International Center for Agricultural Research
In the Dry Areas - ICARDA

INTEGRATED RESEARCH AND DURUM ECONOMICS NETWORK (IRDEN) PROJECT

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ICARDA – IRDEN Project
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INTEGRATED RESEARCH AND DURUM ECONOMICS NETWORK (IRDEN) PROJECT

Program to Foster Adoption of Low-Cost Durum Technologies for Increased Income and Improved Household Food Security of Smallholders in Less-Favored Areas of West Asia and North Africa

Sponsored by

International Fund for Agricultural Development (IFAD)

Implemented by the National Programs of

Algeria, Morocco, Syria, Tunisia and Turkey

Coordination and Technical support provided by

International Center for Agricultural Research in the Dry Areas (ICARDA)

BACKGROUND

Durum wheat is the traditional and noble crop in most countries of the Mediterranean region where it has its centers of origin and diversity and where it contributes significantly, in various forms (flat bread, pasta, couscous, burghul, frikeh...) to household's diets and incomes.

The countries of Algeria, Morocco, Syria, Tunisia and Turkey, participating in the IRDEN project, account for over one third of the World durum area and consumption. Algeria, Morocco and Tunisia are net importers of durum wheat with the Algeria totaling 40% of the world imports.

Durum wheat is grown under different ecosystems in these countries, but its cultivation is predominant in the arid and semi-arid regions under rainfed conditions where it is grown mainly by small farmers. The grain yields are still low and highly fluctuating and their averages do not exceed 1 ton/hectare in the North Africa countries and 3 tons/ha for Turkey and Syria. These low productivities are explained by the adverse climatic conditions characterized by frequent droughts combined with low and high temperatures and with insect and diseases constraints, and by the limited adoption of improved production packages.

The International Center for Agricultural Research in the Dry Areas (ICARDA) has joined efforts with NARSs of the CWANA countries to improve the productivity of durum wheat under different ecosystems and especially in the dry lands and a large number of improved durum varieties have been released. These efforts have been enhanced since 1998 with the financial support of International Fund for Agricultural Development (IFAD) through the past WANADDIN and the on-going IRDEN projects.

The Integrated Research and Durum Economic Network (IRDEN project) is building on the achievements of the WANADDIN project, but has adopted a holistic and integrated approach aiming at the sustainable improvement of durum wheat productivity and the increasing of economic returns of durum growers and targeting the sustainable management of resources and the improvement of livelihoods of local communities. The project will help NARSs to adopt an integrated and participatory approach ensuring the collaboration among scientists, farmers and other key stakeholders (extension, NGOs, women...) to achieve tangible impacts. ICARDA is responsible for the regional coordination of the project through enhancing the networking and integration among project components and by providing germplasm, training and technical backstopping as required. At the national level, the activities are implemented mainly with farmers on the basis of a Memorandum of Understanding between ICARDA, NARS and IFAD.

The project activities are grouped into 5 areas (figure 1): Transfer of technologies through on-farm demonstration of the best available technological packages; improvement of seed production and distribution; promotion of add-value technologies; back-up research and capacity building. These activities are assigned to ensure the complementarities among the project partners.

