

# Seed Info

Official Newsletter of WANA Seed Network



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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 News** provides information on activities relating to global and/or regional cooperation and collaboration in order 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).

In the **News and Views** section, Niels Louwaars, your regular contributor from the Dutch Seed Association, writes about *Climate Change and Seed Systems*, elaborating on the effects of CC on crop improvement and seed systems. Building resilient and robust seed systems is one of the responses for the expected variability and extreme weather conditions in the future. COP22 was recently held in November 2016 in the Moroccan city of Marrakech, charting future alliances in tackling CC. Other news in this section come from Ethiopia, Pakistan, and Tanzania, as well as from regional and/or international organizations, such as the World Bank, the International Seed Federation (ISF), the International Seed Testing Association (ISTA), and the International Union for the Protection of New Varieties of Plants (UPOV). From the World Bank Group, the Enabling the Business of Agriculture team reported the completion of its Enabling the Business of Agriculture 2017 project, which will be published in early 2017. Enabling the Business of Agriculture 2017 will be the third in an annual series of reports, providing objective measures of good regulatory practices and their enforcement in 62 countries studied.

The section on **Seed Programs** presents news from Brazil, Ethiopia, Georgia, Iran, Morocco, and Sudan. Ethiopia is stepping up its seed certification scheme, aligning it with regional and international norms and paving the way for its drive for membership in regional and international organizations. Brazil reports on the release of the first chickpea variety *BRS Aleppo*, whereas Georgia reports on the release of the winter wheat variety *Agruni-1*. Apart from high yields, the chickpea variety is resistant to fusarium wilt and the wheat variety is resistant to rusts, one of the major diseases in the Central Asia and Caucuses. The news from Morocco report on the findings of

Morocco's wheat seed sector performance and technology adoption presented at a National Workshop in April 2016. ICARDA, in collaboration with Moroccan national partners, has conducted a study on the adoption and impacts of improved varieties of wheat and seed system analysis in Morocco. The study was part of a series of research undertakings within the CGIAR Research Program on Wheat and the Wheat-Legume Cropping Systems project in West Asia and North Africa, funded by the European Union and International Fund for Agricultural Development, respectively. In Sudan, a high-level consultation meeting on wheat seed system and value chain analysis was held on 10 May 2016. The study was part of the Support Agricultural Research for Development-Strategic Crops (SARD-SC) project funded by the African Development Bank. In both cases, the objective is to increase the effectiveness and impact of wheat research on food and nutrition security, poverty reduction and resilience of production systems through better targeting of improved technologies.

The **Research** section of *Seed Info* captures information on adaptive research or issues relevant to the development of seed programs in the CWANA region and beyond. This issue features an article by Aynewa et al. from ICARDA, Ethiopia, titled *Identification of Lentil Varieties in Southeastern Ethiopia*. The paper discusses the participatory variety selection (PVS) of lentil varieties carried out across Africa Rising project sites in the Sinana district of Bale Zone in southeastern Ethiopia. PVS, both by female and male farmers, identified high-yielding lentil varieties that were well adapted and preferred by farmers. The activities are coupled with local seed production by organizing farmer groups in order to ensure the scaling out of the new varieties.

*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. Take time to share and contribute to your newsletter.

Have a very Happy New Year,

*Zewdie Bishaw, Editor*



## WANA Seed Network News

This section presents information about 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- and long-term seed courses in order to strengthen the capacity of the human resources of national seed sectors through special projects. These regional and national courses bring together staff from the various sub-sectors of national seed systems.

#### Seed Enterprise Development and Management in Ethiopia

##### Introduction

Farmers' lack of awareness of new and improved agricultural technologies, as well as the availability and access to quality seed, remain among the major bottlenecks in increasing the production and productivity of malt barley, faba bean and chickpea. Addressing awareness, creating demand, and providing sufficient quantity and adequate quality seed through the integration of farmer-based production and marketing and scaling-up of improved technologies are key components of USAID funded malt barley, faba bean, and chickpea projects. Since 2015, ICARDA is implementing two projects in four regional states of Amhara, Oromia, SNNPR, and Tigray in partnership with NARS. Capacity development of partners and stakeholders is one of the main components of the project in order to enable partners to implement the project and to sustain the achievements after the project phases out. Therefore, a Training of Trainers (TOT) course on *Seed Enterprise Development and Management* was carried out in two phases. The first phase concentrated on the technical aspects of crop and seed production, including the available technologies, and was held at Debre Birhan from 12-13 May 2016. The second phase focused on seed business management in Addis Abeba, Ethiopia, from 18-20 August 2016.

##### Course objectives and contents

The first course aimed at providing information on available malt barley, faba bean, and chickpea technologies and the principles and procedures of crop and seed production in a national setting, drawing on experiences from national programs.

The training covered available improved crop varieties and management practices: use and safety of fertilizers, biofertilizers and pesticides, organization of seed producer cooperatives and management of local seed business, seed production, processing, storage, quality assurance and regulatory aspects. Moreover, the application of biofertilizers and the safe use of Purdue Improved Crop Storage (PICS) bags were demonstrated.

**In the second course, emphasis was put on the organization, development and management of seed enterprise based on experiences and best practices available in Ethiopia, with emphasis on: i) sharing experiences and available information in farmer-based seed enterprise development and management for malt barley, faba bean and chickpea seed production, ii) introducing and creating awareness on the alternative seed delivery systems and their relevance, and iii) strengthening capacity on the development and management of farmers' seed producer cooperatives.** The course program consisted of theoretical lectures, practical/exercise sessions, and technical visits where possible.

##### Course participants

During the first phase, about 31 participants from 13 partner research centers and seed production coordinators of the five research institutes in the project target areas attended the *Seed Enterprise Development and Management* course. Similarly, the same 22 participants from the same institutions also attended the second phase of *Seed Enterprise Development and Management* course.

The participants are seed specialists and researchers from partner institutions of the respective regions. A total of 22 participants from 13 partner research centers and seed production coordinators of the five agricultural research institutes in the project target areas attended the course.





Participants of training course on Seed Enterprise Development and Management [Phase one (above) and Phase two (bottom)]

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## Seed Production and Processing of Forage and Pasture Crops

### Introduction

The project of *Provision of Proven Feed Resource Technologies to Improve the Red Meat Value Chain in Tunisia* has a seed component, aimed at improving the forage and pasture seed value chain, in order to narrow the feed gaps as part of adaptation strategies to drought. The project is funded by GIZ (German Agency for International Cooperation) and implemented by IRESA (Institution de la Recherche et de l'Enseignement Supérieur Agricoles). For forage and pasture crops, where forage biomass is a primary product not a seed, makes quality seed supply more difficult and is thus requiring particular attention. Fast track variety evaluation and release and early generation seed production of forage crops was identified as the weakest link in the seed value chain.

ICARDA organized a training course/workshop on *Seed Production and Processing of Forage and Pasture Crops* from 27 September to 5 October 2016. The training was conducted in conjunction with ICARDA's mission to visit the national partners involved in forage seed system development under the project.

### Course/workshop objectives and content

Mechanization of forage and pasture seed production, harvesting, cleaning and quality control

remain critical and problematic in further facilitating large scale seed supply and dissemination in order to bridge the feed gap in the country. Therefore, the Office de l'Élevage et des Pâturages (OEP) signed memorandums of cooperation (MoC) with relevant national agriculture research and development institutions. Under the MoC, the OEP acquired a seed processing plant from the Forage Department of the Ministry of Agriculture and additional equipment for seed treatment through the project.

The practical course was focused on assembling, testing, and demonstrating the equipment for seed treatment and on hands-on practical oriented training on the operation, adjustment and maintenance of the different seed cleaning machines. The two technicians from OEP have acquired the necessary knowledge and skills and demonstrated the operation and adjustment of the seed cleaners to the participants of the workshop.

In addition, a two-day workshop on technical aspects of forage and pasture seed production and supply was organized. Critical issues along the seed value chain were discussed, including forage and pasture crops classification, choice of species and improvement as well as their management in seed production and delivery options. Low varietal turnover and seed renewal rates, leading to a use of obsolete varieties and low quality seed with high level of infestation with parasitic weeds, respectively were some of the critical constraints identified in the seed value chain. Strengthening the variety maintenance capacity at the Al-Grine Research Station by providing specialized small-scale seed cleaners and quality control facilities, and its linkages with public and/or private variety development centers and network of seed suppliers remain crucial for the development of the forage and pasture seed sector.

### Course participants

A total of 17 participants from OEP, Office des Cereal and CRDA (Commissariat Régional du Développement Agricole) attended the two-day workshop alongside the technical staff trained on assembling and operation of seed cleaning machines.

Following the training course and workshop it was recommended that:

- Provide a range of small-scale precision seed cleaners and separators to handle small seed

lots for improved efficiency and effectiveness of forage and pasture variety maintenance and early generation seed production at the Al-Grine Station.

- Ensure sustainability of forage and pasture seed production at the Al-Grine station by establishing functional linkages for variety maintenance with pasture crops improvement institutions.
- Establish a network of certified seed producers using realistic standards under the supervision of seed certification agency.
- Develop an effective assessment of seed demand and supply to better facilitate the organization of the forage and pasture seed sector in the country.



*Participants of pasture and forage seed workshop*

*Abdoul Aziz Niane, ICARDA, Beirut, Lebanon; e-mail: [a.niane@cgiar.org](mailto:a.niane@cgiar.org)*

## 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.

### Climate Change and the Seed Sector

#### *Background*

Climate change is in the news headlines, particularly with the COP22, which was recently held in the city of Marrakesh in Morocco. Weather patterns are changing globally; a change in average temperatures can change winds, and rainfall patterns, significantly changing agro-ecologies. Changing ecologies can also change the distribution of pests and diseases. Whether climate change is man-made or not is irrelevant for the farmers that currently face such environmental

changes to their detriment. Climate change is compounding the difficulties posed by natural disasters, especially for farmers in rain-fed agriculture who do not have the means to ‘repair’ such stresses. Potato farmers in the Andes have to find ever-higher places on the slopes of the mountains to evade crop diseases; and maize farmers in many parts of southern Africa have not been able to harvest a decent crop for several years due to recurrent droughts.

