SEED INFO

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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. The purpose is to help strengthen national seed programs, and thus improve the supply of quality seed to farmers.

From its modest beginnings in the mid 19th century, the seed industry has been revolutionized by hybrid seed technology. The introduction of hybrid maize in the 1930s in the USA led to the development of a strong private-sector seed industry. Hybrids provide higher yields and greater product uniformity. To producers, they offer assured demand for seed; to breeders, an in-built 'protection' mechanism. In the **NEWS AND VIEWS** section, Ritesh Mishra from the Indian seed company Mahyco, describes the potential of hybrids for increasing wheat production in India. He discusses the opportunities for developing hybrid wheat for all wheat-growing areas in India, and particularly for semi-arid regions where farmers often do not have access to irrigation. Drought-tolerant, fertilizer-efficient and herbicide-tolerant hybrid wheat varieties are expected to hit the Indian market in the next 5 to 10 years.

Other news stories include the ECOSA International Seed Conference in Turkey and the Second World Seed Congress in Italy. The ECOSA conference focused on seed trade and exhibitions by the private sector, but also included technical presentations on various subjects: status of the regional and global seed industry; international instruments for seed trade and their relevance to the ECO region; regional collaboration to facilitate seed trade; and the status and role of the private sector in the ECO region. The conference participants included representatives of seed companies, service providers, and regional and international institutions from Africa, Asia, Europe and USA.

The Second World Seed Conference, held in Rome, was organized jointly by FAO, the Organization for Economic Cooperation and Development (OECD), the International Union for the Protection of New Varieties of Plants (UPOV), the International Seed Federation (ISF), and the International Seed Testing Association (ISTA). The conference issued a press release calling for greater public and private sector investment in agriculture to ensure food security for a growing population.

The section on **SEED PROGRAMS** includes news from Egypt, Iraq, Libya, Morocco and Pakistan. Egypt has established post-graduate degree programs in seed science and technology. Four Egyptian universities (El-Minia, Mansoura, Alexandria, Ain-Shams) have launched a new Masters program in seed science in partnership with the Universities of Copenhagen (Denmark) and Cieskowski (Poland). News from Iraq describes the role of the Mesopotamia Seed Company. A contribution from Libya covers the role of the seed society in seed production and delivery.

The **RESEARCH** section aims to capture information on adaptive research or issues relevant to seed program development. This issue features an article by Tesfaye Tadesse and Mihiretu Chernet from the Awassa Agricultural Research Center in Ethiopia. It describes participatory variety selection methods that are being successfully used to introduce new potato varieties in the absence of the formal seed sector operations.

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

Happy New Year

Zewdie Bishaw
Editor

WANA SEED NETWORK NEWS

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

ECOSA Seed Trade Conference

In March 2009, delegates from Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey and Uzbekistan signed the by-laws of the ECO Seed Association (ECOSA) and appointed transitional board members for registration of the association.

First ECOSA General Assembly

ECOSA held its first General Assembly on 1 December 2009, in Antalya, Turkey. Representatives from public and private seed companies from eight countries – Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Turkey and Uzbekistan – attended the meeting and elected ECOSA board members. Dr Vehbi Eser from the Turkish Seed Union was elected President, Mr Bolot Kojamuratov from the Seed Association of Kyrgyzstan and Mr Samad Mobasser from Iran were elected Vice Presidents. Mr Muhammad Saleem from the Seed Association of Pakistan is the Secretary and Mr Saidjan Abdiani from the Afghanistan National Seed Organization the Treasurer.

Board of Directors of the ECO Seed Association

The Board outlined activities to be undertaken in 2010 including strengthening existing seed associations and establishing new ones; expanding the membership by enlisting private and public seed companies from the region and beyond; seeking financial support from donors to support ECOSA activities; and organizing a Second ECOSA Seed Congress planned for 28-31 October 2010 in Istanbul, Turkey.

ECOSA International Seed Trade Conference

The First ECOSA International Seed Trade Conference (ECOSA2009) was held from 2-4 December 2009 in Antalya, Turkey. The conference was organized by the Turkish Seed Union (Turk-TOB) in collaboration with the Economic Cooperation Organization (ECO), FAO and ICARDA, under the auspices of the Ministry of Agriculture and Rural Affairs (MARA).

Dr Ramazan Kadak, Under-Secretary of MARA, opened the conference and the seed trade exhibition. The conference served as a forum to promote regional seed trade among seed companies within and outside the region and for seed industry stakeholders to share experiences.

The conference focused on seed trade and exhibitions, but the program also included technical presentations on various subjects: status of the global and regional seed industry; international instruments and regional collaboration for facilitating seed trade; status and role of the private sector in the ECO region; and successful seed delivery models.

ECOSA2009 attracted over 190 participants from Afghanistan, Azerbaijan, Egypt, Ethiopia, France, Germany, Iran, Italy, Pakistan, Kazakhstan, Korea, Kyrgyzstan, Pakistan, Saudi Arabia, Switzerland, Syria, Thailand, Tajikistan, Turkmenistan, Turkey, USA and Uzbekistan. Apart from public and private seed companies, there were equipment suppliers, national (ANSOR, KSA, SAK, SAT, Turk-TOB), regional (APSA) and international (ISF) seed trade associations, and international organizations working on varieties and seeds (ECO, FAO, ICARDA). There was impressive participation from the public and private seed sector in Turkey.

ECOSA 2009 in pictures

Inaugural session and discussions

Key partners at the opening ceremony: Left to right: Dr Vehbi Eser, Turkish Seed Union; Dr Fathi Unulu, ECO; Dr Zewdie Bishaw, ICARDA; Dr Mustapha Sinaceur, FAO-Turkey; Dr Ramazan Kadak, Under Secretary, MARA, Turkey.

Exhibition and product displays

NEWS AND VIEWS

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

Hybrid Wheat: Mahyco's Experience in India

In India, wheat is the most important food crop after rice, cultivated on 27.7 million ha, with annual production of 78.4 million t. The states of Punjab, Haryana, Rajasthan, and Uttar Pradesh in northwest India accounted for 75% of national wheat output in 2007/08. Gujarat and Madhya Pradesh in the central zone, Bihar in the eastern zone, and Maharashtra in the peninsular zone also have relatively large wheat areas.