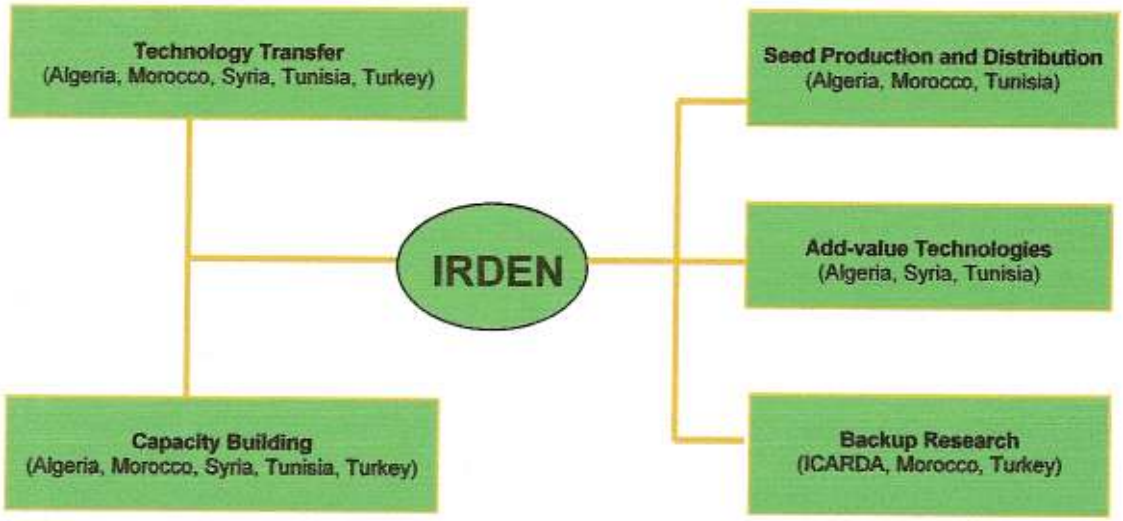

Figure 1. IRDEN Project themes and participating countries.

EXECUTIVE SUMMARY

IRDEN activities during 2005-2006 were conducted as planned. Weather conditions during the season were generally favorable, despite irregular rainfall distribution. Over 100 farmers and 80 workers in research, extension, administration, seed agencies, and development institutions participated in those activities. A larger number of farmers benefited from field days and advisory services of IRDEN Project.

Transfer of technology activities included the implementation of demonstration plots comparing the new technology with farmer traditional practice. New varieties and cultural practices outperformed farmer technology with a yield advantage varying among countries: 100% or more in Algeria, 40% in Turkey, 20 % in Syria, and 10% or less in Morocco and Tunisia. The fourth year of the IRDEN Project has been a year of consolidation of farmer awareness and steady adoption of the improved durum production technology.

On-farm seed production and processing continued to gain momentum, especially in Algeria where 1700 t of seed have been produced by lead farmers and others. About 320 t of seed have been produced by one lead farmer in Tunisia. But only 40 t of seed have been produced in Morocco, most of which through INRA or its close partners in IRDEN, because of unfavorable policy towards durum wheat production in that country. Among very promising cultivars in North Africa are Boussalem in Algeria, IRDEN (1804), ICAMORE and Tomouh in Morocco. Elsewhere, high performing cultivars include Fouatbey-2000 and Saricanak-98 in Turkey, and Douma-1 in Syria. Prospects for a successful small seed enterprise based on on-farm produced quality seed in North Africa seem high in Algeria, moderate in Tunisia, and very low in Morocco.

Activities on durum added-value technologies during 2005-2006 were conducted in Algeria to better define quality traits for the durum food products: galette, couscous, and pasta; to identify and assess quality technological traits of couscous made from old versus modern durum cultivars in Tunisia, and to identify good freekeh making varieties as well as strengthening community work on producing and marketing Freekeh in Syria. Gluten strength was identified as a common criterion for good quality durum end-products in the three countries.

Backup research at ICARDA involved the development of two genetic mapping populations ('Jennah Khetifa x Cham 1' and 'Omrabi5/*T. dicoccoides*// Omrabi5' and their study with respect to drought tolerance and grain quality alongwith the prospects for developing MAS tools for both traits, for use by ICARDA and NARSs scientists. Researchers from both Morocco and Turkey tested specific durum germplasm from ICARDA for drought tolerance and grain quality under their conditions and exchanged results with ICARDA breeders.

The Project provided an opportunity for many farmers to get acquainted with new technologies and to adopt them under their own field conditions. Researchers and students benefited from contacts with international scientific community; students worked on their degree research within the framework of IRDEN topics, under the supervision of Project-involved staff within the country. Project staff produced several publications on IRDEN topics, including brochures, and articles in newspapers and in refereed journals, and exchanged experiences in meetings both within and outside their countries.

