean and chickpea seed were also presented during the course.

*Course participants*

The training course was organized for research staff from agricultural research centers (Adet, Alamata, Gonder, Mekele and Srinka) with invited subject matter specialists/experts from target districts of the Amhara and Tigray regions of Ethiopia. Moreover, project team members from other 13 partner agricultural research centers also participated with the main objective of strengthening the monitoring and evaluation of the progress of these two projects. About 31 participants attended the course: NARS (22) and development experts (9) working on seed production from nine districts.

ICARDA, in close collaboration with Amhara Regional Agricultural Research Institute, organized the course.


*Participants of training course on community-based seed production and marketing*

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## FAO Unveiled a Regional Seed Agreement and Regional Seed Strategy for ECO Region

The FAO/Turkey Partnership Program funded the project *Seed Sector Development in Countries of the Economic Cooperation Organization* implemented from May 2013 to the end of December 2015. The project was aimed at improving and harmonizing regulatory frameworks and its alignment with international norms in variety testing and registration; plant variety protection; seed certification and plant quarantine in Economic Cooperation Organization (ECO) member states[1]. The objective was to contribute to the development of the seed sector, particularly the private sector contributing to national and regional food security and its eventual integration into the global seed industry. This regional integration among member states in the seed sector will help member states benefit from similarities in agricultural production environments extending across large areas of central and west Asia. Since national borders do not correspond with agro-ecological conditions, farmers in different countries may therefore have similar needs and may face similar problems in the agricultural sector.

However, differences among national seed systems lead to delays and complications in conducting trade and in meeting the needs of farmers. Cognizant of this, FAO and ECO supported the project from 2013-15 to promote further collaboration. Representatives of member countries met in a series of national and regional workshops discussing ways to strengthen the seed sector and to increase regional trade.

At a regional workshop in Istanbul on 5-8 January 2015, it was agreed to prepare a draft 'Regional Seed Agreement' that will provide a basis for future collaboration. With the support of the ECO Secretariat, governments of the member countries will be invited to sign an agreement in order to facilitate this process, which can then be carried forward by technical experts where harmonization would be an integral part of the process. Similar efforts are underway among regional groups of countries in several parts of the world and this reflects a global trend to improve the legitimate movement of crop varieties and seeds across national borders. Restrictive regulations lead to an increase in unofficial seed trade, which present serious threats to farmers because the quality of the seed cannot be controlled.

Discussions in the national workshops and regional workshops in Istanbul revealed a wide range of experience among member countries at different stages of seed industry development. It was therefore decided to prepare this 'Regional Strategy on Seed Sector Development' to guide the ECO member countries along the path of harmonization by organizing their seed industries along similar lines, particularly with regard to legal frameworks, institutional arrangements, and technical procedures. Harmonization can facilitate partnerships that bring private sector and public/regulatory authorities together to discuss, build trust, and foster collaboration on key issues. Although this will be a gradual process, participants in the workshop believe it will bring significant long-term benefits to individual farmers, rural communities, and ultimately national economies. It will also support the core objective of the ECO to increase regional trade.

The final workshop of the project was held on 4-5 November 2015 in Antalya, Turkey. During the workshop, the outputs of the project were reviewed and the 'Regional Seed Agreement' and 'Regional Strategy on Seed Sector Development' documents were presented and discussed. Representatives of the member countries defined future action plans for the endorsement and implementation by respective governments of member countries.

It was agreed that the Regional Seed Agreement will be sent to the ECO Secretariat to be part of the agenda at the 26th Meeting of the ECO Regional Planning Council planned to be held on 13–17 December 2015. This will facilitate the approval of the document by the member countries, including those that did not sign the Project Agreement (Iran, Kazakhstan and Turkmenistan) during the Ministerial Meeting of ECO countries.

During the Final Workshop, it was decided to prepare a new project to ensure the realization of the developed Regional Seed Agreement together with the Regional Seed Strategy on Seed Sector Development of the ECO region.

It should be noted that an ECO regional seed association (ECOSA) was established in 2007 as an initiative of a previous FAO project

1 Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikstan, Turkemenistan, Turkey, Uzbekistan

jointly implemented with ICARDA and ECO[2]. This initiative has organized annual events bringing together national seed organizations and commercial companies in the region and beyond. The constitution and objectives of ECOSA are in harmony with the proposed Regional Seed Agreement and Strategy aimed at promoting the regional integration in the seed sector.

*Participants of regional workshop in Antalya, Turkey*

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## NEWS AND VIEWS

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

### Royalty Payments and Collection on Farm Saved Seed

*Background*

New varieties of plants are the backbone of a robust seed system and one of the fundamental tools for sustainable agricultural development. However, breeding new plant varieties requires substantial long-term investment in terms of physical, human and financial resources. Plant Variety Protection (alias Plant Breeders' Rights) has been introduced to provide breeders with an exclusive right to exploit the variety. This allows the breeder to charge a royalty on the sales of seed, thus creating an opportunity to recover their investments. The interest of society is that this provides an incentive for a continuous and sustainable breeding program.

2 Strengthening Seed supply in the ECO Region

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs Agreement) 1994 of the World Trade Organization (WTO) sets the minimum standards for intellectual property protection. WTO requires that 'members shall provide for the protection of plant varieties either by *patents* or *by an effective sui generis system* or *by any combination thereof*'. The UPOV plant variety protection is the most widely and internationally accepted *sui generis* system.

To date, many developed and developing countries alike have recognized the UPOV system as a mechanism for plant variety protection and an incentive for plant breeding for the public and private sectors alike. Currently 72 developed and developing countries and 2 regional organizations (the European Union and the African Intellectual Property Organization) are members of UPOV.

*Farm-Saved Seed*

Whereas the payment of a royalty in the certified seed use is widely accepted and included in the seed price, such payment for on farm-saved seed (FSS) of protected varieties remains a contentious issue between farmers and seedsmen in several countries. On the one hand, it is logical to pay as farmers reuse the genetics created by the breeder whereas on the other hand, it seems illogical to pay again for something already bought earlier. The provisions of FSS have changed with the latest revision of the 1991 UPOV Convention. The new rules explicitly allow farmers to use FSS of selected crops, and explicitly outlaw sales of such seed to other users. A recent UPOV interpretation allowed such local seed exchanges among near-subsistence farmers. However, they also extend the right to the harvested material where there has not been a reasonable opportunity to exercise that right in the past. This gives a further alternative, that of collecting end-point royalties as a levy on the harvested product, notably in commercial flower trade.

The UPOV Act of 1991 allows countries to specify for which crops seed saving is allowed and it prescribes 'taking into account the legitimate interest of the breeder'. However, there are differences in implementation for different countries. The USA, in its 1994 revised PVP Act, decided not to implement this; instead, the right of American farmers to save seed and to re-use

that seed on their own land is not restricted at all. The result is that public universities continue to do most of the breeding of crops but seed is easily saved on-farm. In many other countries, by contrast, this is interpreted as including a payment of a royalty on FSS of a number of listed field crops. In Europe, smallholder farmers are exempted from paying such royalties on FSS. In crops where saving seed is historically less common, such as vegetables, this privilege is not implemented. In countries where no limitations are put on the use of farm-saved seed, such as in the USA, breeders look for even stronger protection, i.e., through patents, resulting in much worse conditions for farmers. Europe is unique in that its patent law also includes this 'farmers' privilege'.

### *Why a Royalty on FSS?*

Both farmer and breeder organisations agree on the importance for agriculture to have a regular supply of better varieties and that breeders should have the financial resources and incentives to continue to invest in breeding. It is also clear that such income has to primarily come from selling seeds. However, when large quantities of seeds are saved on-farm, such income may be too low to sustain a good breeding program. The more FSS, the greater its negative effects on private breeding. Essentially, the bottom line is if there is no money, there will be no breeding. The amount of farm-saved seed varies between crop species and countries. For example, in Canada over 80% of the wheat crop is derived from farm-saved seed. Such seed saving is quite easy for self-fertilizing crops like wheat, barley, pulses, and potato. In such cases, royalties on certified seed should be excessively high to pay for breeding, or breeding would stop as breeders will only invest in other crops, like maize, leaving cereal and pulse farmers without innovation. A solution could be to let farmers pay a (lower level) royalty when they reuse seed. Obviously, farmers are not keen to pay but, in an increasing number of countries, they realize that they cannot rely on government investments in plant breeding and that they are equally responsible for maintaining a good plant breeding base. Since seed saving farmers reuse the genetics developed by the breeder, it is just reasonable they contribute their fair share. It must be clear that there is no limitation by PVP on saving seed on-farm of varieties not protected or of local landraces.