Since the beginning of 'Green Revolution' in 1964, wheat production rose sharply in India with the introduction of semi-dwarf wheat varieties. Between 1964 and 2002, yields more than tripled from 295 to 1120 kg $acre^{-1}$. These yield increases were associated with an increase in irrigation facilities and use of chemical fertilizers. Production gains, however, were unequally distributed. States in the northwestern zone realized the largest production increases, because they had assured irrigation. Wheat growing states in other zones benefited primarily from spillovers of new varieties from irrigated environments, and later from adaptation of irrigated varieties to rainfed conditions.

Despite the successes of the Green Revolution, growth rates in wheat yield have fallen in recent years. While yields grew by 3.4% $year^{-1}$, on average, from 1982 to 1992, growth rates slowed to 0.6% $year^{-1}$ from 1992 to 2002. This decline, combined with a rising population (1.6% each year), reduced per capita availability of wheat. Wheat production is increasing at 0.6% per year, but this needs to be raised to 1.6% per year at a minimum to meet the rising demand. Reversing this decline trend is a priority of agricultural research in India.

In India, diseases, particularly stem and yellow rust, are already affecting yields. Further adverse impacts on production are expected, so urgent solutions are needed.

Mahyco, currently the sole hybrid wheat producer in India, launched its product in 2001. Research efforts are focusing on the central, peninsular, and eastern regions of the country. The company's breeders achieved heterosis in wheat by using cytoplasmic male sterility. The resulting wheat hybrid is adapted relatively well to moisture stress and is grown mostly in central and peninsular India. Hybrid wheat has 15-20% yield advantage over open-pollinated varieties, and its grain quality is well accepted by farmers. Contrary to widespread beliefs, hybrid wheat does not require higher inputs, and the technology is not biased towards larger farms.

Seed can be sown by broadcasting or drilling. Sowing with seed drills, whether tractor or bullock drawn, will deposit the seed at uniform depth leading to a uniform stand and early emergence of vigorous seedlings. In many places, seed is sown by hand in furrows, behind a plow drawn by bullocks. Broadcasting of wheat seed is a common practice in the northeastern plain zone of India, which occupies about 9.2 million ha. Broadcasting requires more seed per unit area and mechanical weed control becomes difficult. However, mechanical control can be practiced effectively when wheat is drilled, facilitating the use of tractor- and bullock-mounted implements.

Seed production is an important part of any hybrid technology. Mahyco has achieved great success by standardizing seed production technology. There are lines which can produce more than 60% of the existing commercial varieties. Mahyco currently markets one hybrid wheat variety (MRW 7070 or Pratham 7070) in the central and peninsular zones and is in the process of launching a new hybrid (MRW 7272 or Pratham 7272) for the northwestern plains.

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Second World Seed Congress held in Italy

The Second World Seed Conference was held from 8-10 September 2009 at FAO headquarters in Rome, Italy. The conference theme was 'Responding to the challenges of a changing world – the role of new plant varieties and high quality seed in agriculture'. It was jointly organized by FAO, OECD, UPOV, ISF and ISTA, and attended by a cross section of the seed industry from policy makers and senior managers of government agencies to plant breeders and seed specialists, to farmers' associations and consumer

organizations. The participants also included breeding companies, breeders' associations, certification agencies, seed producers, seed trade associations, technology companies, academic institutions, and international breeding and seed research centers.

The aim of the Expert Forum was to provide information and facilitate discussion on means of encouraging the development of new plant varieties and the production and distribution of high quality seed. The Policy Forum reviewed the conclusions of the Expert Forum on the means to provide an enabling environment to achieve these ends.

The Second World Seed Conference covered five thematic areas: (i) The role of plant breeding; (ii) The importance of plant genetic resources for plant breeding; access and benefit sharing; (iii) Plant variety protection; (iv) The importance of quality seed in agriculture; and (v) Facilitation of trade and market development. Further information is available at: http://www.worldseedconference.org/en/ worldseedconference/home.html.

The conference issued a press release under the title *World food security: urgent measures on seed needed,* calling for greater public and private sector investment in agriculture to meet the challenges of food security for a growing population.

The conference emphasized the important roles of the public and private sectors, and the benefits when the two work together. It highlighted the critical role of new plant varieties and high quality seed in providing a dynamic and sustainable agriculture that can meet the challenges of the future. It concluded that governments need to develop and maintain an enabling environment to encourage plant breeding and the production and distribution of high quality seed.

The conference concluded that:

- Plant breeding has significantly contributed, and will continue to be a major contributor to increased food security whilst reducing input costs, greenhouse gas emissions and deforestation. With that, plant breeding significantly mitigates the effects of population growth, climate change and other social and physical challenges.
- ITPGRFA is an innovative instrument that aims at providing food security through conservation, as well as facilitated access to genetic resources under its multilateral system of access and benefit sharing. The multilateral system represents a reservoir of genetic traits, and therefore constitutes a central element for the achievement of global food security.
- Intellectual property protection is crucial for the sustainable contribution of plant breeding and seed supply. An effective system of plant variety protection is a key enabler for investment in breeding and the development of new varieties of plants. A country's membership of UPOV is an important global signal for breeders to have the confidence to introduce their new varieties in that country.
- Seed quality determination, as established by ISTA, on seed to be supplied to farmers is an important measure for achieving successful agricultural production. The establishment or maintenance of an appropriate infrastructure on the scientific as well as technical level in developed and developing countries is highly recommended.
- Development of reliable and internationally acceptable certificates, through collaboration between all stakeholders along the supply chain for varietal certification, phytosanitary measures and laboratory testing; and contributes substantially to growth in international trade and the development of seed markets for the benefit of farmers.

Declaration of the Second World Seed Conference, Rome

Urgent government measures and increased, long-term public and private investment in the seed sector are required if agriculture is to meet the challenge of food security in the context of population growth and climate change.

Governments are strongly encouraged to implement a predictable, reliable, user friendly and affordable regulatory environment to ensure that farmers have access to high quality seed at a fair price. In particular, FAO member countries are urged to participate in the internationally harmonized systems of the Organization for Economic Cooperation and Development (OECD), the International Union for the Protection of New Varieties of Plants (UPOV), the International Treaty on Plant and Genetic Resources for Food and Agriculture (ITPGRFA) and the International Seed Testing Association (ISTA). Participation in these systems will facilitate the availability of germplasm, new plant varieties and high quality seed for the benefit of their farmers, without which their ability to respond to the challenges ahead will be substantially impaired.