SUMMARY AND CONCLUSION

The fourth year of the IRDEN Project generally confirms previous years results regarding the relevance of 'growing durum wheat in semi-arid areas' and the real prospects for improving durum productivity in those areas, and hence the opportunity to enhance the welfare of resource-poor farmers in dry areas.

Weather conditions during the 2005-2006 season were generally favorable, especially in Morocco and Algeria, where durum yields were above average, and reached high values (> 4 t/ha) in certain cases. In Algeria, average rainfall at test sites were in the range 370-420 mm, whereas in Morocco, rainfall distribution and amount were favorable with no diseases or Hessian-fly infestation. In Syria, rains started late, but were quite sufficient thereafter, except for some terminal stress in certain sites (e.g. Aleppo). In Tunisia, total seasonal rainfall was rather high (420-480 mm), but distribution was inadequate, with insufficient rain received during the months of March-April. In Turkey, rainfall was adequate and winter months were generally mild.

Transfer of technology activities were conducted successfully in all 5 countries. In Algeria, demonstrations of the improved "variety" and "crop management" technologies were conducted at Ouled Bessam and Guelta Zerga, but not in Rahouia as farmers in the latter area have already embraced the new technology. The new cultivar Boussalem continued to lead in yield, with more than double farmer yield in the same region (2.7 t/ha versus 0.8 t/ha in Ouled Bessam). Weed control and fertilizers also improve yield drastically, multiplying the 'check' yield by 2 when only weed control is adopted and by a factor of 2.5 when both weed control and fertilizers (N, P) are used together. In Morocco, despite the absence of Hessian fly (HF), HF-resistant varieties and other improved varieties outyielded the 'check' Karim by 2 q/ha (with average yields of 2.8 t/ha versus 2.6 t/ha). IRDEN '1804' and ICAMORE cultivars generally outyielded others (average yield of about 3.4 t/ha versus 3.1 for the check or farmer yield; maximum yield reached 5.1 t/ha for the improved variety). With the absence of HF infestation, there was no obvious advantage of early sowing over late sowing. In Syria, yields were under 2 t/ha in dry sites of Zone B, but surpassed 4 t/ha in others. The cultivar Douma-1 outyielded others in most sites for both grain as well as 'freekeh' yield. Bohouth-7 usually ranked second, while Cham-5 performs well under dry conditions. In Tunisia, yield of the recommended practice was equivalent to farmers yield in 2 sites but superior at two other sites. As farmer uses less input (one N application instead of two), there is a need for further research to determine the most adequate technology for durum wheat production in semi-arid areas of Tunisia. Studies of seed rate suggest an optimum seed rate for specific varieties and specific environments, usually not surpassing 300 seeds/m^2. In Turkey, the cultivar Fouatbey-2000 (5 t/ha) in Gaziantep and the cultivars Saricanak-98, Gatae-6, and Aydin-93 (>4 t/ha) in Diyarbakir outyielded older cultivars. Seed of those varieties are enthusiastically purchased by farmer communities.

Project participants in North African countries continued to encourage farmers to produce quality seed on their farms; such seed has proven to equal or approach the yielding value of certified seed as shown in Tunisian studies. Such an approach provides farmers in semi-arid areas a quick and easy access to seed of new or improved varieties. In 2005-2006, relatively large amounts of quality seed of improved varieties have been produced on-farm and sold to farmers within and

outside the community. In Tunisia, the lead farmer identified in previous years continued to produce and market quality seed, both within and beyond his own community. In Algeria, the first lead farmer was an example for several others to follow suit, and very large amounts of quality seed of improved cultivars have been produced and sold to community farmers and to commercial seed companies. The case of Algeria is the most successful one in this respect, essentially because of the extremely high performance of the new varieties (e.g. cv Boussalem) as compared to widely grown older varieties. In contrast, the unfavorable public policy with regard to marketability of durum wheat in Morocco is a real obstacle to mass production of durum wheat in the country, despite the spectacular yield advantage of the improved varieties realized in that country. Although small seed enterprises for on-farm seed production may be established in all 3 countries, sustainability of such enterprises depends on the country. Among sustainability ensuring factors are the availability of adapted varieties and crop management technology for semi-arid areas, and a favorable government policy that encourages the adoption of that technology. Prospects in North Africa for a successful small seed enterprise based on on-farm produced quality seed seem high in Algeria, moderate in Tunisia, and very low in Morocco.