### *Enforcing Royalty Payments*

The execution of such royalty payments is another issue. Breeders have difficulties knowing which farmers use farm-saved seed and for which varieties they reuse seed. It must be clear that such payment is only due for protected varieties and not for old, farmers', or other non-protected varieties. Countries have been experimenting with different systems. In several countries, such as The Netherlands and Sweden, the breeders' associations use a database of all farmers and, based on surveys about seed usage among farmers, invoices are sent for the use of FSS of protected varieties. Farmers are legally obliged to present such information. In Argentina, Uruguay and Poland, special organisations have been set up to fight illegal sales of seed and to collect royalties.

A different approach is taken in Australia and France, where royalties (End Point Royalty) are collected by the grain traders. When grain is delivered, the royalty is deducted from the purchase price and transferred to the breeders. In France, this approach makes it easy to determine smallholders, defined as farmers producing less than (an equivalent of) 92 tonnes of cereals. France has not been able to extend this system to other crops yet. Also in Spain, the system is based on agreements with the large cooperatives in the food chain. The British Seed and Plant Breeders Association has an agreement with the organisation of agricultural contractors, those that among other tasks, provide seed cleaning services to farmers. Most of the royalty payments are obtained through those operators. Funds obtained from such collaborative initiatives are paid to the holders of the breeders' rights after deduction of costs.

On the other hand, the USA has no limitation on the reuse of farm-saved seed under plant breeder's rights. Many varieties and variety characteristics are however patented, which does not allow farmers to reuse farm-saved seed at all. Some breeders allow farm-saved seed under a contract with the farmer, or individually enforce their rights in case saving of seed is suspected.

*Conclusion*

It is important that plant breeding is stimulated. A plant breeder's right is a very important tool to provide breeders with the opportunities to receive their fair share of the benefits resulting from their long-term work and investment provided to the farmers. Despite the benefits of using certified seed, saving of seed is widespread, especially of self-fertilizing cereal crops. Collecting royalties on such farm-saved seed is however difficult. The situation and thus the opportunities to develop mechanisms to effectively collect such royalties are quite different in different countries. The number of payments is much reduced when smallholder farmers are exempt from such payments, as is the case in Europe.

For further reading refer to *Collection systems for royalties in soft wheat-An international study* by Frank Curtis and Malin Nilsson on ISF website at http://www.worldseed.org/cms/medias/file/ResourceCenter/Publications/Royalty_Collection_Breeders'_Remuneration_Study.pdf

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## International Year of Pulses

The 68th United Nations General Assembly declared 2016 the International Year of Pulses (IYP-2016). The Food and Agriculture Organization of the United Nations (FAO) has been nominated to facilitate collaboration with Governments, relevant organizations, non-governmental organizations, and all other relevant stakeholders.

Pulses (such as beans, chickpeas, lentils, and peas) play an important role in farming systems and provide an especially diverse and underexploited set of potential benefits. For instance, many pulses are:

1. Nitrogen-fixing, increasing nitrogen efficiency and enhancing soil fertility and health.
2. Highly nutritious, with substantial amounts of dietary fiber, carbohydrates, proteins, and micronutrients (e.g. Fe, K, Mn, Zn and B vitamins).
3. Affordable and sustainable, providing a good source of protein and being often very water efficient.
4. Resilient, being both drought- and frost-tolerant as well as able to grow in harsher environments than many staple crops.

Despite such potential benefits, pulses are considered 'orphan' crops because they are mainly grown and used locally by communities. They are not part of the main crops that are traded internationally and which have often been considered staple crops. The potential to increase productivity, diversity, and nutritional outcomes through investments in orphan crops is tremendous. Orphan crops require more attention and funding, if they are to contribute fully to food security, nutrition, and sustainability.

The IYP2016 aimed at drawing attention to pulses, as key examples of orphan crops requiring prioritization in future agricultural research and production. Launched on 12 November 2015, at the FAO headquarters in Rome, Italy, the year will be celebrated with various conferences, product show case competitions, etc. at national, regional, and global levels in order to promote awareness about pulses and investments in research and development.

During the launch, ICARDA's work on pulse projects aimed at reducing hunger, and improving farming was highlighted, including the bio-fortified pulses in Bangladesh developed in partnership with NARS where it is grown on 145,600 ha, producing 186,000 tonnes for domestic consumption.

For more information on the IYP2016, please visit the dedicated website at: http://iyp2016.org/

## Global Seed Conservation Challenge

The Botanic Garden Conservation International's Global Seed Conservation Challenge (GSCC) both supports and challenges botanic gardens to increase their contribution to *ex situ* conservation by collecting and banking seed of threatened wild plant species towards Target 8 of the Global Strategy for Plant Conservation.

Currently, the GSCC network includes over 100 institutions in more than 50 countries. Training and online learning modules on seed conservation will build capacity to support gardens that currently bank seed.

The challenge component involves a competition. BGCI's Global congresses will award prizes to gardens that conserve the: (i) the greatest number of taxa; (ii) the most threatened species; (iii) the most useful species; and (iv) the most

difficult species to collect.

For more information, you may kindly visit the website at http://www.bgci.org/plant-conservation/seedconservation/

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## Ethiopia Introduces Quality Declared Seed Certification Scheme

According to the Ethiopian Seed Law, all certified seed sold legally require official certification, where field inspection and laboratory seed testing are mandatory. However, the national seed policy and regulatory framework also encourages farmer-based seed production to fill the gap and diversify seed supply. In Ethiopia, the Growth and Transformation Plan puts greater emphasis on the development and growth of the agricultural sector. In order to increase agricultural production and productivity, the agricultural transformation agenda of the country has prioritized the improvement and the efficiency of the national seed system. The Agricultural Transformation Agency (ATA) was established to address some of these key challenges in the agricultural sector, including the seed sector.

ATA, working with the Ministry of Agriculture and Natural Resources (MoANR) and a broad range of stakeholders, provides policy advocacy and technical assistance in diversifying the national seed sector. Apart from supporting the establishment of the regulatory mechanism for seed quality assurance, ATA assisted the MoANR in expanding the seed supply base through the introduction of *Quality Declared Seed* (QDS). The QDS aimed to encourage local entrepreneurs including farmer groups and cooperatives to enter seed production and marketing by making seed certification more flexible and affordable for new entrants, by providing alternative schemes and removing some of the technical barriers. ATA supported the stakeholder's consultation meeting and the development of the QDS guidelines under Plant Variety Release, Protection and Seed Quality Control Directorate (PVRPSQD) of the Ministry (MoANR). QDS standards are being developed for 35 priority food, feed and horticultural crops. ICARDA provided technical support for the stakeholders' consultation meeting and the guideline drafting committee during the development of the QDS guidelines based on the request from ATA.

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## Kenya Launches New Online Tool for Seed Selection

Farmers in Kenya are now able to benefit from a new online tool, MbeguChoice, which allows them to quickly obtain information about the most suitable varieties for local conditions. MbeguChoice, the first of its kind in Sub-Saharan Africa, allows Kenyan farmers, agro-dealers and extension workers to analyze information about counties, crops, seasons, and crop attributes, such as drought-tolerance, disease- and pest-resistance, providing a list of suitable varieties and where these can be sourced from. The Kenya Agricultural and Livestock Organization, Kenya Plant Health Inspectorate Service, Kenyan seed companies, and the Nairobi-based Agri Experience Ltd. developed the tool with the support from the Kenya Markets Trust. They worked with agricultural extension workers and agro-dealers to narrow the range of crop seed choices, after realizing that farmers often plant seeds out of location, out of season, and because farmers and agro-dealers often lack sufficient knowledge and awareness. The online database has more than 200 commercialized crop varieties, including 61 varieties of maize, 25 common bean, and 11 cassava varieties. The website provides more options on the attributes of crop variety and agro-ecological zones. However, behind the great enthusiasm, others caution that the new application may be timely, but that it may not be widely used by farmers.