News from the International Union for the Protection of New Varieties of Plants

Oman accedes to the 1991 Act of UPOV Convention
The Sultanate of Oman deposited its instrument of accession to the 1991 Act of UPOV Convention on 22 October 2009. The Convention will thus enter into force for Oman on 22 November 2009; and on that date it will become a member of UPOV. With the accession of Oman, UPOV now has 68 members.

Sub-regional workshop on geographical indications and plant variety protection
UPOV and the World Intellectual Property Organization (WIPO), in cooperation with the Government of Oman, jointly organized a sub-regional workshop on *Geographical indications and plant variety protection* for the Gulf Cooperation Council (GCC) countries. The conference was held from 26-28 April 2009 in Muscat, Oman.

Training course on plant variety protection in the Eurasian region
UPOV organized a regional training course on Plant Variety Protection for the Eurasian Region", in cooperation with the State Agency on Intellectual Property (AGEPI) and the State Commission for Crops Variety Testing and Registration of Moldova, the United States Patent and Trademark Office, and the Ministry of Agriculture, Forestry and Fisheries of Japan. The course was conducted from 9-11 June 2009 in Chisinau, Moldova. Participants from 15 countries attended: Armenia, Belarus, Estonia, Georgia, Japan, Kazakhstan, Kyrgyzstan, Poland, Moldova, Russia, Slovakia, Tajikistan, Ukraine, USA and Uzbekistan.

43rd Ordinary Session of UPOV Council
The Council of UPOV held its 43rd Ordinary Session in Geneva on 22 October 2009. A report is available at: http://www.upov.int/export/sites/upov/en/ documents/c/43/c_43_16.pdf. The Council adopted several guidance documents, 'Guidance for the preparation of laws based on the 1991 Act of the UPOV Convention' (UPOV/INF/6/1) and 'Guidance on how to become a member of UPOV' (UPOV/INF/13/1). The documents are available in English, French, German and Spanish on the UPOV website: http://www. upov.int/index_en.html.Document

UPOV is an intergovernmental organization based in Geneva. The purpose of the UPOV Convention is to encourage the development of new varieties of plants by granting breeders intellectual property rights based on clearly defined principles. To be eligible for protection, varieties must satisfy certain conditions, such as being distinct from existing, commonly known varieties and sufficiently uniform and stable. For more information contact UPOV, 34 Chemin des Colombettes, P.O. Box 18, 1211 Geneva 20, Switzerland. Tel: +41-22- 338 91 11; Fax: +41–22-7330336; E-mail: rolf.joerdens@upov.int; Website: http://www.upov.int

China Approves Biotech Rice and Maize

China completes its approval of a troika of key biotech crops: fiber (Bt cotton), feed (phytase maize) and food (Bt rice). In November 2009, the Ministry of Agriculture (MoA) granted two biosafety certificates, and approved biotech Bt rice and phytase maize – the most important food and feed crops in the world, respectively.

The two approvals have significant positive implications for biotech crops in China, Asia and the world. MoA conducted a very careful due diligence study prior to clearing the two biotech crops for full commercialization in 2 to 3 years, pending standard registration trials.

China has successfully grown Bt cotton since 1997. Over 7 million small farmers have increased their income by approximately \$220 ha^{-1} (equivalent to \$1 billion nationally) due, on average, to a 10% increase in yield, 60% reduction in insecticides. China is the world's largest producer of cotton, with 68% of its 5.6 million ha planted with Bt cotton in 2008.

Bt rice offers the potential to generate benefits of \$4 billion annually from an average yield increase of 8%, and an 80% decrease in insecticides, equivalent to 17 kg ha^{-1} on rice. It is estimated that 75% of all rice in China is infested with the rice borer; Bt rice offers an effective solution. China is the world's biggest producer of rice (178 million tons) with 110 million households (about 440 million people) growing rice, and 1.3 billion rice consumeChina is also the world's second largest producer of maize (30 million ha grown by 100 million households). It is principally used for animal feed. Maintaining self-sufficiency in maize

and meeting the increased demand for meat in a more prosperous China is an enormous challenge. For example China's swine herd, the biggest in the world, has increased from 5 million in 1968 to over 500 million today.

Bt cotton, Bt rice and phytase maize (importantly, all developed by Chinese public sector institutions) can also benefit other developing countries, particularly in Asia, but also elsewhere in the world, which have similar crop production constraints. Asia grows and consumes 90% of the world's rice, and Bt rice can have enormous impact in Asia, not only increasing productivity but also helping to alleviate poverty among small-scale farmers, who represent 50% of the world's poor.

Similarly, there are up to 50 million hectares of maize in Asia that could benefit from biotech maize. China's global leadership in approving biotech rice and maize will likely increase the acceptance and speed of adoption of biotech food and feed crops in Asia, and more generally globally, particularly in developing countries.

Bt rice and phytase maize are the first of many agronomic and quality biotech traits to be integrated into improved biotech crops. This technology can significantly enhance yield, quality and production of food, feed and fiber crops with efficient use of resources, particularly water and nitrogen. The approval by China of the first major biotech food crop, Bt rice, can be a catalyst for both the public and private sectors from developing and industrial countries to work together.

Source: Crop Biotech Update, 4 December 2009

Pakistan Approves Bt Cotton for Cultivation

Pakistan has officially approved genetically modified crops for cultivation in the country. The Ministry of Environment, Environment Protection Agency and National Biosafety Committee have cleared two Bt cotton varieties for commercial release. The Bt cotton varieties, CEMB-1 and CEMB-2, were developed at the Centre of Excellence in Molecular Biology (CEMB) of Punjab University. These varieties were recommended by the Pakistan Central Cotton Committee (PCCC) after more than two years of testing.

It was reported that a total of 10 Bt cotton varieties, including these two, might be commercialized in the country. The article also noted that currently, more than 44 genetically modified cotton varieties are being cultivated in the country without government approval. The Bt cotton varieties, awaiting approval from the Punjab Seed Council, will be available for the next cultivation season (Kharif 2010).