#### *Impact on seed systems*

The main challenge for the seed sector is that we may also face the same stresses during seed production, losing a seed crop altogether or having quality problems. However, there are also opportunities, both in terms of markets and in the political debates. In many countries an important message in the biodiversity debate has been for quite some time, and still is, that local landraces are perfectly adapted to the conditions that they grow in, both in terms of ecological adaptation and local culinary needs. The inherent genetic diversity would make such landraces resilient against change. The proponents of this – and I have been one of them for a long time - clearly have a point. Evolution tells us that crops that are exposed to certain selective environments can adapt based on the circumstances of their existing and new diversity. New diversity comes from natural mutation and introduction followed by introgression. These forces have given plant breeders their basic diversity to work with. However, it now remains to be seen, whether these natural processes provide the level of resilience that could meet the current speed of change due to climate change.

#### *Opportunities*

Natural evolution takes many generations to create adaptations; plant breeders have the tools to speed up such evolution in crops - and the seed sector has an important task in multiplying and distributing the results of this breeding programs. Given that in many regions, farmers’ varieties are not optimally adapted to the current weather conditions anymore, there is a task and an opportunity for the formal seed sector to step in. The role of plant breeders is to create solutions for these farmers and the seed sector may find new markets for their products.

Plant breeding also takes time, so where breeders have not already started to select for drought tolerance or drought escape (shorter maturity types) and disease resistance, then they should do so as soon as possible. Seed producers would then need to prepare themselves to reach these new users of formally produced seed. We may not be able to

reach the most remote farmers with our seed, but informal seed exchange systems may help to reach them. Commercial breeders may not necessarily like to see their new varieties shared widely, but when it is to help remote and resource-poor farmers that they would otherwise not reach at all, they don't really miss out on any market opportunities.

Climate change is a risk for farmers, but it can turn out as a positive challenge for the seed sector in the West Asia and North Africa region (which will be most affected by climate change) and elsewhere.

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### **Oromia Seed Enterprise Receives Best African Seed Company Award of 2016**

The Oromia Seed Enterprise (OSE), the regional public seed enterprises in Oromia Regional State of Ethiopia won the award for the best African seed company in 2016 by the Alliance for the Green Revolution in Africa (AGRA). The enterprise distributed about 33,000 tonnes of seed to farmers last year. This year, it is planning to distribute 60,000 tonnes of seed to farmers.

OSE was awarded the prize not only for distributing large quantities of seed, but also for maintaining high standards of seed quality. Using 10 seed processing centers equipped with modern technology, OSE is currently producing seed of wheat, barley, maize and faba bean on 24,000 ha and distributing it to meet the seed demand of farmers in the Regional State.

OSE produces seed of improved varieties released by Ethiopian NARS and introduces tested and adapted improved varieties from abroad.

*Source: Ethiopian News Agency*

### **World Bank Group Publishes Enabling the Business of Agriculture Report**

The Enabling the Business of Agriculture team reported on the completion of its Enabling the Business of Agriculture 2017 project, which will be published in early 2017. Enabling the Business of Agriculture 2017 will be the third in an annual series of reports, providing objective measures of regulatory good practices and their enforcement in 62 countries studied.

Please visit the [website](#) to download a copy of last

year's report and to access country-specific indicator data, with information on the methodology used and general background on the project. You will also find a [Local experts](#) section that acknowledges the indispensable support received from our contributors.

### **Developments in Genetically Modified Crops**

#### ***GM seeds market growth to increase through 2020 due to rise in biofuels use***

The global genetically modified (GM) seeds market will continue to grow at a compound annual growth rate close to 10% by 2020, according to a new report by Technavio, a global technology research and advisory company. Technavio's latest report, *Global Genetically Modified Seeds Market 2016-2020*, covers the present scenario and growth prospects of the global GM seeds market for 2016-2020.

The report states that four factors contribute to the growth of the global GM seeds market: i) rise in adoption of biofuels; ii) increased demand for animal feed; iii) threat from global food companies to non-GM food products; and iv) premium pricing of non-GM food products.

The demand for biofuels during the forecast period will increase as consumers become more concerned about the environment. Biofuels use energy crops, such as wheat, soybean, sugarcane, and maize. As governments in Asia Pacific and Africa encourage the use of biofuels, the increasing production of energy crops will continue to boost the global GM seeds market. The International Energy Agency (IEA) expects a one percent increase in the share of cropland for biofuels during the forecast period.

According to the report, North America will continue to dominate the market, and is likely to occupy around 30% of the total market share by 2020. The growing adoption of agricultural biotechnology in North America makes this market innovative, while providing solutions to farmers for environmental conditions such as drought, salinity, and disease stress that affect the yield and production of many crops. The growing demand for herbicide-tolerant and insect-resistant GM maize and soybean seeds will help the market grow steadily in this region.

For more details about the report, read the [news release](#) or visit the [Technavio website](#).

*Source: Crop Biotech Update (August 31, 2016)*

### **Rothamsted Research submits application to carry out field trial with GM wheat plants**

Ensuring food security is a major challenge given the projected need to increase world food production by 40% in the next 20 years and 70% by 2050. Wheat is one of the major grain crops worldwide and provides approximately one-fifth of the total calories consumed globally. However, wheat yields have reached a plateau in recent years and predictions are that yield gains will not reach the level required to feed a population of 9 billion predicted for 2050. Traditional breeding and agronomic approaches have maximized light capture and allocation to the grain. A promising but as yet-unexploited route to increase wheat yields is to improve the efficiency by which energy in the form of light is converted to wheat biomass.

Rothamsted Research in the UK submitted an application to the Department for Environment, Food and Rural Affairs to conduct [GM wheat](#) field trials in Rothamsted Farm in 2017 and 2018. The GM wheat under study was developed by scientists at Rothamsted Research, University of Essex, and Lancaster University to be more photosynthesis-efficient and to better convert light energy into plant biomass. The field trial will be carried out to assess the performance of GM wheat plants in the field. At present, public consultation regarding the application is being conducted.

Read the original article from [Rothamsted Research](#). More information on this project can be found on dedicated Questions and Answers Section on the [Rothamsted Research website](#)

*Source: Crop Biotech Update (November 9, 2016)*

### **Tanzania plants first GM maize field trial**

The first [genetically modified \(GM\) maize](#) research trials have been planted on October 5, 2016 in Tanzania's Dodoma region, a semi-arid area in the central part of the country. The confined field trial aims to demonstrate the effectiveness and safety of a [drought](#)-tolerant GM maize hybrid developed by the Water Efficient Maize for Africa project.

Tanzania's progress comes a year after the country revised a strict liability clause in the Environment Management Biosafety Regulations. The restrictive clause stated that scientists, donors, and partners funding research would be held accountable in the event of any damage that might occur during or after research on [GM crops](#). Such developments in Tanzania therefore provide hope for the technology's prospects across the continent. This is fundamental because Africa has been ravaged by frequent drought over the years, leading to severe

crop shortages and hunger for over 300 million Africans who depend on maize as their main food source.

Under a royalty-free licensing agreement, seed companies in Kenya, South Africa, Tanzania and Uganda are already growing and selling DroughtTEGO™, a drought-tolerant maize hybrid developed by WEMA to suit local conditions. For more details, read the article at the [Cornell Alliance for Science website](#).

*Source: Crop Biotech Update (October 12, 2016)*

### **Ethiopia supports agri-biotech initiatives**

Ethiopia has made a commitment for placing the country in a strategic position to utilize biotechnology tools in agricultural production. For the first time, the government had committed USD 4.5 million towards the development of the country's biotechnology road map. The road map was unanimously adopted by the Council of Ministers, which led to the establishment of the Ethiopian Biotechnology Research Institute in a bid to raise the country's capacity for agricultural biotechnology.

During the coordination meeting on 29 September 2016 in Addis Abeba, it was announced that after the revision of the biosafety proclamation, which was previously described as stringent, the country has seen a complete turnaround in its progress towards the adoption of agricultural biotechnology. Besides the biotechnology road map, there have also been remarkable institutional achievements such as the development of the country's biosafety guidelines: i) guidelines on application for deliberate release of living modified organisms (LMOs); ii) risk assessment parameters for LMOs; iii) management of risks from handling of LMOs; iv) requirements for transport and storage of products from LMOs; and v) guidelines of application for special permit to handle LMOs for research and teaching.

While tremendous progress has been made, a lot remains to be done in developing the infrastructure and human resource capacity in biotechnology. Awareness creation efforts among policy makers and the public need to be strengthened and enabling environments for scientists to communicate biotechnology information to the public need to be created.

For more updates about biotechnology in Africa, visit the [ISAAA AfriCenter website](#).

*Source: Crop Biotech Update (October 12, 2016)*

## Pakistan Enacted Plant Breeders' Right Bill

In Pakistan, the Senate recently passed the *Plant Breeders' Right Bill* and with the adoption of the bill by both Houses of the Parliament, it will become Plant Breeders' Rights Act of 2016 after the President's assent. The development of new plant varieties and the rights of their breeders are to be protected for the first time in Pakistan under the proposed legislation.

The Plant Breeder Right Act remained pending for the last 11 years. In the absence of this legislation, dealers/companies had no legal protection. The proposed law would encourage plant breeders and seed companies of both public and private sectors to invest in research and plant breeding; development of superior varieties of field, vegetable and ornamental crops; and facilitate access to protected foreign varieties and new technologies.