*Source: SciDev.Net, 30 June 2015*

## Senate Agriculture Committee Approves Amendments to 1976 Seed Act

In recent years, the Federal Seed Certification and Registration Department has been trying to amend the Seed Act by introducing plant variety protection and enacting the biosafety law in Pakistan, in line with its seed sector development.

On 11 June 2015, the Senate's Agriculture Committee of Pakistan approved the amendments to the 1976 Seed Act, which will be deliberated and voted on by the full Senate once it reconvenes. These amendments were drafted and proposed a number of years ago and have made considerable progress in the legislative process over the last nine months. This is one of three key pieces of seed regulations under review by the Government of Pakistan. The others are the Plant Breeder's Rights Act, which would establish intellectual property rights protection and the Biosafety Act for regulating the biotechnology sector.

The amendment of Seed Act primarily focused on eliminating unregulated participation in the seed industry. Key provisions include:

- The amendments would bring the private sector under the purview of the Seed Act. Currently, the Act makes little mention of the private sector, leaving private companies formed under other regulatory statutes (e.g. 1984 companies act) largely unregulated.
- Anyone seeking to participate in the seed industry should have a seed processing plant or work as a registered seed dealer.
- Selling seed without proper registration and selling misbranded seed would be subject to jail time or a fine.
- Biotech seeds may not contain the 'terminator gene', a gene that prohibits the replanting of a crop, but is not deployed in commercial crops.
- Biotech seed must have approval from the National Biosafety Committee stating that the seeds will not have an adverse effect on the environment, human, animal, or plant life and health.

*Source: Crop Biotech Update July 8, 2015*

## ISTA Announces its First Industry Members

Founded in 1924, with the aim to develop and publish standard procedures in the field of seed testing, ISTA is closely linked with the history of seed testing. With member laboratories in 80 countries worldwide, ISTA membership is a truly global network aimed at achieving uniformity in seed quality evaluation worldwide. The association produces internationally agreed rules for seed sampling and testing, accredits laboratories, promotes research, provides international seed analysis certificates and training, and disseminates knowledge in seed science and technology. This facilitates seed trading nationally and internationally, and contributes to food security.

ISTA, recently introduced a new category of Industry Member aimed at engaging the seed industry, streamlining communication, and in the process expanding the activities of the Association. The category is relevant to all members of the industry: large corporations, small companies, and commercial laboratories alike.

From the seed company point of view, a new and important benefit in taking on the Industry Membership is partaking in a new body: the Industry Advisory Group. One seat on the Industry Advisory Group is reserved for a representative of the International Seed Federation (ISF), and the first eight Industry Members will automatically have a place on the group after ISTA executive committee approval. This forum will consist of up to 15 ISTA members and will be in charge of representing the industry's interest in the Association. Accordingly, DuPont Pioneer and Dow AgroSciences become the first members in this category, which will strengthen the collaboration and harmonization of seed quality standards.

For more information, please contact: ISTA, Zürichstrasse 50, 8303 Bassersdorf, Switzerland; tel: +41-44-8386000; fax: +41-44-8386001; e-mail: ista.office@ista.ch; http://www.seedtest.org

## News from UPOV

### *New members of UPOV*

Montenegro deposited its instrument of acces-

sion to the UPOV Convention on 24 August 2015, and became the seventy-third member of UPOV on 24 September 2015. Similarly, the United Republic of Tanzania deposited its instrument of accession to the UPOV Convention[3] on 22 October 2015, and became the seventy-fourth member of UPOV on 22 November 2015.

In another development, Canada deposited its instrument of ratification of the 1991 Act of the UPOV Convention on19 June 2015. Canada, already one of the members of UPOV, is the fiftythird member to become bound by the 1991 Act of the UPOV Convention. The 1991 Act has been put into force in Canada on 19 July 2015, one month after the deposit of its instrument of ratification.

To date, the members of UPOV (22 October 2015) include 72 developed and developing countries from Africa (6), Americas (17), Asia (12), Australasia (2), Europe (37), and two regional organizations (African Intellectual Property Organization and European Union).

The purpose of UPOV is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society. UPOV is an intergovernmental organization based in Geneva.

### *Examination of conformity of Act of Plant Varieties and Seed and Planting Materials of Iran*

The Council of UPOV, at its fortyninth ordinary session on 29 October 2015, recommended that Iran should incorporate certain additional provisions and amendments in the '*Act of Plant Varieties Registration, Control and Certification of Seeds and Plant Materials of 2003*'. Once the additional provisions and amendments are incorporated into Law, the amended Law should be submitted to the Council for examination in conformity with Article 34(3) of the 1991 Act.

### *Statistics on plant variety protection*

Fifty-nine members of the Union now offer protection to all plant genera and species (58 in 2014), with 14 members of the Union offering protection to a limited number of plant genera and species. Of those 14, two members (Brazil and Morocco) extended protection to additional plant genera and species in 2015.

In 2014, the number of applications for plant variety protection in UPOV member countries exceeded 15,000 for the first time. There was a 4.8% increase in the number of applications (15,499 in 2014; 14,788 in 2013), comprising a 2.8% increase in the number of applications by residents (9,770 in 2014; 9,502 in 2013) and an 8.4% increase in the number of applications by nonresidents (5,729 in 2014; 5,286 in 2013). The number of protection titles granted increased from 10,052 in 2013 to 11,569 in 2014 (an increase of 15.1%). About 106,081 titles are in force in 2014 representing a 2.7% increase on figures for 2013 (103,261).

### *Cooperation in examination of new plant varieties*

In 2015, the number of plant genera and species for which there were agreements between members of the Union for cooperation in the examination of distinctness, uniformity and stability was 2,002 compared to 2,005 in 2014.

### *Adoption of documents*

The UPOV Council adopted revised versions of several documents:

- Experience and Cooperation in DUS Testing (TGP/5)
- Examining Distinctness (TGP/9)
- Glossary of Terms Used in UPOV Documents (TGP/14)
- Explanatory Notes on Cancellation of the Breeder's Right under UPOV Convention (UPOV/EXN/CAN)
- Explanatory Notes on the Nullity of the Breeder's Right under UPOV Convention (UPOV/EXN/NUL)
- Explanatory Notes on Provisional Protection under UPOV Convention (UPOV/EXN/PRP)
- Guidance for the preparation of laws based on the 1991 Act of UPOV Convention (UPOV/INF/6)
- Explanatory Notes on Variety Denominations under UPOV Convention (UPOV/INF/12)
- Exchangeable Software (UPOV/INF/16)
- Software and Equipment Used by Members of the Union (UPOV/INF/22)

3 International Convention for the Protection of New Varieties of Plants on December 2, 1961, as revised in Geneva on November 10, 1972; on October 23, 1978; and on March 19, 1991

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

*Election of officials of UPOV Council*

The UPOV Council elected, in each case for a term of three years ending with the fifty-second ordinary session of the Council, in 2018:

1. Mr Luis Salaices Sánchez (Spain), President of the Council;
2. Mr Raimundo Lavignolle (Argentina), Vice-President of the Council.

Ms Kitisri Sukhapinda (USA) was awarded a UPOV Gold Medal in recognition of the contribution made during her term as President of the UPOV Council from 2 November 2012 to 29 October 2015.

For more information, please contact the UPOV Secretariat: tel: +41-22-3389155; fax: +41-22-7330336; 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.

### Bangladesh Releases Micronutrient Dense Lentils

ICARDA and the Pulses Research Centre of the Bangladesh Agricultural Research Institute (BARI), as partners of HarvestPlus Program (CRP-A4NH), have long been collaborating in the development of improved varieties and production technologies for lentil, an important pulse crop contributing to the food and nutritional security of people in Bangladesh.