For more information on biotechnology developments in Pakistan, contact: Dr Iqbal Choudhary, Pakistan Biotech Information Center; E-mail: iqbal.choudhary@iccs.edu.

Source: AgBioView, 2 December 2009

CONTRIBUTIONS FROM SEED PROGRAMS AND PROJECTS

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

Masters Program for Seed Science in Egypt

In Egypt, the seed market is worth $208 million and equivalent to 0.4% of the world seed market ($55 billion). According to official statistics certified seed use ranges from 0.5% to 40% depending on the crop. Although Egypt has a dynamic seed sector with both public and private companies, it is imperative to have a well qualified work force acquainted with new developments in seed science and technology. Four Egyptian universities (El-Minia, Mansoura, Alexandria, Ain-Shams) have launched a new Masters program in seed sciences in partnership with the Universities of Copenhagen (Denmark), and Cieskowski (Poland). The new M.Sc. curriculum will have harmonized mandatory features of the European academic framework and a credit point system compatible with the European credit transfer system. The course is for three semesters of lectures and practical work, followed by one semester for thesis work. For more information, contact: Prof Ahmed Kandil, Project Coordinator, Faculty of Agriculture, Mansoura University. Post Office 35516, P.O.85 Egypt; Tel: +2-050-0105258222; + 2-050-2261577; E-mail: aakandil2@yahoo.com; website: http:// www.mans.edu.eg/projects/ tempus/enewmass

Ethiopia Approves Biosafety Legislation

A Proclamation on Biosafety drafted by the Federal Environmental Protection Authority (FEPA) has been approved in Ethiopia. The legislation was prepared in consultation with various environmental groups and local consumers. It aims at protecting human and animal health, and biological diversity, by managing GMO threats. The draft bill was reviewed by the Environment Council (whose membership includes ministers, regional presidents and a civil society representative), endorsed by the cabinet and subsequently by parliament. Empowered by the new legislation, FEPA will shortly establish a National Biosafety Clearing House that will keep detailed records of experts who specialize in modified organisms in order to monitor their activities. The clearing house will also determine a list of modified organisms that are approved for import and export and make the information available.

This precautionary principle is popular in many countries, including those in the European Union The new law requires that any transit, import and production should be handled only with written consent from FEPA. Violation of various stipulations included in the legislation could mean a prison term of up to 15 years.

The Mesopotamia Seed Company in Iraq

The Iraq State Seed Company is a state enterprise with its own organizational, financial and administrative autonomy, operating under the Ministry of Agriculture. The company has fixed and current assets worth over Iraqi Dinar 800,000 in 2008.

The primary objectives of the company are to: (i) Provide quality seed (basic, registered and certified) of new varieties according to the plan of the Ministry of Agriculture; (ii) Cooperate with research institutions to produce breeder seed of field crops; (iii) Provide raw material for animal feed production through its maize factories.

Seed production and processing facilities

The amount of seed produced and facilities available are shown in Tables 1 and 2. The company has seven seed cleaning and treatment centers with an estimated total capacity of 189 tons per day located in the provinces. These centers also serve as main outlets to distribute seed to farmers.

Table 1. Seed produced by the Mesopotamia Seed Co. in 2006/07 and 2007/08

Crop season	Planned (t)	Produced (t)	Achieved (%)
2006-07	4780	6065	124 %
2007-08	8000	9361	117%

Table 2. Seed processing facilities of the Mesopotamia Seed Co.

Province	Location	Capacity (t h^{-1})
Al-Kadisia	Al-Daywania	3
Al-Tamim	Kirkouk	4
Baghdad	Jarf Al-Nadaf	3
Ninevah	Mousel	7
Salah Al-Din	Al-Dour	4
Waset	Al-Azizia	3
Waset	Al-Ahrar	6

Maize processing facilities

The company has 13 maize threshing and drying facilities in different provinces with a total capacity of 2700 t day^{-1} threshing and 1350 t day^{-1} drying. Providing feed, especially for the poultry industry, is one of the main activities of the company. For more information, contact: Mesopotamia Seed Company, Baghdad, Iraq; E-mail: meso_nahrin @ yahoo.com.

Source: Mesopotamia Seed Company

The Seed Producers Society in Libya

The Libyan national seed system has seen several important changes in the past 10 years. The National Center for Improved Seed Production (NCISP) was established in 1998 and began operations a year later in the Tsawa Project (southern desert areas) and the Kiaam Balkhams Station (northwestern coastal zone). Several government decrees were issued to formulate a well-defined strategy to reduce seed imports and provide incentives for domestic production to meet the country's seed demand according to the guidelines of the Popular General Committee.

In 2005, a National Committee for Variety Registration and Seed Certification was established. Through its technical committees, it has compiled a catalog of all cereal and vegetable varieties marketed in Libya. It handles variety evaluation and registration of domestic

and foreign breeding institutions. Another important development was the establishment of the Seed Producers Society in 2007, at a time when NCISP was exploring alternative seed production arrangements to meet growing demand. The organization has membership of all farmers in major seed production areas of the country who have contractual agreements with the NCISP.

The Tsawa Project, covering 750 ha, specializes in producing seed of wheat, barley, and legumes (faba bean, peas and chickpea). It focuses on variety maintenance and breeder, pre-basic, basic and registered seed production. The project, however, does not have sufficient capacity to meet the national seed demand estimated at 20,000 to 25,000 t of wheat and barley seed. Therefore, NCISP developed a contract seed production scheme with farmers who have agricultural investment projects and sufficient area and equipment for seed production. Members of the Seed Producers Society have large areas under central pivot irrigation, estimated at 30,000 ha with potential for further expansion and use of modern seed production techniques. Since 2006/07, NCISP has established contract production with large numbers of farmers who are members of the Society.

Durum wheat seed production under pivot irrigation

First field inspection of contract seed growers' fields

An NCISP representative will select and monitor seed multiplication fields before and during the growing season. All seed fields are inspected by an independent committee and will be accepted if they comply with the contract particularly regarding varietal purity and weed contamination (e.g. *Avena sativa*). Farmers deliver the harvested seed to Tsawa Center where samples are tested for quality to determine the purchase price (which is set by the State).