Cognizant of this, the government has decided to invite foreign seed companies to overcome cotton seed shortages and to increase yield after getting legal protection through proposed *Plant Breeders' Right Bill*. Only the first generation of BT cotton is available in the country, while the second and the third generations are yet to be made available. However, the proposed legislation would provide a level playing field, thus encouraging seed companies to develop the latest cotton seed technology in the country.

The modus operandi for inviting foreign companies, including Monsanto, to overcome certified cotton seed shortage has been finalized. However, it was decided that foreign companies would only be allowed to provide genes while seed would be developed locally.

Currently, only Bollgard-I is available in Pakistan. However, the move would help in introducing Bollgard-II and Roundup Ready Flux. The Ministry of Climate Change assured that all pending issues before the National Biosafety Committee regarding GMO would be resolved soon.

*Source: Seed Quest*

## ISF Develops a Guide for Maintaining Plant Genetic Integrity of Conventional Vegetables

The International Seed Federation (ISF) in collaboration with Excellence Through Stewardship (ETS) developed the [Guide for Maintaining Plant Genetic Integrity of](#)

[Conventional Vegetables](#). This guide is intended to provide guidance on: (1) understanding through assessment of an organization's risks of materials out of place, including the potential presence of GM material in conventional vegetable seed (known as adventitious presence or AP); (2) developing and implementing a quality management system to manage plant genetic integrity; and (3) developing an incident response plan for responding to potential incidents related to plant genetic integrity concerns. The guidance in this document is intended to be flexible and its application will differ according to the size, nature, and complexity of the organization involved, as well as the products being developed and/or commercialized. Common throughout the entire process is an emphasis on the importance of product identification and traceability, as well as on documentation and governance.

This guide is primarily focused on activities associated with conventional vegetable breeding and seed production to maintain plant genetic integrity and to avoid the presence of material out of place, such as adventitious presence of GM plant material. This Guide addresses quality management systems and risk management for the full life cycle of vegetable breeding and seed production to address any adventitious presence. It is applicable to all stages of the plant Guide for Maintaining Plant Genetic Integrity of Conventional Vegetables for the product life cycle from initial research and discovery through development to commercialization and post-market activities.

## ISTA Revises Procedure for Proficiency Test (PT) Program

The new version of the procedure [PT-P-01-ISTA Proficiency Test Program-V 3.5](#) is posted on ISTA website. The scope, schedule and participants of PT are highlighted below.

### *Scope of ISTA PT program*

All ISTA member laboratories are eligible to participate in all proficiency test (PT) rounds of the ISTA PT Program. It is mandatory for ISTA accredited member laboratories (based on their scope of accreditation) and voluntary for non-accredited laboratories, which want to benchmark themselves with accredited laboratories and to prepare themselves for accreditation in the future. The goal is not to identify the best seed testing laboratory in the world, but to identify those laboratories that do not meet the minimum standard of performance that is reasonably expected from an ISTA accredited laboratory and to determine if such laboratories are taking reasonable corrective



actions to bring their performance standard back to at least the minimal level. Non-members of ISTA may participate in the PT Program for a flat fee determined by the Association. Participation comprises shipment of samples, statistical analysis and reporting to the participating laboratory. Non-members who wish to participate should contact the ISTA Secretariat.

### Schedule

Regular PT rounds are performed three times per year. Each round is made up of three samples for each test (or group of tests) and for each species that are analyzed for purity analysis, other seed determination, germination testing, moisture content determination, viability testing and/or vigor testing as applicable. PTs for tests other than those mentioned may be organized by the Technical Committee, but are, for the time being, not yet part of the rating.

### Program plan

The PT Committee, comprising the Chairman and the PT Leaders, select particular species to be used for the program over a three-year time span between two ISTA Congresses. The species are chosen to represent a size and germination type group and are intended to be generic in representing a crop group listed in the ISTA Rules Table 2A, which may be part of a laboratory's scope of accreditation. If a laboratory is accredited for one or several of the species mentioned in a crop group, participation in a test round which tests another species of the same crop group is mandatory. At the beginning of each PT period, generally after an ISTA Congress, the laboratory will receive the Program Plan (Annex II ISTA Proficiency Test Program Plan). Test rounds are identified by a unique numbering system as follows: last two numbers of the year in which the test is performed, a number indicating the round of that year plus an abbreviation of the species tested. This number is applied and referred to in communication to quickly identify the test round concerned.

### Participants

Before a round starts, the list of participants is generated on the basis of the data available in the Secretariat's database. This list is made up of laboratories obliged to participate due to their specific scope of accreditation and laboratories having indicated their interest. The mandatory status of every laboratory is determined on the basis of their approved scope of accreditation. The scope of accreditation is defined in the document Acc-D-07-Scope of Accreditation Policy.

## News from UPOV

### UPOV membership

The purpose of the International Union for the Protection of New Varieties of Plants (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 consisting of 74 members and covering 93 States from Americas, Africa, Asia and Australasia ([www.upov.int/members/en/](http://www.upov.int/members/en/)).

### UPOV logo and website

The Council of UPOV, at its 50<sup>th</sup> ordinary session on 28 October 2016, approved the new UPOV logo (shown here) and agreed that it should be introduced on the UPOV website in conjunction with the introduction of the new stakeholder features for: breeders; farmers; policy-makers; and the general public and with the introduction of the UPOV YouTube channel. The updated website is available at:



<http://www.upov.int/portal/index.html.en>

### UPOV electronic application form

The UPOV Council approved the launch of the UPOV Electronic Application Form (EAF) in January 2017 for rose, soya bean, lettuce, apple fruit varieties and potato.

The EAF will enable breeders to submit data to participating UPOV members via an online form. The main benefits of the EAF are:

- To provide an online system for UPOV members that do not have their own online application system;
- To allow applicants to read all questions in any of the languages of participating members;
- To enable applicants to reuse existing application data for subsequent applications;
- To facilitate exchange of data in a standard format (PVP-XML).

### UPOV seminars and symposium

On September 7 and 8, 2016, UPOV organized a *Seminar on the Enforcement of Plant Breeders' Rights under the UPOV Convention* (see [http://www.upov.int/meetings/en/2016/enforcement\\_seminar\\_vietnam/index.html](http://www.upov.int/meetings/en/2016/enforcement_seminar_vietnam/index.html)) from 7-8 September 2016 in Hanoi, Vietnam and a *Seminar on Propagating and Harvested Material in the Context of the UPOV Convention* on 24 October 2016 in Geneva, Switzerland (see

[http://www.upov.int/meetings/en/details.jsp?meeting\\_id=39124](http://www.upov.int/meetings/en/details.jsp?meeting_id=39124)). The latter seminar was attended by 151 participants.

Moreover, on 26 October 2016 also in Geneva, Switzerland, UPOV and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) jointly organized a *Symposium on Possible Interrelations between the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the International Convention for the Protection of New Varieties of Plants (UPOV Convention)* (see [http://www.upov.int/meetings/en/details.jsp?meeting\\_id=40584](http://www.upov.int/meetings/en/details.jsp?meeting_id=40584)). The Symposium was attended by 147 participants.

In the closing statements of the symposium it was stated that:

- The symposium has shown the objectives and benefits of both treaties: UPOV Convention, ITPGRFA.
- It is important to interpret and implement the two treaties in a mutually supportive way in the context of each Contracting Party.
- In order to succeed in these objectives, it is important for the two organizations to work together and to provide the necessary support.
- The Symposium highlights the need to involve all stakeholders in this process.

#### **Plant variety protection statistics**

A total of 61 members of the Union now offer protection to all plant genera and species (59 in 2015), with 13 members of the Union offering protection to a limited number of plant genera and species. Of those 13, five members (Brazil, China, Morocco, South Africa and Turkey) extended protection to additional plant genera and species in 2015.

In 2015, there was a 3.2 percent decrease in the number of applications for plant variety protection (15,017 in 2015; 15,511 in 2014), resulting from a 2.9 percent increase in the number of applications by residents (10,061 in 2015; 9,778 in 2014) and a 13.6 percent decrease in the number of applications by non-residents (4,956 in 2015; 5,733 in 2014). The number of titles granted increased from 11,566 in 2014 to 12,409 in 2015 (7.3 percent increase).

The total of 107,232 titles in force in 2015 represented a 0.6 percent increase on figures for 2014 (106,575).

#### **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 totaled 2,031, compared to 2,002 in 2014.

#### **Adoption of documents**

The UPOV Council adopted revised versions of the following documents:

##### *(a) TGP documents*

TGP/7: Development of Test Guidelines (Revision)

TGP/8: Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability (Revision)

##### *(b) Information documents*

UPOV/INF/16 Exchangeable Software

UPOV/INF/22 Software and Equipment Used by Members of the Union

All adopted documents will be published in the UPOV Collection (see

[http://www.upov.int/upov\\_collection/en/](http://www.upov.int/upov_collection/en/)).

#### **Election of president and vice-president of UPOV council**

The UPOV Council elected, in each case for a term of three years ending with the 53rd ordinary session of the Council, in 2019:

- (a) Mr. Raimundo Lavignolle (Argentina), President of the Council
- (b) Mr. Marien Valstar (Netherlands), Vice-President of the Council

#### **Election of Chair and Vice-Chair of the Administrative and Legal Committee**

The UPOV Council elected, in each case for a term of three years ending with the 53rd ordinary session of the Council, in 2019:

- (a) Mr. Anthony Parker (Canada), Chair of the Administrative and Legal Committee (CAJ)
- (b) Mr. Patrick Ngwediagi (United Republic of Tanzania), Vice-Chair of the Administrative and Legal Committee (CAJ)

#### **Election of chair and vice-chair of technical committee**

The UPOV Council elected, in each case for a term of three years ending with the 53rd ordinary session of the Council, in 2019:

- (a) Mr. Kees van Ettehoven (Netherlands), Chair of the Technical Committee

- (b) Mr. Nik Hulse (Australia), Vice-Chair of the Technical Committee

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## 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.