In 2015, BARI released a micronutrient-rich variety, *BARIMasur-8*. The new lentil variety was developed by crossing ILL 5888 (*BARIMasur-1*, a lentil variety from Bangladesh) and ILL 6002 (a breeding line from ICARDA); and selected from among 412 lines supplied by ICARDA. The variety is stable, high yielding with an average seed yield of 2-2.2 tonnes $ha^{-1}$, and rich in iron (72-75 ppm) and zinc (58-60 ppm) essential to combat micronutrient malnutrition, 'the hidden hunger'. In comparison, in the local varieties, iron and zinc contents vary between 55-62 ppm and 32-41 ppm respectively, and the average yield is around 1.05-1.10 tonnes $ha^{-1}$. It also provides combined resistance to rust and stemphylium blight a serious threat to lentil throughout South Asia (Bangladesh, Nepal and eastern Indian states). This short-duration variety matures in 110-115 days and fits very well in existing cropping patterns. Another desirable trait is that it has late planting potential (up to the last week of November), following the harvest of late-maturing rice varieties, which is important for the vast lentil and rice growing areas of Bangladesh.

For more information, visit the website at: http://www.icarda.org/update/barimasur-8-micronutrient-rich-lentil-variety-launched-bangladesh#sthash.2Utp Zfmq.dpuf

### Ethiopia Releases Lentil and Wheat Varieties

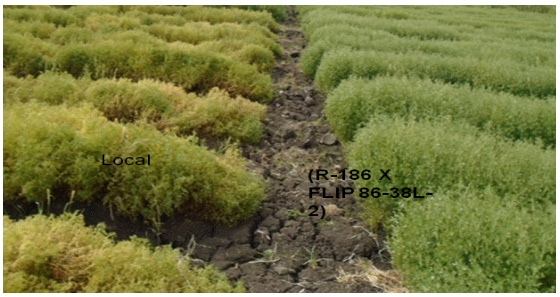
*Rust resistant lentil variety*

Lentil is an important food and cash crop for close to 953,000 smallholder farmers in the Ethiopian highlands. In 2012/13, lentil covered 124,000 hectares with a production of 155,000 tonnes at an average productivity of 1.225 tonnes $ha^{-1}$. However, rust is one of the major threats of lentil production in Ethiopia.

The Debre Berhan Agricultural Research Center of Amhara Regional Agricultural Research Institute released a new lentil variety *Jiru* from germplasm (R-186 x FLIP86-38L-2), a cross from local material and a line received from ICARDA. The variety consistently gave higher seed and stable yield across locations implying its wider adaptation. During the regional variety trial, the grain yield was 16.2% over *Alemaya* (standard check), a rust resistant and widely adopted lentil variety in the country (see Table below). The new lentil variety has medium stature, good seed size, and light green seed color making it suitable for home consumption and marketing due to its attractive seed size. The variety was also found to be resistant to rust, a major lentil disease in the country.

**Mean seed yield of lentil varieties in regional trials**

| Variety | Yield (t/ha) | Yield advantage (%) |
|---|---|---|
| *Jiru* | 2.163 | 16.17 |
| Chekol x R-186-8-1 | 2.151 | 15.50 |
| R-186 x FLIP86-38L-2 | 2.131 | 14.43 |
| *Alemaya*[3] | 1.862 | |




*Field performance of rust susceptible (Left: local) and resistant (right: improved) variety*

The variety performed well both in high and low potential lentil-growing areas and adapted to vertisols. It is recommended for Enewarie, Bichena, and other lentil growing areas with vertisols and similar climatic conditions in the Amhara Regional State.

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### *Bread and durum wheat varieties*

Wheat is grown extensively under rainfed condition in the Ethiopian highlands, covering an area of 1.7 million ha and producing 4.23 million tonnes at an average yield of 2.5 tonnes $ha^{-1}$, where there is a growing production shortfall in the country. However, rusts are becoming one of the major threats of wheat production in the highlands across the country. With a growing domestic grain demand and a serious threat of rust, the country is looking for alternative ways to boost wheat production by expanding its frontiers to the irrigated lowlands and diversifying to drum wheat where rust threats are relatively less severe.

Currently there is an estimated 3,798,782 ha of land suitable for irrigation in the seven river basins across the country, including the Afar and Somali regions in eastern Ethiopia. Previous studies have demonstrated the potential of wheat production under irrigated conditions in the lowlands of Awash Valley of Afar region. Since 2006, there is growing interest for irrigated wheat production and in recent years, the WARC is introducing and testing germplasm from CG centers like ICARDA and CIMMYT to identify high yielding and heat tolerant bread wheat varieties for irrigated lowland areas.

The WARC of the Ethiopian Institute of Agricultural Research released three new rust resistant varieties *Doukkala-4, Moontiji-3* and *Saamid-3* from germplasm received from ICARDA (and one with cross from CIMMYT material). The three varieties are tolerant to heat, drought, and salinity. They are recommended for irrigated lowland areas in Amibara, Afambo, Awash-Fentale, Asaita, Dubti, Gewane, and similar areas of the Afar Regional State.

On another note, the Sinana Agricultural Research Center of the Oromia Agricultural Research Institute also released two bread wheat varieties *Obora* and *Dambal* adapted to the Bale highlands and similar agro-ecologies in the country. They are moderately resistant to all three rusts with a white and red to amber grain color preferred by farmers and consumers. The SARD-SC project implemented by ICARDA and funded by AfDB supported the varietal evaluation and release as well as accelerated seed multiplication of some of these wheat varieties.

Ethiopia is considered a center of diversity for wheat where this crop traditionally dominates the agricultural landscape across the country. In the last three decades durum wheat areas continue to decline because of competition from *tef* and bread wheat. The latest estimates put the area at 290,764 ha and the coverage by improved variety at less than 1% in 2009. There is growing interest in the expansion of durum wheat due to the growing domestic demand from the agro-industry and diversification in combating the threat of rust in bread wheat.

The Debre Zeit ARC also released a durum wheat variety *Utuba* in 2015 from a germplasm supplied by ICARDA. It is expected that this new variety will be multiplied and made available to farmers in the attempt to increase durum wheat production in the coming years.

**Agronomic and morphological descriptors of released wheat varieties in 2015 crop season**

| Description | Doukkala-4 | Moontij-3 | Obora | Dambal | Utuba |
|---|---|---|---|---|---|
| Pedigree and source | SHUHA-8/ DUCULA | FERROUG-2/ FOW- | UTIQUE96/ FLAG-1 | AGUILAL/3/PYN/ BAU//MILAN | Omruf1/Stojocri2/3/1718/ BreadWheat24//Karim |
| Adaptation | Irrigated lowlands | Irrigated lowlands | Rainfed highlands | Rainfed highlands | Rainfed highlands |
| Days to heading | 57 | 51 | | | |
| Days to maturity | 90 | 82 | | | |
| Plant height (cm) | 70 | 74 | 94 | 102 | |
| 1000 seed weight (g) | 35 | 32 | 39.0 | 41.2 | |
| Test weight (kg/hl) | | | 82.1 | 81.7 | |
| Grain color | | | White | Red to amber | |
| Yield in research fields (t/ha) | | | 3.3 -6.3 | 3.4-6.4 | |
| Moderately resistant | | | All three rusts | All three rusts | |
| NARS | WARC | WARC | SARC | SARC | DZARC |

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## Kazakhstan Releases New Chickpea Variety

In 2015, the Scientific Production Centre of Grain Farming has released a new chickpea variety *Vostok* (FLIP94-87C) in Kazakhstan. The variety, selected from an international elite nursery provided by ICARDA, is a cross between FLIP82-150C/FLIP83-48C and followed by individual selection in 2000. The line underwent national competitive variety testing during 2010-14 and farm-scale variety trials in 2014. During the competitive variety testing, the grain yield of this new variety was 11% higher than the yield of the local variety (*Volgogradsky*). *Vostok* is moderately resistant to aschochyta blight and has medium-sized seeds. It is an erect and compact plant with high pod attachment and it is resistant to lodging. It matures early allowing for early harvesting in wet conditions.

The availability of and access to seeds of this new variety is expected to increase chickpea production in Kazakhstan. Chickpea cultivation is useful because firstly, it is a good rotation crop for most cereals and oilseed crops, and secondly, it has high drought tolerance, which is quite important for the regions facing drought.