The NCISP processes (clean, treat, package) and stores the seed until it is sold to public and private enterprises. The Agricultural Bank may support cereal prices to encourage the purchase and use of improved seeds produced by the Center. The NCISP, through contract seed production, was able to provide 80% of commercial seed of cereals (bread and durum wheat, barley, forage grasses, oats) during 2007/08 (Tables 1 and 2, page 12). The performance of the private sector in 2008/09 was excellent, not only in seed production but also in durum wheat grain production, which for the first time reached about 300,000 t, enabling Libya to achieve self sufficiency.

The Seed Producers Society not only multiplies seed, but also coordinates with the NCISP in receiving, transporting and delivery operations. In addition, it provides inputs (fertilizers, herbicides) and farm equipment (irrigation, etc) and helps find solutions to problems faced by seed producers during the season.

Several factors have enabled Libya to achieve self-sufficiency in seed supply of wheat, barley and oats. These include government policy and support in establishing the National Committee for Variety Registration and Seed Certification; the increase of area under pivot irrigation systems; the activities of the Seed Producers Society; and the incentives for seed prices particularly for durum wheat. *Ali Salem Al-Shreidi, Agriculture and Animal Research Center, National Cereal Crops Improvement, Tripoli, Libya; E Mail: alishreidi2009 @gmail.com.*

Table 1. Wheat and barley seed production in Tsawa Project, Libya, 2000-08

	Production (t)		Productivity (t ha^{-1})		
Year	Wheat	Barley	Durum wheat	Bread wheat	Barley
2000	243	170	2.20	3.00	3.40
2001	322	230	3.40	3.80	4.60
2002	1818	1507	4.20	5.10	5.10
2003	2832	828	5.60	6.80	6.20
2004	1182	755	2.10	4.40	6.13
2005	2454	1529	7.00	5.60	6.20
2006	2647	1930	6.68	5.43	6.13
2007	4293	4247	6.88	6.33	5.58
2008	13058	5047	7.12	5.11	6.21
Total	28849	12243	-	-	6.21
Average	3205	1805	5.02	5.06	5.50

Source: NCISP Report

Table 2. Wheat and barley seed production in 2007/08 crop season

	Seed production (t)				Seed cost
Crop	Tsawa Project	Contracts	Total	Contract production (%)	(Dinar t^{-1})
Durum wheat	2458	9399	11875	79	1141
Bread wheat	230	972	1202	80	607
Barley	1397	3650	5045	72	672
Total	4035	14081	18106	77.78	2420

Source: NCISP Report

Morocco Establishes Biosafety Association

The Moroccan Biosafety Association (MOBSA) or the Association Marocaine de Biosécurité (AMABIOS) was officially approved as a legal entity by the Constitutional General Assembly of Morocco. The Executive Board was formed with nine members including among others, a biochemist, microbiologist, toxicologist, public health doctor, and a virologist. MOBSA is also open to accepting associate members and partners from other organizations outside Morocco with similar objectives. It plans to have its fist General Conference in 2010. For more information about MOBSA, contact: Prof Khalid Riffi Temsamani; E-mail: ktemsamani@uae.ma.

Van Rijn Establishes Subsidiary Company in Morocco

Van Rijn b.v., a Dutch company founded in 1855, is the only company in Europe combining potato, vegetables and fruit businesses on a large scale. The company has been working in Morocco for more than 30 years. In 2006, it established a new subsidiary called Dynagri, which is the latest example of the commercial synergy of both businesses. Dynagri, located in Casablanca, started its operation with potato seed multiplication for the Moroccan market and eventually also for other countries in North Africa.

Van Rijn has also established daughter companies or trade partners in Algeria, Egypt, France, Germany Italy South Africa and Scandinavian countries. Morocco is seen as complementary to other centers in the company's strategy to supply the world market all year around. The Van Rijn group trades over 250,000 t, of which 75,000 t is seed potatoes, 70,000 t is early potato from different origins and the remaining are vegetables and fruit.

In 2008, Van Rijn's seed potato department entered into a 50-50 joint venture with KWS, one of the world's leading companies in cereals and sugarbeet. The merger will create more options in breeding of new potato varieties; both companies will use each other's channels to market seed potato throughout the world. Van Rijn–KWS b.v. is headquartered at Poeldijk and its breeding station located at Emmeloord. in the Netherlands.

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Performance of the Seed Sector in Pakistan

Pakistan's national seed sector has made steady progress after the national seed policy was declared in 1994. According to data released by the Federal Seed Certification and Registration Department, about 259,439 t of seed of various crops was produced in the 2007/08 crop season. This includes about 177,792 t of wheat, 31,691 t of cotton, and other crops. Private sector seed supply is growing rapidly, and is even overtaking the public sector. Meanwhile substantial amounts of seed of hybrids and fodder crops were imported into the country in the same year: 29,551 t worth Pak Rupees 3,723.29 million. This clearly shows the great potential for domestic seed production (Tables 1 and 2).

Seed availability during two seasons, 1997/98 and 2007/08, is presented in Table 3. The figures show substantial increase in seed provision with an average of 16% although for rice, maize, pulses, sunflower and vegetables there is a substantial increase. Seed imports for the same years are shown in Table 4. There is a substantial increase in seed supply of cereals (especially hybrid maize) as wel as other crops and vegetables, with an overall increase of 200%.

Source: The Seed News, Volume 10 No 3, April-June 2009

Table 1. Seed imports in 2007/08

Crop	Imports (t)	Value (Rs million)
Maize (hybrids)	6175.32	1,152.86
Millets (hybrids)	531.49	42.18
Sorghum (hybrids/OPVs)	3743.15	159.23
Rice (hybrid)	1528.37	225.7
Sunflower (hybrid)	1,639.36	421.97
Canola (hybrid)	14.03	4.14
Vegetables	5,885.88	1,004.76
Potato	4,869.56	245.03
Alfalfa	1,045.24	147
Berseem	4106	316.23
Grasses	6.16	2.28
Cycas	4	0.35
Palm	2.7	1.56
Total	29,551.26	3,723.29

Table 2. Seed produced in 2007/08 crop season

		Quantity supplied (t)				
Crop	Potential demand (t)	Public	Private	Import	Total	Achievement (%)
Wheat	1,032,964	55,442	122,350	-	177,792	17
Rice	39,660	2,371	9,969	1,528	13,868	34
Maize	30.036	214	3,072	6,499	9,785	32
Vegetables	5,500	256	486	5,598	6,340	115
Potato	311,500	588	727	6,885	8,200	2
Fodders	73,249	17.45	12	11,734	11,763	16
Cotton	65,000	5,035	26,656	-	31,691	48
Total	1,527,903	63,923	163,272	32244	259,439	17