Research was conducted in Algeria, Syria and Tunisia to characterize important farm-made durum end-products in each country.
In Algeria, grain samples from six durum varieties were distributed to 4 households in each of the 2 IRDEN-target communities who proceeded to their grinding, and the preparation and evaluation of end-products: galette, couscous and pasta. Despite some discrepancy, women evaluation of varieties for end-product making generally conforms to lab rating that was based on semolina color, extraction rate, and gluten quality.
In Syria, the freekeh-making quality of several varieties was assessed using different methods. Farmers' evaluation and lab and organoleptic tests confirmed the superiority of cultivar Douma-1, and to a secondary level Bohouth-7. Lab tests also showed that protein content of durum varieties is reduced through the freekeh-making process. Members of the Freekeh Association held meetings and discussed ways to enhance further efforts to assist farmers in the making and marketing of freekeh.
In Tunisia, researchers conducted a comprehensive evaluation of factors determining couscous quality. This involved tests on physico-chemical traits, technology parameters, protein characteristics, couscous processing and organoleptic assessment. Landraces generally were better than modern cultivars for kernel and semolina (greater protein content and better gluten strength) and for couscous characteristics (hydration and particle cohesion) and the quality of cooked couscous (higher firmness, no stickiness on cooking).

Backup research at ICARDA involved the development of two genetic mapping populations ('Jennah Khetifa x Cham 1' and 'Omrabi5/*T. dicoccoides*// Omrabi5' and their study with respect to drought tolerance and grain quality along with the prospects for developing MAS tools for both traits, for use by ICARDA and NARSs scientists.
In Morocco, studies on seed rate and date of sowing of HFR and HFS cultivars showed no significant difference of average yields for low versus high seed rate (120 and 250 kg/ha). This is true for both Hessian-fly resistant and Hessian-fly susceptible varieties, in evident contrast to previous years' results. The slight advantage of early versus late planting is due to escape of terminal stress in early planted wheat. In

addition, durum international nurseries, as well as two mapping populations were evaluated at Sidi El Aydi and Jemaa Shaim and test results shared with the ICARDA durum scientist.
In Turkey, 24 durum wheat entries making up the ICARDA trial IDYT06-CA were evaluated at Diyarbakir Research Institute for yield and related traits, and for grain quality (1000-kernel weight, test weight, vitreousness, protein content, and yellow pigments) and selected entries were shared with ICARDA durum breeder.

IRDEN Project staff organized field days and traveling workshops through IRDEN project sites in collaboration with other stakeholders in each of the 5 countries. This provided an opportunity for farmers to observe the on-farm performance of IRDEN technology in comparison with predominant farmer technology, and to discuss technology demonstrations and get up-to-date information from extension and research staff on upcoming varieties and crop management techniques. They also had the opportunity to learn important aspects of seed production and processing from lead farmers and seed production experts. Project staff participated in production of extension materials, and in newspaper releases related to IRDEN project, including improved production technology, seed production and on-farm durum wheat processing. These activities greatly increased awareness of farmers and other stakeholders of the need to improve durum wheat productivity and farmers income and livelihood in semiarid durum wheat growing areas. The IRDEN Project also enabled some researchers to attend the International Conference on minimum tillage organized in Spain in 2006 and a number of students and research technicians to upgrade their scientific knowledge in IRDEN related topics.