*Field performance during chickpea variety trials*

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## Syria Releases New Lentil Variety

In Syria, lentil suffers heavily from a soil borne disease, called Fusarium wilt, which can cause yield losses as high as 72% in wilt-infested fields. In order to grow a successful lentil crop, farmers require a high yielding cultivar with wilt resistance and amenable to machine harvesting. *Idlib 5,* a small seeded red lentil variety with fusarium wilt resistance and amenable to machine harvest, has been released after a multi-location and multi-year evaluation in the Aleppo, Dara, Idlib, Hama and Kamishli provinces by the General Commission for Scientific Agricultural Research.

This variety was developed from a single cross and selected as FLIP95-29L (91S 89718) at ICARDA and shared with the GCSAR for testing in its wide network of research stations. The new variety, *Idlib 5*, out yielded previously released varieties, namely *Idlib 2, Idlib 3* and *Idlib 4* over a period of several years of testing in research stations and farmers' fields.


الجمهورية العربية السورية
وزارة الزراعة والإصلاح الزراعي
الهيئة العامة للبحوث العلمية الزراعية
إدارة بحوث المحاصيل
قسم بحوث البقوليات

تقرير مقدم إلى اللجنة الوطنية لاعتماد الأصناف

Lens esculenta سلالة مبشرة من العدس
صغيرة البذرة ILL7685

إعداد
م. أحمد غنوم
م. محمد مروان الديس
م. عبد المسيح ناصيف
م. فواد الاشقر
م.ز. أحمد منذر عواد

*Majd Jamal, ICARDA, Damascus, Syria; e-mail: m.jamal@cgiar.org*

## Barley Improvement and Release of Varieties in Tunisia

In Tunisia, barley is the second most cultivated cereal crop after durum wheat covering half a million ha. Barley improvement started early in the last century. Several barley lines, from INRAT and later on introduction from ICARDA and ACSAD, were evaluated between 1914 and 2008. About 27 barley varieties were released including selections from local populations/introduction (19) and local/foreign crosses (8) during this period.

Through the INRAT-ICARDA collaborative crop improvement program, several barley lines were introduced and seven varieties were released in Tunisia: Rihane-03 (1987), Roho (1985), Momtaz (1999), Manel 92 (1992), Tibica (1996), Taj (1985) and Faiz (1985). The study of 104 barley lines developed by ICARDA from the 1970s to the 1990s showed that they were generally made of crosses from 735 parents of wide or specific adaptation using different breeding techniques. Moreover, the pedigrees of these varieties show the presence of Atlas 46, Arivat and Athenais in 49% of the material developed, including the parents of Rihane. For example, among these, the Rihane variety was registered in 1987 and is still widely grown in Tunisia.

During 1991-2004, ICARDA initiated a decentralized barley breeding strategy and started distributing targeted barley special nurseries for NARS in North Africa: Algeria, Libya, Morocco and Tunisia. Several international observation and adaptation yield trials of winter, facultative and naked barley composed of landraces and germplasm pool, from crossing blocks to segregating populations, targeting abiotic stresses (boron, heat, etc) and biotic stresses (stem gall midge, wheat stem saw fly, etc.) were distributed.

In 2010, the spring barley variety *Kounouz* was registered from a selection made from the ICARDA germplasm provided through a decentralized barley improvement program for North African regions. *Kounouz* is a cross between *Alanda/5/Aths/4/Pro/Toll//Cer*2/Toll/3/5106/6/24569*. The cross was created in 1995 and was grown as F2 to F3 in segregating generations (SEGMAG-1997, No 264). Initially, the line was selected from the barley segregating populations for North Africa grown in Béja. The line was subsequently evaluated in on-station and on-farm variety trials and released for grain production in semi-dry to dry areas of the country.

*Kounouz* is six-row spring barley with semi-compact and drooping ears at maturity, yellowish-white kernels, lodging resistant with medium height (95 cm) and medium maturity (103 days) in semi dry areas. The variety is moderately resistant to scald and powdery mildew compared to Rihane and has a good resistance to net blotch under natural inoculation compared to *Manel*, another widely grown variety in the country. *Kounouz* gave an average yield of 5.2 tonnes $ha^{-1}$ compared with Rihane yielding 4.7 tonnes $ha^{-1}$. The specific weight is 0.6 to 0.7 t/hl in high input environment in Béja; and 0.63 t/hl in low input environment in Kef. The total protein content is 9-12% in Béja and 11.5-14.9 in Kef.

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## RESEARCH NOTES

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

### Impact of Ultra-drying on Molecular and Ultra-structural Profile of Pearl Millet (Pennisetum glaucum) Genotypes

*Manish Kumar Vijay[1], Sushil Pandey[2]*, Chitra Devi Pandey[2], Lalit Arya[2] and C. Tara Satyavathi[3,4]*

**Abstract**

The purpose of this study was to determine how drying seeds to low moisture content (ultra-drying) using different drying methods could cause damage to the seeds at molecular and ultra-structural level in pearl millet genotypes, viz Pusa 443 and Pusa 415. Moisture content of seeds was reduced to 7±0.2, 5±0.2, and 3±0.2% (wet weight basis) using four different drying methods: silica gel, lithium chloride, sulfuric acid, and seed drying chamber. After drying, seed lots were subjected to an accelerated aging treatment at 43°C and 90% relative humidity for one week and tested for viability. The results indicate that seeds can be safely dried to moisture content as low as 3%, without affecting the viability and the structural integrity. Seed drying also increased the storability of the genotypes whereas silica gel performed better followed by treatment in a seed drying chamber.

Seed samples were further evaluated for their genetic stability using single sequence repeat (SSR) markers and for ultrastructural changes by scanning electron microscopy (ESM). SSR profiles of ultra-dried seeds were monomorphic and similar to those of non-aged (control) seeds, irrespective of moisture content and drying methods confirming their genetic integrity. However, micro-morphological studies using SEM clearly indicate that there is destruction of seed surface and endospermic starch granules in acid dried seeds resulting in adverse effects on seed longevity.

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#### Introduction

Pearl millet (*Pennisetum glaucum*.) is an important crop in terms of area and production on the Indian sub-continent. India is the largest producer of pearl millet and the crop is grown on 8.7 million ha with an estimated production of 10.1 million tonnes (DES, 2011). India is a secondary center of origin for pearl millet with many distinct landraces growing throughout the country.

Three major factors, the seed moisture content, the temperature, and the relative humidity influence the storage potential of seed for conserving plant genetic resources. Among these, seed moisture content is more influential than temperature. Moreover, survival of seeds in dry storage conditions depends more on its moisture content than on any other factor (Ellis et al. 1988). Drying seeds to reduce their moisture content to a safe level prolongs longevity during seed storage in genebanks. Many genebanks use the conventional drying room or desiccants such as silica gel to dry seeds and store them at the preferred temperature of -15°C, recommended by the Bioversity International. In many resource-limited Asian and African countries, either the required facilities are missing or the power supply to run the equipment regularly is rather erratic or costly. Therefore, developing efficient and affordable low cost drying methods and procedures to reduce seed moisture content without causing damage to the seed tissue is a priority, especially for resource-limited genebanks in developing countries.

Ultra-drying storage has been identified as a better and more feasible technology for the seeds of traditional species, compared with traditional methods (Ellis *et al.* 1988; Li, *et al.* 2009). For developing countries, this technology, with its simple management and low cost (Zheng, 1994), can greatly reduce the cost of constructing and maintaining genebanks. Positive results of ultra-dry seed storage have been reported (Zheng, 1994; Li et al. 2006). However, drying seeds to very low moisture contents may reduce longevity. Nevertheless, the optimum moisture content for storage may exist and the minimum moisture content required for maintaining the viability will vary among species (Yi et al. 2007).

Using silica gel to dry seeds to low moisture contents showed no adverse effect on seed longevity or storage life when seeds were dried to

very low levels (Ellis *et al.* 1988; Zheng, 1994). However, there are no reports on the impact of ultra-drying on the molecular and ultra-structural level changes in pearl millets. Hence, the aim of the study was to investigate the changes or damages that may occur at the DNA level using SSR and to investigate the structural integrity of pearl millet seeds due to ultra-drying using SEM.

### *Materials and methods*

In order to investigate the effect of different drying methods and the rate of drying, seeds of Pusa 415 and Pusa 443 were divided into five equal sets. One set from each lot were kept as control and the remaining four sets were subjected to different drying methods such as silica gel, saturated sale of lithium chloride, acid drying (conc. $H_2SO_4$) and conventional drying room (15°C and 15% RH). The moisture content was calculated based on weight loss, at an interval of four days, as per the method described by Rao *et al.* (2006).