Note: Some imported vegetable seed was exported

Table 3. Seed produced and supplied in 1997/98 and 2007/08

Crop	Supplied in 1997/98 (t)	Demand met (%)	Supplied in 2007/08 (t)	Demand met (%)
Wheat	78,544	10.63	177,792	17
Rice	1,734	2.88	13,868	34
Maize	1,674	4.78	9,785	32
Chickpea	192	0.44	107	0.25
Pulses	117	2.41	1,524	24
Sunflower	571	57.1	1,206	39
Canola	511	43.98	97	13
Rape & mustard	nr	nr	224	17
Ground nut	nr	nr	6	0
Vegetables	3,181	63.62	6,176	115
Potato	6,824	3.45	8.348	2
Fodders	873	6.02	11,923	16
Cotton	23,128	34.52	31,691	48
Total	117,349	10.05	262,747	16

Note: Some imported vegetable seed was exported, nr = not recorded

Table 4. Amount of seed imported (t) by Pakistan in 1997/98 and 2007/08 crop seasons

Crop	1997/98	2007/08	Crop	1997/98	2007/08
Maize (hybrids)	1,173.84	6,175.32	Potato	5,396.25	4,869.56
Millets (hybrids)	nr	531.49	Alfalfa	5	1,045.24
Sorghum (hybrids/OPVs)	789.31	3,743.15	Berseem	nr	4,106
Rice (hybrid)	nr	1,528.37	Grasses	nr	6.16
Sunflower (hybrid)	403.15	1,639.36	Cycas	nr	4
Canola (hybrid)	30.105	14.03	Palm	nr	2.7
Vegetables	2,269.91	5,885.88	Jobjoba	11.782	nr
Total (All crops)				10,079.35	29,551.26

nr = not recorded

RESEARCH NOTES

Short communications on practical research or relevant information on agriculture or seed technology are presented in this section.

Participatory Variety Selection to Strengthen the Informal Potato Seed System in Southern Ethiopia

by

Tesfaye Tadesse and Mihiretu Chernet[1]

Potato is the world's most important food crop after wheat, rice and maize. It is a cheap, high quality food with good balance between proteins and carbohydrates, substantial amounts of vitamins, minerals and trace elements. It is one of the cheapest sources of energy and gives the highest production of protein per unit land among the four major staple food crops (CIP and FAO, 1995.)

Ethiopia possibly has the greatest potential for potato production in Africa because 70% of its arable land, mainly in the highlands above 1500 masl, is believed to be suitable for the crop. FAO estimates that potato production in the country has increased from 280,000 t in 1993 to around 525, 000 t in 2007. In southern Ethiopia, mostly a local variety called *Durame* is produced, without any improved technologies (fertilizer, etc). Farmers are aware of the potential of the crop and are looking for high-yielding disease-resistant varieties that are responsive to improved production technology.

In 2005, the Awassa Agricultural Research Centre (AARC) released three potato varieties: *Bulle* (CIP-387224.25), *Marachere* (CIP-389701.3) and *Shenkola*. All are adapted to a wide range of climatic conditions and mid and high altitudes in southern Ethiopia. In 2009, AARC released another variety named *Dancha*. These varieties produce 32-39 t ha^{-1} at research stations and 28-29 t ha^{-1} on farmers' fields which is far higher than local varieties (5 to 8 t ha^{-1}).

However, the new varieties have not been widely adopted by farmers due to lack of seed. There is no proper formally organized public or private sector dealing with potato seed. Therefore, AARC aimed at introducing improved varieties and production technologies by strengthening the informal seed sector in potato producing areas of the southern region.

Participatory variety selection

In October 2008, participatory problem appraisal was conducted and farmer research and extension groups (FRs) were established in different districts (*woreda*s). Bulle, Dara, Wolayta and Chencha *woredas* were chosen for potato variety selection. AARC has also multiplied newly released potato varieties *Bulle, Marachare* and *Shenkola* from AARC and *Jaleni* (best adapted variety from the National Potato Program) in order to have sufficient seed for distribution. Potato seed was produced at high altitudes, and stored under diffused light storage (DLS) for sprouting before being introduced to farmers.

In March 2009, farmers from Bulle, Chencha, Dara and Wolayta *woredas* were selected and trained in potato seed production.

Two farmers from Dara, three from Bulle and four from Chencha and Wolayta and two Farmer Training Centers (FTCs) from each district were selected for the trials. Farmers were encouraged to construct DLS to initiate participatory variety selection and seed production. About 20 kg potato seed tubers of one improved and one local variety

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each were planted on selected farmers' fields and FTCs at the same time. All improved varieties were planted with their full agronomic package. All varieties were planted at spacing of 75x30cm; and urea and DAP fertilizers were applied at 165 kg ha^{-1} and 195 kg ha^{-1} respectively. The researchers and farmers made frequent follow-ups at various stages after crop establishment.

Four months after planting the crop was harvested and yield data were recorded. Farmers and researchers evaluated the vegetative performance and yield of varieties in all locations. Performance data and farmers' perception of the varieties were collected and analyzed. Farmers ultimately selected and retained their preferred varieties for further multiplication and use.

Performance of varieties

The performance both on farmers' fields and on FTCs is presented in Tables 1 and 2**.**

Farmers' fields: Among three varieties evaluated, *Bulle* gave the highest marketable and total yield at Bulle, Chencha and Dara *woredas*. At Wolayta*, Marachere* gave the best tuber yield. At all locations, the farmers' variety (local) gave the lowest marketable and total yield (Table 1).

Farmer Training Centers: Although different varieties were evaluated in each location, improved varieties consistently performed better than local varieties. The local variety was severely infected by potato late blight and gave low yield except at Chencha where it outperformed improved varieties *Shenkola* and *Marachere,* probably due to its tolerance to high soil acidity. Among varieties evaluated, *Jaleni* recorded the best performance at Bulle even though it was tested in one location only (Table 2). *Jaleni, Bulle* and *Marachere* gave the best total tuber yield in Bulle, Chencha and Wolayta *woredas*, respectively (Table 2).