In conclusion, results of 2005-2006 confirmed the superior performance of improved technology as compared to farmer's practice in most of the countries, and the greater farmers awareness of this improved technology and their keen enthusiasm for its adoption. However, this may be hindered in certain cases by the unavailability or lack of quality seed of improved cultivars in the semi-arid areas, especially in North Africa. Prospects for the establishment of sustainable small seed enterprises in those areas seem better in Algeria as compared to Morocco and Tunisia. While durum wheat enjoys a certain advantage as a source commodity for valued farm-made durum food products, future challenges for durum cultivation in dry areas include the development and adoption of even newer technologies (e.g. suitable rotations, conservation agriculture, etc.) that take into consideration the decreasing water availability for wheat in North African semi-arid areas.

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ANNEXES

Annex 1: Project team-Algeria

Zaghouane Omgar. ITGC – Algiers. Project coordinator
Seba Sadjia, ITGC, SIG
Dekkiche Nacera, ITGC, SIG
Boufenar–Zaghouane Fatiha. ITGC–Algiers. Surveys and study analysis. Seed technology
Merabti Amal. ITGC–Algiers. Surveys and study. Food technology and cereal quality
Amrani Mohamed. ITGC–Algiers. Training and technology transfer document editing
Ait Abdellah yugurtha. ITGC – Tiaret. Regional coordinator. Extension
Feknous Mustapha. ITGC - Tiaret. Transfer of technology. Extension
Bouadelli Fatiha. ITGC – Tiaret. Cereal technology
Ghlamallah Nadjet. ITGC – Tiaret. Cereal technology
Allou Hamid. Agricultural services Tiaret. Transfer of technology
Sakou Larbi. Agricultural Services Tissemsilt. Transfer of technology
Makhlouf Mahfoud. ITGC – Sétif. Regional coordinator. Extension
Hassous Kenz Liamine. ITGC – Sétif. Transfer of technology
Zerargui Hocine, ITGC – Sétif. Transfer of technology. Extension

Annex 2: Project team- Morocco

Dr. Nsaerellah Nasserlehaq. project coordinator. INRA/Settat
Dr. LHALOUI Saadia. Cereal Entomologist. INRA/ SETTAT
Mr. LAAMARI Abdelali. socio-economist. INRA/ SETTAT
Mr. BOUGHLALA Mohammed, Agroeconomist, INRA
Mr. AMAMOU Ali, Wheat Breeder, INRA/SETTAT
Mr. BENAOUDA Hassan. Researcher. INRA/SETTAT
Dr. OUABBOU Hassan. INRA/SETTAT
Ministry of Agriculture: Extension. Planning and Development
DPA. CT Sidi El Aydi-Extension
DPA. CT Jemaa Shaim-Extension
Farmers of Sidi El Aydi and of Jemaa Shaim regions.

Annex 3: Project team-Syria

Dr. Majd Jamal. Director General-GCSAR and national Coordinator. IRDEN-Syria
Mr. Ziad Al-hallak. National Project Manager
Dr. Ghassan Naissa. Deputy of National Coordinator. Head of Aleppo team
Mr. Ali Khnifis. Division of socio-economic studies
Ms. Kaoser Al-Hamed. Cereal Technology -GCSAR
Mr. Kaled Salh. Cereal Technology -GCSAR
Mr. Mohamed Al-Moula. GCSAR
Ms. Intesar Hassan, Cereal Technology, GCSAR
Mr. Mustafa Mohammed. Aleppo Research Center
Mr. Mostafa Haj Ebrahem. Aleppo Research Center (Yahmool station)
Mr. Naeim Al-Hossayn. Aleppo Research Center
Mr. Amer Katnegy. Aleppo Agriculture Extension
Mr. Fayez Amer. Aleppo Agriculture Extension