### *Accelerated ageing test and PCR primers*

After ultra-drying, the accelerated ageing test was carried out on both genotypes where two replicates (5 g) from each set were withdrawn and the seeds were kept at 43$^0$C and 100% relative humidity as described by Delouche and Baskin (1973). Seed samples from each set were withdrawn on the fourth and seventh days of aging and the DNA was extracted following the method given by Saghai-Maroof *et al.* (1984).

After screenings using many SSR primers, eight primers were selected for amplification. PCR amplification was carried out with 100 ng of genomic DNA, 1.25 mM $MgCl_2$, 0.8 U *Taq* DNA polymerase, 1µ PCR buffer without $MgCl_2$, 0.4 µM each (forward and reverse primer) and 0.2 mM dNTP mix (Allouis *et al.* 2001; Senthilvel *et al.* 2004). Initial denaturation at 94°C for 3 minutes followed by ten cycles of denaturation at 94°C for 30 seconds, touchdown annealing starting at 62°C for 30 seconds and decreasing 0.7°C per cycle and extension at 72°C for one minute and primer annealing at 55°C for 30 seconds. The resolved amplification products were visualized under UV light on a UV-Transilluminator. A Bio Imaging System (SynGene) was used to photograph the gel (Table1).

### *SEM ultra-structural study*

Seed samples were prepared for scanning electron microscopy (SEM) by fracturing the samples with a dull razor blade. The samples were mounted on stubs with silver conductive paste and coated with 24 nm gold-palladium. Micrographs were taken on a Zeiss EVOMA10 scanning electron microscope at 20 kV/EHT and 10 Pa. Micro-morphological changes due to different drying methods were studied for both genotypes.

**Table 1: Details of SSR primers used in pearl millet analysis**

| Reference | Primer annealing | Primer Sequence | Expected size (bp) |
|---|---|---|---|
| Senthilvel et al., 2004 | 3002 | AAAGTTACCGGGAGGGTAAAAA<br>TCGCCTAAAAACTGGAGGAA | 205 |
| | 3017 | CACCAAACAGCATCAAGCAG<br>AGGTAGCCGAGGAAGGTGAG | 200 |
| | 3027 | ACACCATCACCGACAACAAA<br>AGTGACCTGGGGTACAGACG | 210 |
| | 3032 | AGGTAGCCGAGGAAGGTGAG<br>CAACAGCATCAAGCAGGAGA | 190 |
| | 3035 | GCCAAGGAGGTCAAGATCG<br>ACACGACTCGACTCAGACCA | 280 |
| | 3038 | CTCTCGGTTTGACGGTTTGT<br>GGGGAAAACAAAGTTGCTCA | 180 |
| Allouis et al., 2001 | PSMP2229 | CCACTACCTTCGTCTTCCTCCATTC<br>GTCCGTTCCGTTAGTTGTTGCC | 241 |
| | PSMP2261 | AATGAAAATCCATCCCATTTCGCC<br>CGAGGACGAGGAGGGCGATT | 193 |
| | PSMP2263 | AAAGTGAATACGATACAGGAGCT-GAG<br>CATTTCAGCCGTTAAGTGAGACAA | 238 |
| | PSMP2273 | AACCCCACCAGTAAGTTGTGCTGC<br>GATGACGACAAGACCTTCTCTCC | 169 |

### *Results and discussion*

### *Drying rate*

Figure 1 presents the effects of different drying methods on the rate of drying. It is evident from the results that the drying rate was found to be fastest in acid drying methods followed by silica gel irrespective of the genotypes, while lithium chloride and drying room were found to be slow drying methods. Based on these results, both silica gel and lithium chloride were used for ultra-drying.

### *SSR analysis*

In the present experiment, after initial screening, eight primers were amplified and all the

SSR primers produced monomorphic banding patterns after ultra-drying and accelerated aging, irrespective of the genotypes (Figure 2). This result confirmed the genetic fidelity of dried seeds irrespective of the different drying methods and moisture content. Similar results were also reported in RAPD profile of Radish (*Raphanus sativus*) where seed moisture content less than 5% enhances longevity (Mukesh *et al.* 2011). DNA of an embryo becomes progressively cleaved as dry seeds age, losing their ability to germinate. However, genomic integrity is restored by an active repair of such breaks and lesions upon hydration of a viable embryo. As the seeds become older, these DNA repair processes become slower due to inactivation of at least some of the key enzymes, such as DNA ligase and DNA polymerases (Coello *et al.* 1996).

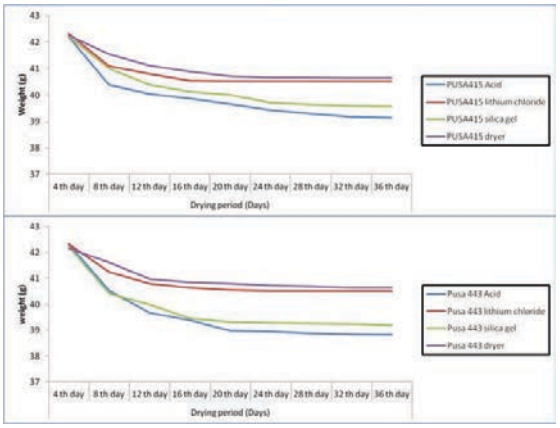


**Figure 1: Effects of different drying methods on rate of drying in pearl millet genotypes**

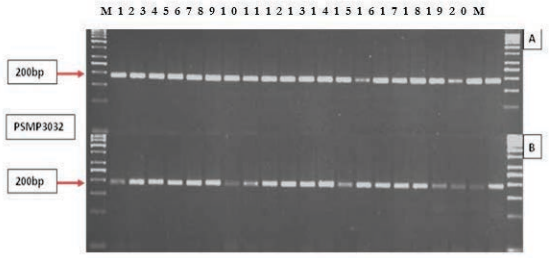


**Figure 2: SSR profile of both the genotypes of pearl millet after ultra-drying and accelerated aging using PSMP 3032**

*Note: M: marker; 1: Control; 2: Control aged (4 days); 3: 3%; 4: 3% aged (4 days), 5:3% aged (7 days), 6:5%; 7: 5% aged (4 days); 8: 5% aged (7 days); 9: 7%; 10:7% aged (4 days); 11: 7% aged (7 days), 12: Lithium chloride, 13: LC aged (4 days); 14: LC aged (7 days); 15: Acid drying; 16: Acid aged (4 days); 17: Acid aged (7 days); 18: Dryer; 19: Dryer aged (4 days), and 20: Dryer aged(7 days); Genotypes: A: PUSA 415; B: PUSA 443*

### *SEM seed structure*

Many cellular and biochemical events appear associated with the desiccation tolerance of seeds, including events that modify ultra-structural characteristics, like vacuolation, heat shock proteins, and withdrawal of plasma membrane from cell wall (Bailly et al. 2001; Galau et al. 1991; Folkert et al. 2001), leading to poor storability of seeds.

Figure 1 and Table 2 present the results of SEM on pearl millet genotypes. The results of the present experiment on the micro-morphology by SEM of ultra-dried seed using silica gel showed no change in the cellular pattern. However, acid treated seeds showed the collapsing of seed coat cells in both genotypes. Similarly, the micro-morphology of endosperm and starch granules of ultra-dried seed showed sharp lesions/breaks on the surface of granules in acid dried seeds but not in seeds dried using silica gel. This information may be useful tool for genebanks to determine the critical moisture content and structural integrity for safe storage.