### Ethiopia Stepping-up its Seed Certification Scheme to International Standards

The Ethiopian Federal Constitution granted Regional Administrative States (RAS) to lead their own developmental goals, particularly in the agricultural sector. RAS are given the right to design their legal needs to meet regional contexts based on federal frameworks. Constitutionally, there are issues, which are centrally managed by the Federal Government, fully decentralized to the regions, or jointly managed by both administrative levels. Among these, the seed sector is managed by both the Regional and Federal Governments. The revised Seed Proclamation No 782/2013, among others, provides the framework for seed quality assurance at the national level and clearly defines the roles and responsibilities of regional and federal seed regulatory authorities. The regional states are responsible for fully managing and leading seed certification at regional levels, whereas the federal level provides overall policy and a regulatory framework for variety release and protection and quality assurance in the country. However, during the implementation of the scheme, there were some deviations from the technical guidelines set by the federal authorities and the Ministry of Agriculture and Natural Resources (MoANR).

The Agricultural Transformation Agency (ATA) facilitated and coordinated various activities with Plant Variety Release, Protection and Seed Quality Control Directorate (PVRPQCD) of the MoANR, to harmonize quality standards and certification schemes across regional states in accordance with international best practices. Some of these initiatives are outlined below.

### Membership of Ethiopia in International Seed Testing Association

ATA supported the national seed testing laboratory (NSL) to become a member of the International Seed Testing Association (ISTA) since January 2016. The laboratory had access to recent documents, participated in proficiency tests and adopted current seed testing methods and procedures based on international rules for seed testing of 2016. This will enable the country to update its seed testing methods and procedures to an international level. The proficiency tests will enhance the skills of the national seed laboratory and will serve as a reference laboratory for the 13 regional seed testing laboratories. Currently, it was agreed that the regional seed laboratories send 2 to 5% of their seed samples to the NSL for reference testing annually. The referee tests will check the reliability of the results from seed laboratories of the regional seed certification agencies. The results from referee testing will be reported at the National Platform for Seed Quality Control workshops, hosted twice a year. Besides the reports, recommendations for improvement will be sent regularly to regional seed certification agencies.

### Updating seed quality control standards to international levels

Apart from adopting the 2016 ISTA rules (methods and procedures) for seed testing, the field standards were also revised and aligned with OECD seed schemes, harmonized with seed regulations of COMESA and adapted to the best quality control practices from other countries. In May 2016, ATA coordinated a working group from the Standard Authority, MoANR, Ethiopian Institute of Agricultural Research, Ethiopian Seed Enterprise and other institutions to review the standards. Accordingly, field and seed standards, including the seed testing procedures for 48 crops, were developed and endorsed by the National Standard Council.

### Establishing national platform for seed quality control

The PVPSQCD and the regional seed certification authorities were operating with little interaction among themselves, lacking communication and information exchange. The establishment of the national platform for seed quality in 2014 enabled them to work in close collaboration to exchange best practices in seed quality control and to report on progress made in certification and harmonization of standards and regulations. The idea of the common platform springs from the mandate of decentralization of the seed certification given to the regions. The platform is expressed in terms of conducting common national workshops

twice a year, sign Memorandum of Understanding on agreed upon implementation of procedures, standards or rules, work jointly to control illegal seed trade, and to evaluate the progress of implementation on a regular basis.

### **Introducing additional test protocols in seed certification**

The regional seed certification agencies were not in a position to conduct all the necessary seed quality tests according to international norms. ATA identified some of the gaps and encouraged the regional certification agencies to introduce both seed health and post control tests. This was made possible by organizing training courses and mobilizing the necessary budget from regional governments. Currently, regional agencies are being equipped for laboratory seed health testing and have acquired stations for control plot testing.

### **Enhancing capacity for harmonization of standards and procedures**

ATA's close engagement with and its support of seed regulatory agencies over the last four years enabled the identification of gaps and opportunities in standardizing seed quality assurance activities across regional states. Among others, three key activities were found lacking harmony during implementation: seed testing, field inspection, and crop yield estimation. To date, three training sessions were organized in order to improve the process and enhance harmonization.

Harmonization of seed testing was checked by sending samples from a common seed lot to national seed laboratory for referee testing and by comparing the results with that from regional laboratories. The results were found comparable for purity and moisture tests although germination results showed variability among the regional and federal laboratories. Provision of a germinator or growth chamber was found to overcome the variation and comparable results were obtained in germination tests.

Field inspection was the second area where variation was identified in seed certification. Therefore, theoretical and practical training courses were conducted in the class and fields, receptively. The practical field exercise in field inspection of wheat and maize found that variations were observed in identifying diseased plants and offtypes, as well as in making decisions whether to accept or reject the seed production fields.

The third area identified was the variation in yield estimates. Practical training was conducted for seed producers and field inspectors, based on established

practices and internationally accepted methodologies. The training gave participants a common understanding in yield estimation. It was agreed to apply the procedure for 2016 and to adopt a common method in 2017. A total of 136 seed producers, field inspectors and officials participated from the respective regions.

### **Brazil Releases Kabuli Chickpea**

The Brazilian Agricultural Research Corporation (Empresa Brasileira de Pesquisa Agropecuária), known as EMBRAPA, has released a new chickpea variety from materials introduced in 2010 from the International Center for Agricultural Research in the Dry Areas. *BRS Aleppo* was selected from *Chickpea International Fusarium Wilt Nursery 2010* accession FLIP02-23C (X99TH54/FLIP84-11C x S95082). The variety gave a yield from 3 to 3, 5 tonnes ha<sup>-1</sup> in commercial areas under central pivot irrigation during the winter season and it has good grain quality and field tolerance to *Fusarium* sp. It is well adapted to the Cerrado area (Brazilian Savannah) and thrives in higher and drier areas in northern Minas Gerais, in the Goiás state municipality Cristalina, and in the Federal District. Another advantage of growing chickpea is that it is not affected by the whitefly, compared with beans grown at the same time of the year.

Although chickpea is grown in several countries, there are no varieties adapted to tropical climates as in Brazil, where EMBRAPA encourages domestic chickpea production in order to reduce imports with the ultimate objective of surplus production and export. Last year, Brazil spent about USD 8 million importing 7,000 tonnes of chickpea. In order to boost domestic production, EMBRAPA developed a project focusing on the introduction of germplasm and on the improvement of legumes, such as peas, chickpeas and lentils.



The new variety is currently under multiplication and seed sales to growers are expected to begin by 2018. More efforts will be made in promoting the

variety to consumers and in persuading growers to produce it.

Source: *Brazil-Arab News Agency*

### Iran Releases New Wheat Variety for Drylands

In Iran, about 4.2 million ha of wheat is cultivated under rainfed condition out of which about 2.2 million ha is in mountainous cold areas of northwestern regions of the country, including the provinces of Ardebil, East Azerbaijan, etc. Wheat production in these areas is severely affected by cold, heat, drought, high rainfall, or yellow rust infection. The average productivity of wheat in rainfed areas has doubled from 0.6 tonnes ha<sup>-1</sup> in 1981 to about over one tonne ha<sup>-1</sup> in 2011, with great variation depending on the annual weather condition particularly rainfall.

A new winter wheat variety *Saaen* (Azar2/87Zhong291 IRW 2010-0120-0MA-99MA-99MA-99MA-0MA) was developed by crossing *Azar2* (winter wheat, cold and drought tolerant, moderately susceptible to rust, white kernel) from Iran with *87Zhong291* (intermediate growth, high yield, large seeded, stripe rust resistant, red kernel) from China by Dryland Agricultural Research Center in Maragheh in 1999-2000. The crosses were selected during subsequent generations (2002-06) and tested for agronomic performance (2006-10) at Maragheh and were further evaluated across location (2011-13) as shown in the table below.

#### Grain yield (tonnes) of wheat promising lines in cold and temperate rainfed research stations, 2010-2013

Location	Variety		
	Saaen	Ohadi	Azar2
Arak	1.003	1.222	1.254
Ardebil	1.604	1.267	1.355
Qambo	2.721	2.999	3.182
Sararood	1.798	2.148	2.124
Shirvan	1.430	1.671	1.387
Uromieh	0.844	0.994	0.898
Zanjan	0.842	1.333	1.500
Maragheh-rainfed	2.722	2.712	3.066
Maragheh-irrigate*d	3.319	2.996	3.113
<b>Mean</b>	1.809	1.927	1.986

Note: a single irrigation at sowing time

In Ardebil, the average grain yield of *Saaen* and *Azar2* was 1.604 tonnes and 1.355 tonnes ha<sup>-1</sup>, respectively. However, in Maragheh, with a single supplementary irrigation, the yield reached 3.319 tonnes and 3.113 tonnes ha<sup>-1</sup>, respectively. The results showed that the new variety yields 18% (0.249 tonnes ha<sup>-1</sup>) higher than *Azar2* in rainfed condition of Ardebil and 7% (0.206 tonnes ha<sup>-1</sup>) higher than *Azar2* with one supplementary irrigation in Maragheh.

During 2011-12, the new variety was also tested for rusts and other wheat diseases. The variety was found resistant (20R) to moderately susceptible (50MS) to yellow rust across locations and moderately susceptible (40 MS) to leaf rust in one location only. However, the variety was found resistant to loose smut, septoria and fusarium head blight diseases of wheat.

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### Georgia Releases Winter Wheat Variety

Wheat is one of the most important crops in Georgia. In 2016, about 40,000 ha were planted and 50,200 tonnes of grain were produced with an average productivity of 1.25 tonnes ha<sup>-1</sup>, one of the lowest in the region.