Farmers' perceptions

Farmers from different locations selected improved varieties over local landraces. *Jaleni* and *Bulle* were selected for their excellent agronomic

Table1. Performance of potato varieties in farmer's fields in southern Ethiopia

Location	Variety	Marketable yield t ha^{-1}	Total yield t ha^{-1}
Bulle	Bulle	31.71	33.66
	Local	13.11	18.41
Chencha	Bulle	28.03	31.86
	Marachere	23.75	29.8
	Local	12.50	15.6
Dara	Bulle	32.80	36.96
	Marachere	32.39	37.79
	Local	9.90	12.94
Wolayta	Bulle	31.42	32.99
	Marachere	35.34	36.93
	Local	6.81	8.434

Total yield = marketable yield + unmarketable yield

Table 2: Performance of potato varieties at Farmer Training Centers

		Average number/hill		Average tuber		Yield t h^{-1}		Diseases	
Location	Variety	Main stem	Tubers	Wt/hill (kg)	Diameter	Marketable	Total	Observed	Severity
Bulle	Jaleni	4.4	12	0.84	4.6	45.53	50.21		
	Marachere	4.6	9.4	0.88	4.96	31.21	33.55		
	Shenkola	3	10.8	0.62	4.43	15.96	19.01	PLB	30
	Local	3.6	16.4	0.3	3.52	3.97	5.96	PLB	80%
Chencha	Bulle	3	12.6	0.68	5.5	20.50	22.41	free	-
	Marachere	3.4	14.8	0.9	4.52	14.61	17.52	free	-
	Shenkola	1.6	5.8	0.4	4.98	6.74	7.305	PLB	40
	Local	4.2	28.8	0.82	3.94	13.48	19.08	PLB	85
Wolayta	Bulle	2.3	18.5	1.76	6.25	30.09	32.25		
	Marachere	2.4	21.2	1.92	5.96	39.79	41.63		
	Wechecha	2.6	11.8	2.22	7.02	34.04	34.82		20
	Local	1.9	10.7	0.595	3.54	5.60	6.95		

traits (ground cover, freedom from disease) and excellent consumptive values (taste, uniform, large tuber size, palatability, etc) at Bulle. *Jaleni* also had the potential to give more yield if left in the ground for an additional 1-2 months. Similarly, farmers in Chencha and Wolayta selected *Bulle* and *Marachere* for their large and uniform tubers, high tuber yield, earliness, and freedom from diseases. *Shenkola* and local varieties were rejected because of their susceptibility to diseases, low vegetative performance and yield.

Conclusions

Farmers selected and maintained new potato varieties for further multiplication and distribution to other producers. Since there is no organization to multiply root and tuber planting materials the intervention of research centers is essential to strengthen the existing informal seed system and thus enable small-scale farmers to easily access potato seed at local levels. The Bureau of Agriculture and Rural Development, Cooperatives and NGOs are expected to exert more effort in organizing farmers for local-level potato seed production and marketing.

Acknowledgments

The authors would like to thank Heads and experts of *Woreda* office of Agriculture for Crop Production and Development, especially the development agents, for their valuable support in identifying farmers, planting the trials, collecting the data, harvesting and overall supervision of trials in farmers' fields and training centers.

References

CIP (International Potato Center) and FAO (Food and Agricultural Organizations). 1995. Potato in the 1990s. Situation and prospects of the world potato economy. FAO, Rome, Italy. 39 pp.

MEETINGS AND COURSES

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

Conferences

AFSTA Congress 2010, 1-4 March 2010 in Bamako, Mali. Each year, AFSTA holds a Seed Congress in a member country. The Congress is an ideal forum for seed sector stakeholders to discuss issues affecting the seed industry both in Africa and globally. Registration is now open at www.afsta.org. For further information contact: AFSTA Secretariat, Nairobi, Kenya; E-mail: afsta@afsta.org

8th European Sunflower Biotechnology Conference, 1-3 March 2010, Antalya, Turkey. The conference is orgnaized by the Trakya Agricultural Research Institute in collaboration with the Turkish Plant Breeders Association, International Sunflower Association, Directorate General of Agricutural Research and FAO. For more information visit the website: http://www.sunbio8.org/

International Seed Testing Congress 2010, 16-22 June 2010, Cologne, Germany. This is a triennial congress organized by the ISTA Secretariat. During the Congress, the 29th ISTA Seed Symposium will be organized from 16-18 June 2009 under the theme *Application and improvement of established and advanced technologies in seed testing*. The Symposium will consist of five oral sessions and two poster sessions, each of 2 hours, covering the same topics. A lead speaker in the field of seed science and technology will chair each oral session.

ISTA Workshops

ISTA Seed Health Workshop, 2-5 March 2010, GEVES-SNES, Angers, France. For more information visit: http://www.seedtest.org/en/workshopdetail---1--1113--210--75.html

ISTA Workshop on GMO Testing, 8-13 June 2010, Bavarian State Office for Health and Food Safety, Bavaria, Germany. For more information visit: https://www.seedtest.org/en/workshopdetail---1--1113--210--79.html

ISTA Workshop on Species and Variety Testing/ Protein Electrophoresis, 11-13 June 2010, Federal Plant Variety Office, Hanover, Germany. For more information visit: http://www.seedtest.org/en/workshopdetail---1--1113--210--78.html

ISTA Workshop on Viability and Germination Testing, 9-14 June 2010, Landwirtschaftliches Technologie Zentrum Augustenberg, Karlsruhe, Germany. For more information visit: http://www.seedtest.org/en/workshopdetail---1--1113--210--77.html

Courses

The European Plant Breeding Academy, March 2010 to October 2011. The European Plant Breeding Academy offers a training program for working professionals who wish to become plant breeders. The Plant Breeding Academy was established at the University of California, Davis in 2006. To date, 38 seed professionals from around the world have participated in the first two classes. Building on this success, UC Davis is partnering with European seed companies, institutions and associations to offer the European Plant Breeding Academy. For more information and applications, contact Joy Patterson (jpatterson@ucdavis.edu) or visit the website at http://pba.ucdavis.edu.