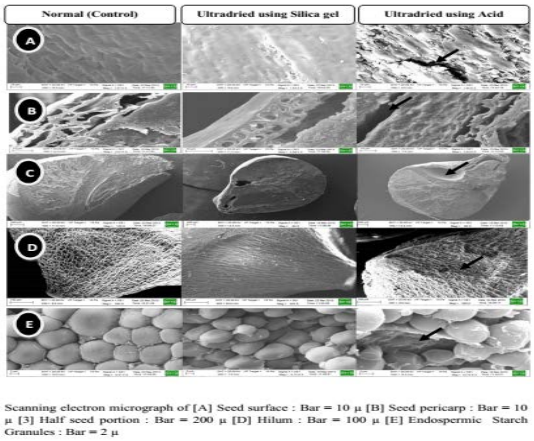


**Figure 3: SEM profile of pearl millet after ultra-drying**

**Table 2: SEM observation of normal and ultra-dried seeds of pearl millet**

| Genotype | Treatment | Observation under SEM | | | | |
|---|---|---|---|---|---|---|
| | | Seed surface | Hilum | Seed pericarp | Half seed | Endosperm |
| PUSA 415/ PUSA 443 | Ultradried using silica gel | Comparable to normal (control) seed | Comparable to normal (control) seed | Comparable to normal (control) seed | Comparable to normal (control) seed | Comparable to normal (control) seed |
| | Ultradried using acid | Collapsing of seed surface | Drastic structural difference some cracks was observed | Breakdown of cellular integrity | Damage of endosperm cells, collapsing of embryo, separation of embryo from endosperm | Deformation of starch granules |

*Conclusion*

The present study on pearl millet seeds using molecular and micro-morphological parameters reveals that pearl millet seeds can be dried up to 3% moisture content without affecting the structural integrity and storage potential. The SSR primer study showed mono-morphism, irrespective of moisture contents, drying methods and genotypes studied. The micro-morphological study using SEM clearly showed the destruction of seed surface and endospermic starch granules in acid dried seeds of pearl millet, whereas no change was recorded in pearl millet ultra-dried seeds using silica gel. Therefore, ultra-drying was found to be suitable for extending the seed storage life in pearl millet.

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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

### Pan-African Grain Legume and World Cowpea Conference

In order to celebrate the IYP-2016, a Joint Pan-African Grain Legume and World Cowpea Conference will be held in Livingstone, Zambia, from February 28 to March 4, 2016. The conference is organized by the International Institute of Tropical Agriculture and the Feed the Future Innovation Lab for Collaborative Research on Grain Legumes in partnership with the Pan-Africa Bean Research Alliance, the International Center for Tropical Agriculture, the Centre for Coordination of Agricultural Research and Development for Southern Africa, the International Center for Research in the Semi-Arid Tropics, the CGIAR Research Program on Grain Legumes, the Zambia Ministry of Agriculture and Livestock, and the Zambia Agriculture Research Institute.

For more information, please visit the conference website: http://gl2016confa.iita.org.

### AFSTA Congress 2016

AFSTA Congress 2016 will take place 1-3 March 2016 in Nairobi, Kenya. For more information, please contact the AFSTA Secretariat at afsta@afsta.org.

### International Conference on Pulses for Health, Nutrition and Sustainable Agriculture in Drylands (ICP-2016)

ICARDA and INRA-Morocco, in collaboration with UN-FAO, OCP-Foundation and CRP-Grain Legumes, will be organizing an International Conference on Pulses for Health, Nutrition and Sustainable Agriculture in Drylands in Rabat, Morocco during April 13-15, 2016. The ICP-2016 is held on the occasion of the 2016 International Year of Pulses in order to provide a platform to various stakeholders, including scientists, policy-makers, extension workers, traders and entrepreneurs, and to discuss the various contributions of pulses to food and nutritional security and ecosystem health. The challenges ahead in driving increased production and greater benefits for all will be addressed with a focus on Central and West Asia, and North Africa. A roadmap will be developed in order to increase productivity and profitability of pulses through diversification and intensification of cereal/livestock-based cropping systems. For any inquiries, please contact: ICP.2016@cgiar.org

### 2016 ISF World Seed Congress

The ISF World Seed Congress 2016 will take place in Punta del Este, Uruguay on 15-18 May 2016. Registration will open on 5 Jan 2016 at 11.00 h (GMT). It will be organized under the theme 'World Seed Congress 2016–The Way Forward in Business and Life'. For more information, visit the website at: http://worldseedcongress2016.com/ WORLDSEEDCONGRESS2016/Welcome2016.html.

### 19th International Sunflower Conference

The 19th International Sunflower Conference will be organized on 29 May–3 June in Edirne, Turkey by the ISA (International Sunflower Association) and Trakya University. The conference is intended to present scientific subjects of broad interest to the sunflower community, providing an opportunity to present their work as oral or poster presentations that can be of great value for global sunflower production and trade.

The organizers intend to bring together three communities: science, research, and private investment in the friendly environment of Edirne, Turkey to share their interests and ideas and to benefit from interaction with each other. The subjects covered include production, agronomy, breeding and genetics, genomics, genetic resources, physiology, biology, biotechnology, plant protection, trade and economy.

Please contact the Organizing Committee: Bilge Afsaroglu, Tel: +90-284 2261218; +90-2842261218 int. # 1310; e-mail: info@isc2016.org. Further information and registration form will be available on the Conference website **www.isc2016.org**

### 31st ISTA Congress 2016

The 31st ISTA Congress 2016 will be held 14–21 June 2015 in Tallinn, Estonia. The ISTA congress provides an excellent opportunity to meet other seed experts and to exchange experiences. It also provides a chance for in-depth discussions about topics of interest to the ISTA community. For more information or to register, please visit the web site: https://www.seedtest.org/en/event-detail---0--0--0--70.html

### ISTA Seed Symposium

ISTA is organizing the Seed Symposium during its 31st Congress. The ISTA Seed Symposium 2016 under the theme 'Progress in seed testing and seed quality improvement through science and technology' will be held from 15-17 June 2016, as part of the 31st ISTA Congress in Tallinn, Estonia from June 14-21. Participants intending to take part are encouraged to present their work as oral or poster presentations detailing a range of topics under the above theme.

Papers should be submitted online only in the form of an abstract in English with a maximum of 1600 characters. Papers will be presented orally and as posters, both having equal status.

The deadline for submission of all papers is 23 October 2015. The selected authors will be contacted to provide further information on experimental results, in addition to the abstract.

For more details on the ISTA Seed Symposium or to submit a paper visit the ISTA Website: http://www.seedtest.org/en/seed-symposium-_content---1--1463.html or use the following link: http://www.seedtest.org/en/ abstractpaper-submission.html.

For more information please contact: ISTA, Zurichstrasse 50, 8303 Bassersdorf, Switzerland; Tel: +41-448386000; Fax: +41-448386001; e-mail: ista.office@ista.ch; www.seedtest.org

### 12th International Conference on Development of Drylands

The Twelfth International Conference on Dryland Development, with the theme '*Sustainable Development of Drylands in the Post 2015 World*', will be organized by the International Dryland Development Commission (IDDC) and hosted by Bibliotheca Alexandrina, Alexandria, Egypt, 21-24 August 2016. It will be co-sponsored by the Arid Land Research Centre, JICA and JIRCAS, Japan; Arid Land Agricultural Graduate Studies & Research Institute, Desert Research Center and Agricultural Research Center, Egypt; Cold and Arid Regions Environmental and Engineering Research Institute, China; Desert Research Institute, USA; CIHEAM; FAO; ICARDA; and the United Nations University. The Conference will be supported by the Arab Fund for Economic and Social Development, AAAID, AOAD, IDRC (Canada), IFAD (*T.B.C*) and co-sponsored by other international organizations (CIHEAM, FAO, ICARDA, and UNV) and national organizations.

Please return letter of intent to: Prof. Dr. Adel El-Beltagy, Chair of IDDC, ICDD Secretariat, 19 Aboul Feda St., Zamalek, Cairo, Egypt, Zip code: 11211; Fax: +202-27370037; E-mail: aidahanem@gmail.com and copy to: Dr. Mohan C. Saxena, Executive Secretary, IDDC, E-mail: m.saxena@cgiar.org; mohan.saxena@yahoo.com

### 2nd International Legume Society Conference

The Second International Legume Society Conference will take place on 11-14 October 2016 at the Tróia resort, Lisbon, Portugal. The conference is organized by the International Legume Society and the Instituto de Tecnologia Química e Biológica António Xavier of the Universidade Nova de Lisboa.

The conference will address the following themes: Legume Quality and Nutrition; Farming Systems/Agronomy; Abiotic and Biotic Stress Responses and Breeding; Legume Genetic Resources; and New "Omics" Resources for Legumes. The health and environment benefits as well as the marketing of legumes will be transversal topics throughout the conference. Special attention will be given to foster the interaction of researchers and research programs with different stakeholders, including farmers and farmer associations, seed/feed and food industries, and consumers.