ICARDA is collaborating with NARS in Georgia via its CAC Regional Program. A new winter wheat variety *Agruni-1* [TAST/SPRW//BLL/3/NWT/4/3013 (TCI-02-440: 0AP-0AP-5AP-0AP-3AP-0AP)] was released in Georgia. The advanced breeding line was received in 2010 from IWWIP in an advanced yield trial (not international nursery), was evaluated for three years in Uzbekistan, and sent out to CAC countries in 2013. This variety has high grain yield, good grain quality, and it is resistant to yellow rust and leaf rust.

The variety is registered at the Official Bulletin for the Protection of New Varieties of Plants and Breeds of Animals. The variety is another added value to IWWIP from Uzbekistan-based activity.

### Morocco's Seed System Performance and Technology Adoption Presented at a National Workshop

ICARDA in collaboration with Moroccan national partners from **INRA, SONACOS, ONSSA** and the Department of Statistic under the Ministry of

Agriculture, Fisheries and Maritime (MAPM) has conducted a study on the *Adoption and Impacts of Improved Varieties of Wheat and Seed System Analysis in Morocco*. The study was part of a series of research undertakings within the CGIAR Research Program on Wheat and the Wheat-Legume Cropping Systems project in West Asia and North Africa, funded by the European Union and the International Fund for Agricultural Development, respectively. The objective is to increase the effectiveness and impact of wheat research on food and nutrition security, poverty reduction and to enhance gender equality and resilience of production systems through better targeting of improved technologies.

In order for wheat research to achieve its goals, adoption of the technologies and innovations that are generated should be achieved at scale. To this effect, among other things, it is critical to make adequate quantities of high quality seed available at the right place and time and at affordable prices. Given that improving the seed sector is a national priority for Morocco and in a context of a long history of national and international agricultural research in the country, this study was an in-depth review and analysis of the adoption and impacts of improved wheat technologies and the functioning of the wheat seed sector with the following main sub-objectives:

1. Provide credible estimates of the levels of adoption and impacts and identification of the most important factors that enhance or hinder the wider adoption and diffusion of wheat technologies in Morocco;
2. Understand the performance of the wheat seed sector in Morocco to draw important conclusions for adaptation in other countries; and
3. Identify opportunities for the Moroccan seed sector and overcome systemic bottlenecks (if any) that are detrimental for national food security and livelihood improvements of men and women farmers.

The national workshop on Varietal Adoption and Wheat Seed System Analysis in Morocco was jointly organized by INRA and ICARDA, held on 8 September 2016 at the premises of INRA in Rabat, Morocco. The workshop was attended by 53 scientists and experts from key national stakeholders of the wheat sector, the CGIAR (particularly ICARDA and CIMMYT) and it was chaired by Mr Ahmed Ouayach, the President of the FNIS (National Federation for Seeds) and COMADOR (Federation of Moroccan Inter-professions for Rural Development).

‘Meeting the targeted plan of seed production and marketing is a priority for the country and is fully supported by the Government under the Green Morocco Plan (GMP), along with the roles played by INRA and other gathered key stakeholders from both the public and private sectors,’ stated Mr. Ouayach in his opening remarks.

Prof Mohammed Badraoui, DG of INRA in his opening statement, said that ‘INRA along with its international partners, including ICARDA and CIMMYT, has been and will continue to play an important role in generating new improved varieties and associated technologies and seed production effort for the national agricultural development of the country to support the GMP’. During the workshop, the following presentations, drawn from the comprehensive study, were made by representatives of the study team:

1. Background and context of the study, by Dr Aden Aw-Hassan, ICARDA
2. Variety development, evaluation and licensing, by Dr Chaouki Al Faiz, INRA
3. Variety release, protection and seed certification, by Mr. Aziz Onsajjay, ONSSA
4. Seed production and commercialization, by Mr. Mohammad Sabik, SONACOS
5. Adoption and impact, by Mr. Mohamed Boughlala, INRA



The presentations revealed important facts and raised a number of stimulating questions, vibrant discussions, and comments from the participants. Key recommendations and issues are listed below:

### 1. Taskforce establishment

- a. The establishment of a taskforce is needed to follow up on the recommendations of the study and the outcomes of the workshop. The taskforce would preferably involve influential people from FINS, COMADOR, INRA, SONACOS, private seed companies, ONSSA, ONCA, and the MAPM to carry

forward the recommendations and their implementation.

## 2. *Varietal Development*

- a. For INRA to remain a strong competitor in agricultural research and variety development, or in partnership with private seed companies, sufficient investment should be made available to develop its human resources capacity at both professional and technical staff level. There is a need for strengthening the capacity of the domestic breeding program through recruitment of both experienced and young professional and technical staff and for forging strong partnerships with public and private institutions with strong ties to international agricultural research institutions

## 3. *Variety release*

- a. A need for reviewing ONSSA's principles for VCU (value, cultivation and use) testing for performance across all agro-ecologies (AEZs). Release decisions made based on wide adaptation across testing sites are discriminating against varieties with high specific adaptation. In other words, some principles should be relaxed to allow the targeted release of varieties with high performance in specific AEZs.
- b. A need for revising the policy on seed imports of foreign varieties. Varieties imported from other countries should be less than 5 years old since their release. Old foreign varieties should not be released in Morocco.
- c. A need for introducing a system for the removal of old varieties from the official catalogue and production in the country.

## 4. *Varietal licensing*

- a. A need for reviewing the merits and demerits of levying royalties for the acquisition of varieties coming from the public national agricultural research program in view of promoting farmers' access to new improved varieties and in incentivizing researchers.
- b. Establish an effective royalty system to generate benefits and to support the agricultural innovations efforts of the country. Any future licensing agreements set a minimum level of commercialization, legally binding and enforced by the laws of the country. Although the royalty granting mechanism has been reviewed recently, at least one clause containing a performance review or a minimum production

requirement should be included to avoid any ulterior motives and experienced staff should review it and ensure that INRA's and the national interests are served.

- c. A need for varieties offered for licensing to be accompanied by a clear statement about their key attributes and merits for promotion.

## 5. *Variety maintenance and early generation seed production*

- a. A need for reviewing and establishing a functional unit within INRA to undertake the maintenance, early generation seed production, and commercialization of improved varieties.

## 6. *Seed quality assurance*

- a. Morocco needs to establish an ISTA accredited seed quality assurance laboratory, which is self-sustainable and service oriented to maintain its integration with the global seed industry.
- b. A need for continuous government support for ONSSA to implement the strategy for the expansion of physical facilities and decentralized seed quality assurance programs.

## 7. *Seed production and commercialization*

- a. A need for the government to take the lead role and bear the cost for popularizing and creating demand for Certified Seed and new improved varieties by:
  - i. Revitalizing the agricultural extension system with qualified personnel to inform, educate and demonstrate the individual and combined benefits of certified seed and improved varieties.
  - ii. Creating a development or commercialization wing within INRA to assume this responsibility.
- b. Increase the seed and agro-input distribution points at regional and district levels along with agricultural advisory services.
- c. Understand the functioning of the informal seed sector, recognize its role in diffusing new technologies, and provide appropriate training in order to ensure better access to quality seed of new varieties and to benefit farmers. Envisage the informal sector as a strategy for empowering farmers, not only for commercializing seed, but also for a package of complementary production inputs to exploit the full potential of the varieties.

- d. Help in solving farmers' liquidity problem by creating better access for farmers to inputs on credit.

### 8. Seed policy

- a. Review the seed subsidy system to ensure that the primary beneficiaries of the seed subsidy in the country are the farmers and not the seed companies.

During the closing of the workshop, Dr Andrew Noble, Deputy Director General of ICARDA noted "The rigor of the study in developing the recommendations puts Morocco on a firm path for improving the seed systems and achieving the national goals in the coming years".

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### Sudan Organizes High Level Consultation Meeting on Wheat Seed System and Value Chain Analysis

ICARDA, in collaboration with Agricultural Research Corporation (ARC), conducted a Wheat Seed Sector Study and Wheat Value Chain analysis with the support of SARD-SC to identify critical bottlenecks in the wheat sector in Sudan. The *High Level Consultation Meeting on Wheat Seed System and Value Chain Analysis* was held on 10 April 2016 in Khartoum, Sudan organized by ARC and ICARDA, under the auspices of the Federal Ministry of Agriculture and Forestry.

The consultation meeting was opened by a statement from H.E Sabry Aldaw Bakheet, State Minister of Federal Ministry of Agriculture and Forestry (MoAF) and was attended by key wheat value chain actors from the public and the private sector, including high level policy makers from MoAF and its Departments (ARC, Departments of Agricultural Production, Agricultural Extension Services, Seed Administration), Central Bank of Sudan, Agricultural Bank of Sudan, Farmers Bank, Sudan Seed Trade Association, National Seed Council, private seed companies (Arab Sudanese Seed Company, Nile Sun Seed Enterprises, irrigated schemes) and flour mills, as well as country representatives of international development partners (FAO, IFAD, AAAID). About 100 participants attended the national workshop.

During the meeting two studies on the wheat sector were presented: i) Wheat seed system in Sudan, by Dr Zewdie Bishaw, ICARDA; and ii) Wheat value chain in Sudan, by Professor Abdelmoneim Taha, ARC.

The national wheat seed sector review has identified critical constraints, which hindered the development and growth of the sector. The annual wheat requirement of Sudan is about 2.5 million tons and in the 2014/15 season production was about 0.5 million tons. Following an erratic and declining production for many years, the government has decided to substantially increase domestic wheat production. The long-term goal is to produce two million tonnes from one million feddans (500,0000 ha), with about half of this production being in the Gezira. In the next two seasons, the government expects to increase the domestic contribution to 30 or 40% of the total requirement by setting a favorable buying price. However, the unknown factor is the world price, which can change quickly depending on global harvests.