Mr. Mohammed Osman. Aleppo Agriculture Extension
Mr. Abed alla Kakajy. Aleppo Agriculture Extension
Mr. Mohammed Adeib Al-Ali. Aleppo Agriculture Extension
Mr. Mohammed Al-Gassem. Aleppo Agriculture Extension
Mr. AbdessalamSkcal, Agriculture Extension, R.C.D. at Jabal Al-hoss
Mr. Abd Al-Rahman Al-Abdo. Rural Community Development at Jabal Al-hoss
Mr. Ghssan Ziada. Aleppo Agriculture Extension
Mr. Moufeed Al-Ommar. Edlib Research Center- Head of Edlib team
Mr. Abed Al-Ghany Al-touwiny. Edlib Research Center
Mr. Waheed Al-Pezmawey. Edlib Research Center
Mr . Jomaa Moustafa. Edlib Agriculture Extension
Mr. Kewan Khalil. Edlib Agriculture Extension
Mr. Ahmed Hamamish. Edlib Agriculture Extension
Ms. Ibtissam AlHallaq, Typist.

Annex 4: Project team-Tunisia

Dr. Rezgui Salah: Plant breeder (INAT), National Project Coordinator
Dr. Zaibet Lokmane: Socio-economist (ESA Mograne)
Dr.Elyes Hamza: Agriculture machinery INAT
Mrs. Nafti Amal: Director of Cereal units
Mr. M'Hedhbi Khelifa: General Director of CTC.
Mr. Fakhfakh Moez: Agronomist of CTC.
Mr. Amdouni Arbi: Seed technologist. COSEM
Mr. Hmili Salah: Field crops regional director CRDA, Zaghouan
Mss Yahyaoui Nadia. Rural Women activity specialist PDARI-FIDA Project. CRDA Zaghouan
Mrs. Bouicha Olfa. Food technologist. INAT
Mr.Touibi Salah: Director of PDARI-FIDA Project. Siliana
Mr.Mejri Ridha: Cereal unit. CRDA Siliana
Regional Extension services and farmers' union
Students
Ghazzai Soumaya: MS in biotechnology and seed production, INAT
Mrs Olfa Daaloul Bouicha: MS Food Technology-INAT
Mokhtar Aloui: BS Socio-economics –ESA Mograne
Partners
CTC. UTAP, COSEM, IFAD Development Projects in Siliana and Zaghouane

CRDA Siliana and Zaghouane
UTAP
COSEM.

Annex 5: Project team-Turkey

Dr. Abdulkadir AVÇİN: Wheat agronomist. National coordinator. Çukurova ARI. Adana
Dr. Hasan AY: Wheat breeder, Çukurova ARI, Adana
Mr. Sait AYKANAT. Wheat agronomist, Çukurova ARI. Adana
Dr. Hasan KILIÇ: Wheat breeder Assistant coordinator. South East ARI. Diyarbakır
Mr. Ahmet ALTIKAT: Socio-economist, South East ARI, Diyarbakır
Mr. Enver KENDAL: Wheat breeder, South East ARI, Diyarbakır

Mr. Hüsnü AKTAŞ: Wheat breeder, Adana.

Ministry of Agriculture. General Directorate of Development of Agricultural
Agriculture Advisor: Halil BURÇ, Gaziantep
Agriculture Advisor: Eda HANIM, Gaziantep
Extension staff: Yavuzeli. Araban (Gaziantep). Çınar and Bismil (Diyarbakır)
Farmers: Gaziantep: Murat Büyükarpacı, Karabey Village (Derince), Yavuzeli; Sadettin Torbacı, Köklüce Village, Araban.
Diyarbakir: Mahmut ÖZTÜRK, Aktepe Village, Çınar; Mehmet Sait ALTUNÇ, Kazancı Village, Bismil

Annex 6: ICARDA backstopping team

Dr. Mohamed El Mourid, Regional Coordinator
Dr. Sanjia Rajaram, Director ICWIP
Dr. Miloudi Nachit, Backup Research
Dr. Kamel Shideed, Socio-economics
Dr. Ahmed Amri, WARP Regional Coordinator
Dr. Zewdie Bishaw, Seed Technology
Dr. Koffi Amegbedo, Seed Technology
Dr. Habib Ketata, Wheat Breeding Consultant.