There are several satellite events before and after this conference, including the 4th International Ascochyta Workshop two days prior to the ILS conference. For more information and registration, please contact: **2ILSCSecretariat- secretariat.ils2@itqb.unl.pt** or visit the website at http://www.itqb.unl.pt/meetings-and-courses/legumes-for-a-sustainable-world/contacts#content

## 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 land man-

agement, diversification and intensification production systems, and socioeconomics and policy research. For more information on the ICARDA annual training program, contact: Charles Kleinermann, Head of Capacity Development Unit, ICARDA, Amman, Jordan; e-mail: c.kleinermann@cgiar.org

### UPOV Distance Learning Courses

Two sessions of the following UPOV Distance Learning Courses will be run in 2016: (i) DL-205 'Introduction to the UPOV System of Plant Variety Protection under the UPOV Convention', (ii) DL-305 'Examination of applications for plant breeders' rights'; (iii) DL-305A 'Administration of Plant Breeders' Rights' (Part A of DL-305); and (iv) DL-305B 'DUS Examination' (Part B of DL-305)

The timetable for all courses will be the following:

#### Session I - 2016

- Registration: January 1 to February 7
- Study period: February 15 to March 20
- Final exam: March 14 to 20

#### Session II – 2016

- Registration: August 15 to September 18
- Study period: September 25 to October 30
- Final exam: October 24 to 30

The categories of participants for the DL 205 and DL 305 courses are as follows:

*Category 1:* Government officials of members of the Union endorsed by the relevant representative to the UPOV Council (*no fee).*

*Category 2:* Officials of observer states/inter-governmental organizations endorsed by the relevant representative to the UPOV Council (o*ne non-fee paying student per state/inter-governmental organization; additional students, CHF1000 per student).*

*Category 3:* Others (f*ee, CHF1000).*

The registrations of participants in Categories 1 and 2 must be endorsed by a representative of the UPOV Council, a UPOV member or observer, as appropriate, in order to formally nominate the participant. More detailed information about the course and online registration is available on the UPOV website: http://www.upov.int/resource/en/ training.html

### ISTA Training Workshops

*ISTA Quality Assurance Workshop, 10-13 June 2016; Saku, Estonia*

The objective of this workshop is to give experienced laboratories the opportunity to discuss and to receive guidance about ways of improving their Quality Assurance system. The workshop is for members of experienced laboratories that have already a well running quality management system in place. The workshop will consist of oral presentations, group work and exercises. The attendees' involvement in exercises and discussions will be encouraged. For further details and to register, please visit: http://www.seedtest.org/en/event-detail---0--0--0--72.html

*ISTA Germination Workshop in Seed Testing, 11-13 June 2016, Saku, Estonia*

This workshop aims to present and discuss the principles of the ISTA germination test, seedling evaluations for different species, result calculations and reporting, and aspects of quality management linked to germination testing. The workshop is for persons who are involved in seed testing according to the ISTA Rules. The workshop will consist of lectures and practical exercises. It will offer the opportunity for general discussion on germination testing, as well as for specific questions regarding testing procedures. The ISTA Rules and the ISTA Handbooks will be discussed and used during the workshop. Participants of this workshop will be actively involved through group work, discussions and practical work. For further details and to register, please visit: http://www.seedtest.org/en/event-detail---0--0--0--71.html

For more information, please contact: ISTA, Zurichstrasse 50, 8303 Bassersdorf, Switzerland; Tel: +41448386000; Fax: +41448386001; e-mail: ista.office@ista.ch; website: www.seedtest.org

## 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

**Qaim, M. 2015.Genetically Modified Crops and Agricultural Development**

*Published by Palgrave Macmillan; ISBN 9781137405715; Price: £75.00 (+ delivery); 228 pp;*

In spite of the rapid adoption of genetically modified (GM) crops in some countries, the use of this technology remains contentious. Public opposition and overregulation have become real threats to further developments in modern plant sciences. It is widely believed that GM crops are bad for human health, damage the environment, and hurt smallholder farmers in developing countries, but research has shown the opposite to be true.

The book analyzes the impacts of current and possible future GM crop applications and shows that these technologies can contribute substantially to sustainable agricultural development and food security. Popular narratives about *frankenfoods, genetic contamination,* and *terminator genes* are deconstructed. Continued opposition to technologies that were shown to be beneficial and safe entails unnecessary human suffering and environmental degradation. To advance GM crop innovations, better science communication, more integrity in public and policy debates, and streamlined regulatory approaches are required.

**Vadivel. K., S. Ganesan and J. Jayaraman (eds.). 2015 Sustainable Crop Disease Management Using Natural Products**

*Published by CABI (www.cabi.org); ISBN 9781780643236; Price: $175.5 (Hard cover); 424 pp;*

Alternative methods for disease control, such as natural products and compounds derived from biological origins, provide an effective alternate to the use of chemical products or a means to minimize their use. It is imperative now to look for such sustainable crop disease management approaches, that include routine and alternative methods. Natural products for sustainable crop disease management represent an effort in this direction, and deal with immediate concerns in the field of natural and alternative products for disease control, apart from using biocontrol organisms. This book presents the latest information on natural products and compounds, derived from biological origins and it thoroughly discusses their applicability, field use, and prospects for adoption under different cropping conditions. This book also validates disease management strategies.

**Low, J., M. Nyongesa, S. Quinn and M. Parker (eds.). 2015. Potato and Sweetpotato in Africa: Transforming the Value Chains for Food and Nutrition Security**

*Published by CABI; ISBN9781780644202; Price: $216 (Hard cover); 662 pp*

Sweetpotato and potato are expanding faster than any other food crops in sub-Saharan Africa. There is growing investment in research to address bottlenecks in value chains concerning these two crops and growing interest from the private sector looking to invest in them. This book addresses five major themes on sweetpotato and potato: policies for germplasm exchange, food security and trade in Africa; seed systems; breeding and disease management; post-harvest management, processing technologies and marketing systems; nutritional value and changing behaviors

## Websites

### *CAB Abstracts*

CAB Abstracts is the leading English-language bibliographic information service providing access to the world's applied life sciences literature. CAB Abstracts provides researchers and students alike with the fullest global picture for any subject.

CAB abstracts include:

- CAB Abstracts gives researchers access to 7.6 million records from 1973 onwards, with around 350,000 new records added each year
- over 187,000 full text journal articles, reports, and conference proceedings – 70% of which are not available electronically anywhere else
- publications from over 116 countries in 50 languages
- indexing over 10,000 academic journals, books, conference proceedings, and reports specially selected by our subject experts
- comprehensive subject indexing with the CAB Thesaurus – our controlled vocabulary tool–making searching easier and providing more precise access to all relevant research

As well as indexing thousands of core scientific journals, CAB Abstracts offers extensive coverage of non-journal literature from around the world including annual and general reports, books and book chapters, handbooks, bulletins, monographs, conference proceedings, newsletters, discussion papers, technical information, field notes, theses, and posters.

### *Seed Association of the Americas*

SAA (Seed Association of the Americas) is a non-governmental organization that fully represents the interests of the seed industry within the Americas. SAA members are countries from South, Central and North America, represented trough their national seed associations and seed companies.

The main purposes of the SAA are to educate and support development, marketing and free movement of the seed within the Americas and advocate seed industry legislation and regulation issues as to ensure plant property rights.

## Newsletters

### *Seed E-News*

This is an electronic newsletter of the American Seed Trade Association. Established in 1883, the ASTA continues to be the industry's leading advocate for the development, marketing and movement of quality seed and associated products and services throughout the world. ASTA promotes the development of better seed to produce better crops for a better quality of life.

The association represents over 700 companies engaged in every aspect of seed production and trade – driving innovation in agriculture. Each company, regardless of its size, has an equal vote on policies and programs that promote business opportunity, fair trade and sound, science-based production practices.

For more information, visit the website at http://www.amseed.org/media-center/news/.

**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 in 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 proposed by subscribers. The Editor always welcomes suggestions on format and content. Please send inputs by email to z.bishaw@cgiar.org