It is clear that the seed supply system for wheat has been seriously weakened over recent years, due to the lack of any direct involvement by the government and due to the crop not being attractive to the private sector. Furthermore, the government now recognizes seed supply as a high priority and has taken steps to focus more attention and resources on the seed sector in order to meet the area expansion. Given the revised regulatory framework with an effective National Seed Council, a National Seed Policy was finalized for the country. For wheat, the challenge is how to strengthen the seed system such that the achievement of national policy goals is not constrained by the quantity or quality of seed available. The seed-related activities of the wheat sub-project in Sudan are therefore in close harmony with, and provide support to, this policy of the Government.

It will be very difficult to meet the wheat seed requirement through formal channels that lead to 'certified seed'. Some intrinsic characteristics of wheat seed as a product would make this an expensive and risky approach that could only be supported with subsidies. Moreover, the past experience of bulk seed purchasing schemes by the government has caused financial stress for companies and they may lack the confidence to do this again. For this reason, it is preferable to organize a supply chain that begins with certified seed and continues through one or two generations of multiplication on a semi-formal basis that is



closer to the end users. This approach has advantages in terms of cost and accountability, although it will require some support from extension staff. Seed production conditions are generally favorable in Sudan and it is quite feasible to implement a more devolved system of this kind, if farmers have been trained in good management practices.

The wheat sub-project is currently implementing various schemes of decentralized seed production within its Innovation Platforms and a range of experiences is being accumulated by the project. It is essential that this experience is consolidated, reviewed, and distilled into some pragmatic working models that can be replicated at different locations. As far as possible, the allocation of responsibility for each generation of multiplication should be standardized and there should be a limit on the number of generations, each with its defined name. Private sector companies could still participate in these arrangements by supplying the initial certified seed to selected growers and by overseeing the subsequent multiplications.

The system of seed supply for wheat that is proposed here will be implemented in a devolved way, using formal and semi-formal actors and that will require good coordination. However, the government must provide confidence by maintaining a stable policy for wheat production and by recognizing the essential role that seed supply plays in this. There is complete agreement that 'wheat is a strategic crop' but that strategy must be reflected back into the upstream seed supply system, which has a planning horizon of two or three seasons and is therefore vulnerable to sudden changes. In order to achieve the necessary commitment, it is proposed that an indicative seed production plan be prepared each year involving all participants in the chain, from breeders to millers. The National Seed Council should review this plan and monitor its implementation.



Following the presentation and ensuing discussions the following recommendations were made during the workshop:

### *Recommendations*

- Formation of Wheat Commodity Council (activate Wheat Commodity Board formed during the Agricultural Revival Program which lay dormant) that includes all stakeholders along the value chain in order to strengthen the value chain. It is suggested that the Board is directly backed by the Minister for Agriculture and Forestry, in partnership with SARD-SC and TAAT projects.
- Create stable and sustained policies for wheat commodity and development of a clear plan of action by the state for wheat grain and seed production and marketing, and to strictly adhere to these policies and action plans.
- Establish a clear short- to long-term plan for a target area to be covered by wheat, along with a plan for seed production to gradually cover with 25% certified seed annually, taking into account the contribution of the informal sector. This plan should be aligned and synchronized with the production of higher seed categories of breeder and foundation seed and the maintenance of commercial varieties.
- Adoption of an integrated plan with enabling policies (tax exemptions, subsidies, etc) to encourage the private sector to be enrolled in the seed production of the strategic crops, which will result in the rapid evolution of the seed industry in Sudan.
- Declare innovative and supportive financial and insurance policies for agricultural production that would support producers and would encourage them to continue and sustain wheat seed and grain production.
- Undertake further analysis and study of the wheat seed sector and value chain by a specialized taskforce, with the participation of all partners in the seed industry with clear terms of reference and a timeframe under the auspices of the Minister of MoAF, in partnership with SARD-SC/TAAT Projects.
- Develop a clear vision for wheat production from research to end use with a focus on strengthening the value chain, supporting all stakeholders, their interrelations and capacity.
- Ensure that the vision takes into account maintaining high standards of quality during seed and grain production and adoption of marketing policies commensurate with area expansion.
- Explore areas for horizontal expansion and provide the required infrastructure and production technologies. Current areas under wheat production may not assure the realization of self-sufficiency.

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## Research Notes

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

### Identification of Lentil (*Lens culinaris* L.) Genotypes with Farmers in Southeastern Ethiopia

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#### Abstract

The study was conducted to identify suitable lentil varieties at Selka and IluSanbitu *kebeles*, Sinana district, Southeastern Ethiopia in the 2015/16 main cropping season. Five released lentil varieties were evaluated through participatory varietal selection (PVS) on four farmer's fields (two farmers per *kebele*) with mother trial type. Farmers preferred the varieties *Derash* and *Alem Tena* at IluSanbitu and Selka, respectively. The highest grain yield was recorded for *Derash* (2 tonnes ha<sup>-1</sup>) and *Alem Tena* (3.1 tonnes ha<sup>-1</sup>) at IluSanbitu and Selka, respectively. The highest and lowest mean biomass yield was recorded for *Derash* (5.9 tonnes ha<sup>-1</sup>) and *Checkol* (5 tonnes ha<sup>-1</sup>), respectively. Lentil varieties showed differences for infection with *Stemphylium* disease at IluSanbitu. The highest score value was recorded for *Alem Tena* (80%) whereas the lowest was for *Checole* and *Denbi* (5%).

**Key words:** Lentil, score value, grain yield, farmer's participation

#### Introduction

In Ethiopia, lentil is grown by about 686,415 smallholder farmers on an estimated area of 100,693 ha producing 133,934 t of grain at an

average yield of 1.33 t ha<sup>-1</sup>. Lentil is also one of the most important and popular pulse crops consumed in a variety of forms in the country, particularly during fasting days (Frehiwot, 2009). It is also widely used in crop rotation to improve soil fertility and health.

The shortcomings of conventional and centralized plant breeding in addressing the enormous diversity of environmental conditions and end users' needs have been recognized (Morris and Bellon, 2004). Participatory varietal selection (PVS) is an approach to identify farmer preferred and well adapted varieties to their diverse agro-ecological environments and socio-economic conditions.

PVS involves both research and extension activities to deploy genetic materials in on-farm experiments. PVS provides an opportunity of providing access to a large number of diverse varietal choices to farmers, allows varietal selection in targeted areas in a cost effective manner, helps in the adoption of released varieties, ensures rapid seed production and access at community level, and increases production and ensures food security (Yadaw *et al.*, 2006). A variety developed through PVS is expected to meet the demand of farmers.

In the 2015/16 crop season, a PVS of lentil was conducted in southeastern Ethiopia with two main objectives: (i) to evaluate and select suitable lentil varieties adapted to the region through farmers' participation, and (ii) to support community seed production and supply of lentil varieties selected by the farmers.

#### Materials and Methods

Participatory variety selection of lentil was conducted at Sinana (Ilu Sanbitu and Selka *Kebeles*) in the 2015/16 cropping season. Five lentil varieties released by NARS were used for the PVS, namely; *Alemaya*, *Alem Tena*, *Derash*, *Denbi* and *Checole*. Each variety was planted on four farmer's fields (i.e. two farmers per *kebele*) with a plot size of 25m<sup>2</sup> (5 m x5m) in mother trials. A seed rate of 80 kg ha<sup>-1</sup> was used with a starter fertilizer (DAP) applied at a rate of 100 kg ha<sup>-1</sup>.

Male and female farmer's groups evaluated the trials separately at physiological maturity of the crop. The members were selected randomly from nearby communities to the experimental site. In addition, farmers in the community also participated in field days and guided visits to the trial sites.

The farmers' criteria for evaluating lentil varieties include crop stand, plant height, lodging tolerant,

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maturity, disease tolerance, number of secondary branches, number of pods and potential marketability. Grain and biological yield and disease data were also recorded for each plot.

Matrix ranking was used based on criteria identified in brain storming meetings with farmers. Ranking was made in groups with score value of 1 (very poor) to 5 (excellent). Evaluations were made during crop maturity.

### Results and Discussion

Among lentil varieties evaluated at Selka, var. *AlemTena* ranked first with a score value of 740 and 298 by male and female farmers, respectively (Figure 1). At Ilu Sanbitu var. *Derash* was selected by male farmers with the score value of 306 while var. *Checkol* ranked first by female farmers with the score value of 116. In general, score values by female farmers were lower than those by male farmers. The overall weighted mean score values revealed that farmers preferred *Alem Tena*, followed by *Derash* (Figures 1 and 2). PVS has been very successful both in understanding farmers' preferences and in facilitating adoption by smallholder farmers in less favorable environments, not reached by formal plant breeding (Maurya et al., 1988; Sperling et al., 1993; Joshi and Witcombe, 1996). Moreover, mother and grandmother trials of malt barley PVS in northwestern Ethiopia (Aynewa et al. 2013) and mother trial on durum wheat in southeastern Ethiopia (Aynewa et al 2016) proved successful in identifying farmers' preferred varieties.



Figure 1. Lentil fields for PVS at vegetative (top) and flowering (bottom) stages

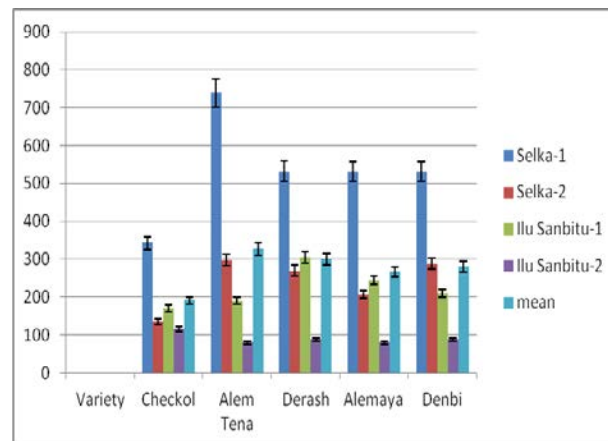


Figure 2. Participatory evaluation of lentil varieties by male and female farmers (bars indicate SEM).