Plant Variety Protection, 14-25 June 2010, Wageningen, the Netherlands. The course aims at facilitating the introduction and practical implementation of Plant Breeders' Rights (Plant Variety Protection). Application forms can be downloaded from www.cdic.wur.nl. For more information contact: Wageningen International, Project Support Department, P.O. Box 88, 6700 AB Wageningen, The Netherlands; fax: 31 (0) 317 495 395; E-mail: training.wi@wur.nl, www.cdic.wur.nl

Distance Learning Sessions 2010
UPOV runs the Distance Learning Course DL-205 'Introduction to the UPOV System of Plant Variety Protection under the UPOV Convention'. For more information see the UPOV website at: http://www.upov.int /en/about/training.html).

LITERATURE

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

Books

MacRobert, J.F. 2009. Seed Business Management in Africa, CIMMYT, Harare, Zimbabwe. This book, **al**though targeted to the African business environment, is likely to benefit newly emerging seed enterprises worldwide. Different from other maize seed production books, it links technical and business related aspects, and most importantly draws on the experiences of entrepreneurs who have successfully managed small and large seed businesses under most difficult conditions. . The book is available at: http://www.cimmyt.org/english/docs/manual/SeedBusinessAfrica.pdf

Funk, A.O. 2009. The African Seed company toolbox: 52 Tools Every Seed Company Manager Should Know How to Use. This book is written for managers of seed companies in sub-Saharan Africa working with smallholder farmers. The tools cover a variety of topics in production, marketing, distribution, and business management. The toolbox include a set of interactive exhibits, which can be customized for individual company use and was constructed based on input and questions from the managers of 20 African seed companies. The toolbox is available on the AGRA website at the following link: http://www.agra-alliance.org/ content/news/detail/1066

George, R.A. 2009. Vegetable Seed Production (3rd edition). Providing broad expert coverage of the horticultural production of vegetables grown from seed, this new edition also explores the production of genetically modified crops, organic seed production, honey bee population and packaging. Further updates from the last edition include full revisions throughout the text, summary boxes for quick reference, further reading sections and fully updated references, making this an essential read for horticulturalists, researchers, seed scientists, vegetable producers, students, technicians and practitioners in vegetable seed production. CABI, ISBN 9781845935214 (HP); 320 pp; Price:£65/$130/€100; Website: http://www. cabi.org/CABIPages/bk_BookDisplay.asp?PID=2176

Mannino, M.R. J. Taylor and S. Jones. 2009. ISTA Handbook on Pure Seed Definitions (3rd edition): This handbook will expand on and illustrate the pure seed definitions (PSDs) of the International Rules for Seed Testing. It will be valuable in training programs on purity testing. Illustrations of the most relevant genera within a PSD will provide practical guidance on the application of each definition. Each PSD is illustrated with scaled color photographs or line drawings. A comprehensive glossary of scientific terms applying to seed purity is also included. ISTA Publication price: CHF270 ($245).

Websites, Journals, Newsletters

Scitable
Scitable is a free science library and personal learning tool brought to you by Nature Publishing Group. Scitable currently concentrates on genetics, the study of evolution, variation, and the rich complexity of living organisms. As you cultivate your understanding of modern genetics on Scitable, you will explore not only genetics and the ways it impacts our society, but also the evidence that supports current knowledge. http://www.nature.com/scitable

The Crop Genebank Knowledge Base
The Crop Genebank Knowledge Base (http://cropgenebank.sgrp.cgiar.org/) is a product of the CGIAR System-wide Genetic Resources Program. The aim is to provide dynamic, up-to-date information on best practices for germplasm conservation of major crops, including genebank procedures (registration through to distribution), protocols, guidelines, manuals, as well as training materials and other aspects of genebank management

New Journals

Plant Biology International is a new, open access, online-only, peer-reviewed journal that considers scientific papers in all different sub-disciplines of plant biology, such as physiology, molecular biology, cell biology, development, genetics, systematics, ecology, evolution, ecophysiology, plant-microbe interactions, mycology and phytopathology. Plant Biology International publishes original articles, brief reports, and reviews. Editor-in-Chief: Dijon Sergio Ochatt, France.

Educational DVDs
This set of four seed testing DVDs, developed by the Ohio State University and Dr Miller McDonald, is a comprehensive review of the most common techniques used to assess seed quality. Text, figures, animations, and videos are used to effectively explain each testing procedure, which makes this collection valuable for training programs on seed testing. The DVDs were developed in cooperation with the Consortium for International Seed Technology Training (http://www.seedconsortium.org/). Snippets can be viewed at:
http://www.seedtechnology.net/DVDs.htm.

Seed Newsletter
Cultivar Seed is a seed magazine targeting the private sector. It has a worldwide directory of seed organizations and a website (www.cultivarseed.com) dedicated to seed industry stakeholders. The magazine is published three times a year during AFTSA congress in February, ISF congress in May, and ESA congress in October. Articles are in French and English.

About ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is one of 15 centers supported by the CGIAR. ICARDA's mission is to contribute to the improvement of livelihoods of the resource-poor in dry areas by enhancing food security and alleviating poverty through research and partnerships to achieve sustainable increases in agricultural productivity and income, while ensuring the efficient and more equitable use and conservation of natural resources.

ICARDA has a global mandate for the improvement of barley, lentil, barley and faba bean, and serves the non-tropical dry areas for the improvement of on-farm water use efficiency, rangeland and small-ruminant production. In the Central and West Asia and North Africa (CWANA) region, ICARDA contributes to the improvement of bread and durum wheats, kabuli chickpea, pasture and forage legumes, and associated farming systems. It also works on improved land management, diversification of production systems, and value-added crop and livestock products. Social, economic and policy research is an integral component of ICARDA's research to better target poverty and to enhance the uptake and maximize impact of research outputs.

About the CGIAR

The Consultative Group on International Agricultural Research (CGIAR) is a strategic alliance of countries, international and regional organizations, and private foundations supporting 15 international agricultural Centers that work with national agricultural research systems and civil society organizations including the private sector. The alliance mobilizes agricultural science to reduce poverty, foster human well being, promote agricultural growth and protect the environment. The CGIAR generates global public goods that are available to all.

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the International Fund for Agricultural Development (IFAD) are cosponsors of the CGIAR. The World Bank provides the CGIAR with a System Office in Washington, DC. A Science Council, with its Secretariat at FAO in Rome, assists the System in the development of its research program.