In a relatively favorable area at Ilu Sanbitu-1, the highest grain yield was recorded for *Derash* (2 tonnes ha<sup>-1</sup>) whereas the next highest grain yields (1.8 tonnes ha<sup>-1</sup>) were recorded for *Alemaya*, *Alem Tena* and *Checole* (Figure 3). At Ilu Sanbitu-2, under moisture stress, the results revealed that *Alem Tena* and *Derash* varieties gave the highest grain yield (1.4 tonnes ha<sup>-1</sup>) and the lowest grain yield was recorded for *Denbi* variety (0.4 tonnes ha<sup>-1</sup>). On the other hand, at Selka-2, the highest grain yield was recorded for *Alem Tena* (3.1 tonnes ha<sup>-1</sup>) whereas the lowest was recorded for *Denbi* (1.8 tonnes ha<sup>-1</sup>) at Selka-1 (Figure 3). *AlemTena* and *Derash* gave the highest overall mean grain yield of 2.3 tonnes ha<sup>-1</sup> across the four environments.

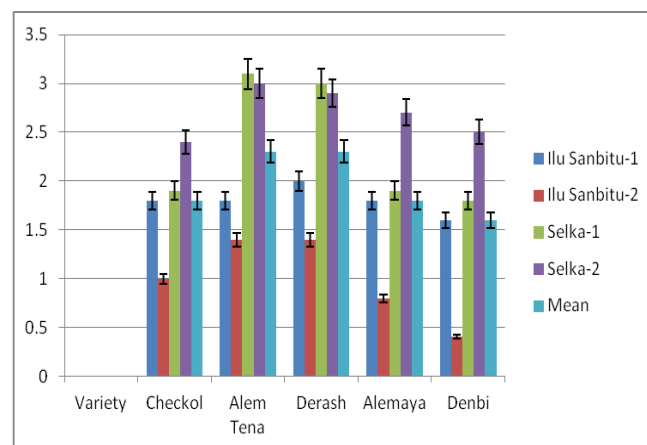


Figure 3. Mean grain yield of lentil varieties at IluSanbitu and Selka *kebeles* (bars indicate SEM)

At Ilu Sanbitu-1 and 2, *Derash* gave the highest biomass yield of 5 and 3.4 t ha<sup>-1</sup>, respectively (Figure 4). The lowest yield was recorded for *Denbi* at 1.6 t ha<sup>-1</sup> at Ilu-Senbitu 2. Likewise, *Derash* gave the highest yield of 9.6 t ha<sup>-1</sup> in Selka-1 followed by *Denbi* with 9.2 t ha<sup>-1</sup>. However, *Derash* recorded the lowest biomass yield of 5.4 t

ha<sup>-1</sup> at Selka 2. However, the highest overall mean biomass yield of 5.9 t ha<sup>-1</sup> was achieved by *Derash*, followed by *Alem Tena* at 5.8 t ha<sup>-1</sup>.

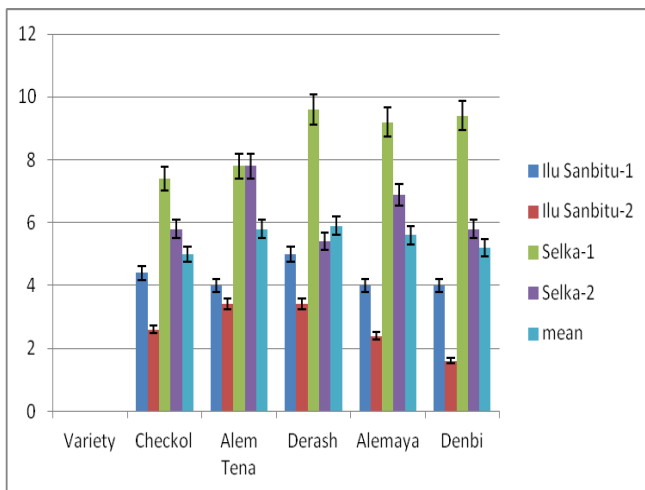


Figure 4. Mean biomass yield of lentil varieties at Ilu Sanbitu and Selka *kebeles* (bars indicate SEM)

The lentil varieties showed differences in infection with *Stemphylium* disease, ranging from 5%–80% at Ilu Sanbitu (Figure 5). The highest disease score value (susceptible disease reaction) was recorded for *Alem Tena* (80%) whereas the lowest (tolerance disease reaction) was recorded for *Checole* and *Denbi* (5%).

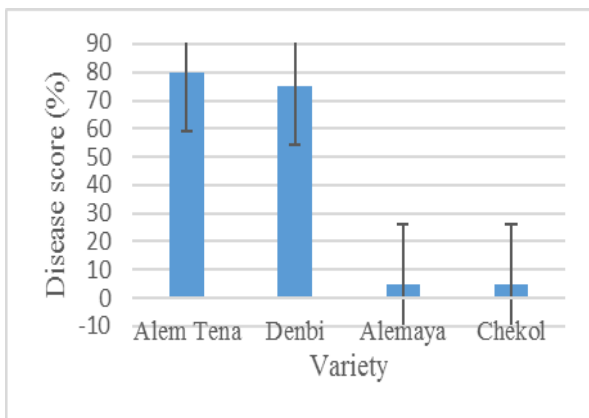


Figure 5. *Stemphylium* disease infection on lentil varieties at Ilu Sanbitu

### Conclusion

There were differences among lentil varieties in terms of overall performance in grain and biomass yield and farmers' preferences. Most lentil varieties selected by farmers, based on their own selection criteria and yield data analysis, had the same results. Farmers' participation is crucial in identifying preferred lentil varieties for adoption, household consumption, and marketing.

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## Meetings and Courses

Announcements of national, regional, or international conferences, meetings, workshops, meetings and training courses appear in this section.

### Conferences

#### *New Business Models for Legume Seed: A Conference on Seed Systems for Resilience and Nutrition*

The conference on *New Business Models for Legume Seed* will be held from 1-2 March 2017 in Baltimore/Washington, D.C., USA. Substantial investments have been made to develop high performing varieties of legumes in recent decades. Yet, less than 3% of legume seed comes from the formal sector and farmer adoption of, and access to, new varieties have lagged behind. Without repeating the usual excuses—that farmers save and recycle seed—new business models are needed (i.e., non-maize focused models). Also, key bottlenecks need to be examined more closely (e.g., seed quality issues which skyrocket production costs).

This conference is meant to be provocative and stimulate thinking on business models that deliver legume seed. Who is our client? In particular, we think about smallholder farmers in remote regions, with modest purchasing power. *Think about how we can reach farmers 'at the last mile.'*

The conference will be divided into two types of presentations:

#### *A. Business models for legume seed*

- Businesses which are successfully selling legumes to smallholder farmers 'at the last mile'
- Multi-purposed rural businesses, which have an important component of legume seed sale (e.g., 'Mom and Pop' chain).

#### *B. Building blocks for legume seed business*

- Seed Quality presentations on legume seed:
  - Is Quality Declared Seed an option or not?
  - Can Certified Seed be produced more cheaply?
- Service Provider/Delivery options that reach 'the last mile'-potentially with legume seed
- Seed interventions with a nutrition focus-what are the compelling lessons/needs?
- Seed Intervention focused on Resilience- what are the compelling lessons/needs?

For more information please contact:

[coordinator@seedssystem.org](mailto:coordinator@seedssystem.org) or

[louise.sperling@crs.org](mailto:louise.sperling@crs.org)

#### *2nd Agriculture and Climate Change Conference: Climate ready resource use-efficient crops to sustain food and nutritional security*

The 2nd Agriculture and Climate Change Conference: Climate ready resource use-efficient crops to sustain food and nutritional security will be held 26–28 March 2017 at the Meliá Sitges, Sitges (near Barcelona), Spain.

The 2nd Agriculture and Climate Change Conference will focus on the likely impact of climate change on crop production and explore approaches to maintain and increase crop productivity into the future.

The main topics include:

- Increased agricultural uncertainty
- Modeling and its application
- Abiotic stress
- Effects of CO<sub>2</sub> on plant growth
- Impacts on nutrition, quality and resource use efficiency
- Plant-microbe interactions
- Innovative agronomic and breeding practices
- New crops for a new climate

Selected speakers will be invited to extend their presentation into a review and submit it to *Current Opinion in Plant Biology*. When all invited papers have been published, a *Virtual Special Issue* will be created, collecting all the papers from the conference.

A virtual special issue with selected articles from the Agriculture and Climate Change Conference 2015 is freely available online until 6 March 2017 ([Click here](#)).

For further information on the conference and to sign up for email updates, please visit the [website](#).

### AFSTA Congress 2017

The next AFSTA Congress will be held in Dakar, Senegal, from 28 February 2017 to 2 March 2017, and preparations are already in full swing. For more information, please contact the AFSTA Secretariat at [afsta@afsta.org](mailto:afsta@afsta.org)

### ISF World Seed Congress 2017

The ISF World Seed Congress 2017 will take place in Budapest, Hungary on 22–24 May 2017. Registration will open on 10 Jan 2017 at 11:00 h (GMT) and close on 3 May 2017 at 13:00 h (GMT). More than 1000 seed industry professionals are expected to gather to discuss global issues facing the seed industry. For more information, visit the [website](#).

### International Seed Testing Association (ISTA) Annual Meeting 2017

The ISTA Annual Meeting 2017 will take place at the Renaissance Hotel in Denver, Colorado, USA, on 19–22 June 2017. The event will be held in collaboration with the Association of Official Seed Analysts (AOSA) and the Society of Commercial Seed Technologists (SCST). This will be the first time that the three seed testing associations will hold a joint Annual Meeting. We are hopeful that this meeting will foster even stronger relationships between ISTA and AOSA/SCST members, and improve seed science by creating an environment where networking, productive brainstorming, and idea sharing can occur. To register, please visit the web site [www.seedtest.org/en/event-detail---0--0--0--70.html](http://www.seedtest.org/en/event-detail---0--0--0--70.html)

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

### 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 management, 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](mailto:c.kleinermann@cgiar.org)

### International Union for the Protection of New Varieties of Plants Distance Learning Courses

Two sessions of each of the following UPOV Distance Learning Courses will be run in 2017: (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 of all courses for 2017 is as follows:

#### Session I

- Registration: January 9 to February 10
- Study period: March 6 to April 9
- Final exam: April 3 to 9

#### Session II

- Registration: August 14 to September 15
- Study period: September 25 to October 29
- Final exam: October 23 to 29

The categories of participants 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 (*one non-fee paying student per state/inter-governmental organization; additional students, CHF1000 per student*)
- *Category 3:* Others (*fee, CHF1000*).

More detailed information about the course and online registration is available on the UPOV [website](#)

### International Seed Testing Association (ISTA) Training Workshops

*ISTA Workshop on Advanced Seed Vigor Testing, 20-23 February 2017; Bengaluru, India.*

The workshop will focus on two of the ISTA validated tests, the Radicle Emergence test and the Conductivity test. The workshop will report on practical experience of the two tests, providing lectures and interactive seminars. It will also offer an opportunity for general discussion on seed vigor and time for participants to ask specific questions regarding vigor testing procedures.

For further details and registration, please visit:

<http://www.seedtest.org/en/event-detail---0--0--0--81.html>

*ISTA SHC Workshop: How to validate a method and check the performance of quality system in Seed Health testing, 3 -6 April 2017, Almeria, Spain.*

This workshop will provide an overview of Seed health testing methods and method validation principles, as well as methods to check the performance of their quality system: ability to implement a method, proficiency tests organization. It will allow participants to work with their computer on practical examples of qualitative and quantitative Seed Health results, providing training on test plan writing, characterization of samples, analysis of results, redaction of protocols, ranking of labs for Seed Health proficiency tests.

For further details and registration please visit: <http://www.seedtest.org/en/event-detail--0--0--0--73.html>

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

#### **Grants and Awards: MMANA Fellowships**

Postdoctoral Fellowships on Innovative Methods and Metrics for Agriculture and Nutrition Actions ([IMMANA Fellowships](#)) aim to create a cadre of emerging leaders in agriculture, nutrition, and health research. This work stream of the IMMANA program is led by the Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy at Tufts University. It consists of four annual rounds for six Fellowships each year. The call for Round 3 applications is now open. Concept notes should be submitted as soon as possible, and will be accepted on a rolling basis until 1 February 2017. Applicants must submit a full proposal by 28 February 2017 and selected candidates will be notified no later than 1 May 2017.

#### **FAO E-learning Module on Improving Nutrition Through Agriculture and Food Systems**

This course illustrates the linkages between agriculture, food systems and nutrition. Starting from two realistic scenarios, the course describes the benefits and opportunities for integrating nutrition into food system policies, investments and programs. It also provides a series of examples of nutrition-sensitive policies and interventions, as well as an overview of the main initiatives and commitments on nutrition on which learners can build to integrate nutrition in their work. The course is designed to assist professionals from any fields related to agriculture and food systems (from inputs and production, through processing, storage, transport and retailing, to consumption) that are

involved in shaping and implementing nutrition-sensitive programs, investments and policies. This includes professionals working for development partners (i.e. international organizations, donor agencies, NGOs), for national governments, or as independent consultants. The course consists of 5 lessons, ranging from approximately 20 to 45 minutes' duration each: Lesson 1: why does nutrition matter? Lesson 2: how does the food system influence nutrition? Lesson 3: making agriculture and food systems nutrition-sensitive: key principles. Lesson 4: making agriculture and food systems nutrition-sensitive: key interventions; and Lesson 5: a conducive international environment for nutrition. For more information, please follow the [link](#).

## Literature

**Books, journal articles, and other literature of interest to readers are presented here. It may include relevant information on agriculture-related publications including seed policy, regulation, and technology.**

### Books

***Bishaw, Z., D. Alemu, A. Atilaw and A. Kirub (eds.). 2016. Containing the Menace of Rusts: Institutionalized Interventions and Impacts***

*Published by EIAR ([www.eiar.gov.et/](http://www.eiar.gov.et/)); ISBN: 9789994466344; Price: Free; 153 pp*

The book is the grandstand of the collaborative endeavors of diverse stakeholders in addressing the challenges of wheat production and wheat rusts in Ethiopia, within the context of the international efforts across Africa and Asia. Wheat is one of the most important staple crops across the globe, including Ethiopia. The emergence and quick spread of Ug99, coupled with a devastating outbreak of stripe rust in 2010, caused significant losses and economic hardship for Ethiopia's wheat farmers and underlined the country's increasing vulnerability to the disease - a result of climate change and changing weather patterns. In response, the rapid development and deployment of high-yielding, rust-resistant wheat varieties, which are helping Ethiopian farmers to raise their production and achieve higher incomes and greater food security, was developed by a USAID funded initiative.

The book provides a synthesis of the research for development and rich experience gained in quick deployment of rust-resistant wheat varieties through this effective partnership between the Ethiopian Ministry of Agriculture and Natural Resources and Regional Bureaus of Agriculture, the National Agricultural Research System (NARS), the International Centre for Agricultural Research in the Dry Areas (ICARDA), formal and informal seed suppliers, NGOs and farmers.

Many of the contributors to this volume provide sound evidence in favor of diversified interventions with due focus on mechanisms for institutionalizing the research approaches in order to ensure sustainability in addressing the ever increasing challenges of wheat rusts. The experiences and knowledge gained are put into context and are aimed at decision-makers, not only in Ethiopia, but also in other developing countries for wider application and spill overs. The book provides useful insights to policy makers, researchers, students, development practitioners and donors involved in international development for generating and moving technologies out to the farmers' fields.

The book can be accessed on ICARDA [website](#)

**Raju, K.V. and S.P. Wani (eds.). 2016. *Harnessing Dividends from Drylands: Innovative Scaling up with Soil Nutrients***

*Published by CABI (www.cabi.org); ISBN 9781780648156; Price: \$190 (Hard cover); 336 pp*

The livelihoods of millions of people in developing countries, which depend on dryland agriculture to ensure their food security and their well-being, could be improved measurably by gains in agricultural crop yields. This book describes lessons learnt from an innovative scheme in India that improved crop yields in drylands. It shows how the scheme can be scaled up for other dryland regions of the world. The scheme uses localized soil nutrient analyses to create an integrated, climate-smart fertilizer and planting plan that maximizes yields for farmers.

This book describes how a partnership between a global scientific organization (such as ICRISAT), state and non-state actors can provide a route to equitable growth, specifically for small and marginal farmers, and how this approach can be replicated worldwide to enhance rural livelihoods. This strategic collaboration and its conceptual and functional design are fully outlined, as well as the scheme's implementation and the effective

monitoring and learning process that has been created.

**Farooq, M. and K. Siddique (eds.). 2016. *Innovations in Dryland Agriculture***

*Published by Springer (www.springer.com); ISBN 978-3-319-47927-9; Price: \$249 (Hard cover); 571 pp*

In this book leading scientists in the field describe the basic principles of dryland agriculture and synthesize recent experiences and innovations in dryland agriculture research and development. It is a ready reference on the subject and reinforces the understanding for its utilization to develop environmentally sustainable and profitable food production systems. Various elements of dryland agriculture are described, highlighting associated breeding and modelling efforts, analyzing the experiences and challenges of dryland agriculture in different regions, and proposing some practical innovations and new areas of research in this critical area of agriculture. This book is an invaluable source of information for scientists, teachers, and students in the fields of agronomy, ecology, environmental sciences, range management, land and water management and sustainable livestock grazing systems.

## Websites

### **Seed Quest**

Seed Quest, established in 1992, provides global information services for seed professionals. It is a dynamic and resourceful website with a comprehensive coverage of news, events, suppliers, directories and catalogues among many others. Seed Quest is committed to fostering and promoting communication and information sharing among seed sector professionals and the seed industry.

## Newsletters

### **Seed E-News**

Seed E-News is a newsletter of American Seed Trade Association (ASTA). Founded in 1883, ASTA is one of the oldest trade organizations in the United States with a membership of over 700 companies involved in seed production and distribution, plant breeding, and related industries in North America. ASTA works on behalf of the seed industry to promote research, development and movement of quality seed to meet the world's demand for food, fiber, and fuel.



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## About ICARDA

The International Center for Agricultural Research in the Dry Areas (ICARDA) is the global agricultural research organization working with countries in the world's dry and marginal areas to deliver sustainable systems solutions that increase productivity, improve rural nutrition, and strengthen national food security. ICARDA's integrated approach includes new crop varieties; agronomy; on-farm water productivity; natural resources management; rangeland and small ruminant production; and socio-economic and policy research to better target poverty issues and accelerate technology adoption. As a member of the CGIAR Consortium, ICARDA works closely with national agricultural research programs and other partners in more than 40 countries across North and Sub-Saharan Africa, and Central, South, and West Asia.



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### 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](mailto:z.bishaw@cgiar.org)

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