

RALF02-05 Final Technical Report  
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Increased Productivity and Profitability of  
Wheat-based Cropping Systems to Reduce  
Reliance on Opium Poppy in Northern  
Afghanistan

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## Executive Summary

The purpose of this project was to work with farmers in Balkh, Baghlan and Badakhshan using a participatory technology development approach that developed high value agriculturally based sustainable livelihood options that improved the productivity and profitability of the wheat-based system. Research activities were 1) research in oilseeds, grains and grain legumes, 2) research in low external input sustainable agriculture (LEISA), conservation agriculture (CA) and resource conserving technologies (RCTs) and 3) market research to lay the groundwork for potential businesses to develop and/or capitalize on research results. Multi-location trials in oilseeds, grains and grain legumes were performed in the northern provinces of Afghanistan. Trial work extended into Saripul and Kunduz. Research in crop production (LEISA, CA and RCT) was done in Balkh, Jawzjan, Baghlan, Kunduz and Badakhshan.

Through research conducted from 2005 – 2008, varieties of safflower, canola, wheat, maize, chickpea, pigeonpea and other small grains were identified in research trials with potential to help farmers. Two wheat varieties, 'Darulaman-07' and 'Ariana-07' were released in 2007. A number of maize varieties are in the pipeline for release to farmers- 'Zardana-08,' developed with assistance from the Balkh University Faculty of Agriculture (BUFA); 'Speen Jawar-08' and a quality protein maize variety 'Jawari Mughazi-08.' A number of cold tolerant chickpea varieties (developed by ICARDA) have shown promise and may be available by 2009 or 2010.

In oilseeds, safflower research done under RALF02-05 enabled the project to secure other funding for further variety evaluation, which resulted in getting safflower out to some farmers in Jawzjan, where they have grown it under production contracts for the 2007 – 2008 season. Based on farmer feedback in Jawzjan, demand for safflower seed is expected to be high for the 2008 – 2009 season. There is a guaranteed market for safflower seed and Afghans like the oil, comparing it to sesame, which is the most expensive oil in the northern provinces of Balkh, Jawzjan and Saripul.

In production research, the Chinese 2-wheel tractor (C2WT) was shown to plant wheat earlier, cheaper and in less time per unit area than typical planting methods. Conservation agriculture (CA) was proven to be many years away in terms of adoption by farmers. There are many constraints for CA to be adopted, and experience from other countries that have adopted CA shows that time (7 – 10 years) and a concerted research effort are needed for successful and widespread adoption. The C2WT can be seen as one step towards CA.

Because of research in the C2WT, a private Afghan company was started in early 2007 to import and sell C2WTs. This company, Osiyo Hamkorlik Trading Ltd (OH), is also entering the oilseed processing sector. It will purchase safflower seed from farmers and process it into oil. In Baghlan, AKF has imported a simple, hand operated oil press that produces high quality oil.

Capacity building, initially centered on MAIL research personnel, extended to BUFA in 2005. BUFA teachers and students gained practical, hands-on experience in agricultural research and development that centered on the project's research areas.

In sum, the project has developed a number of technologies that can help farmers become more efficient and profitable. Some of these are already available to farmers, while others will need more time be extended to farmers. The RALF program's emphasis on research, which is unfortunately rare in the development funding world in Afghanistan, has enabled these things to happen.

## **Background**

This project sought to address constraints within the wheat-based cropping system of northern Afghanistan. As poppy is grown within the wheat-based system of farming in northern Afghanistan, alternatives need to work within that system. Our premise was that if the wheat system can be made more profitable and production efficiency increased by reducing input costs and increasing the value gained per unit of land area per unit of time through double cropping of high value crops (with local value addition and suitable markets found for the new output), then farmers will have alternatives to poppy.

Edible oilseed crops, grain legumes and other grains were the primary crop groups identified that could enhance the wheat-based cropping system. For production technologies, conservation agriculture and low external input sustainable agriculture (LEISA) were identified. These production system approaches have the potential to reduce input costs, raise yields and produce a truly sustainable system based on more efficient use of natural resources and less impact on the environment. Conservation agriculture/LEISA practices can improve irrigation efficiency by 30-40%, improve soil fertility and structure, and make other crops more productive through synergistic crop rotations.

In addition, credit was also identified as a key constraint to farmer adoption of new technologies, whether crop (e.g., a new variety or species) or production based (e.g., machinery necessary for conservation agriculture). Our assumption was that if farmers are provided with fair credit and viable alternative crops and associated value added products that have a secure market and positively enhance wheat-based systems, then they will have incentives to reduce opium poppy acreage.

## **Project Purpose**

The purpose was to work with farmers using a participatory technology development approach that developed new high value agriculturally based sustainable livelihood options that improved the productivity and profitability of the wheat-based system.

In the current situation, farmers turn to opium poppy as current crops and the associated cropping system, and markets, are not meeting their needs. This, combined with no or little available fair credit, gives farmers limited livelihood alternatives to opium poppy. In addition, the ready market for opium poppy fuels its growth in planted acreage. Farmers are constrained by a lack of choices in profitable crops, and by lack of knowledge or capacity in LEISA, which can enhance their farming system.

A guiding principle behind introducing new technology is that it must be tested in an applied research setting (research farm), and must be demonstrated to farmers (e.g., through demonstration plots and field days). The project did not want to put farmers at risk by experimenting with unproven technology on-farm, no matter how promising a particular technology may seem in areas outside of the project target regions. Farmers had to see for themselves what works and what does not. Then they can request technology to be tried on their farms with project assistance.

Creating a framework upon which micro, small and medium sized enterprises can be created in the future for high value crops and their respective value added products was a key part of the project.

Although the project could not create the businesses around new technologies, it did conduct the research and analysis necessary to start new businesses. In sum, this project aimed to offer farmers viable alternatives to reduce the differential margin of poppy, and that are environmentally sustainable, marketable, provide economic security, enhance wheat-based cropping systems and enable farmers to regain agricultural stability and food security.

## **Research Activities**

Research activities focused on 3 general areas – 1) crop research (wheat/small grains, maize, edible oilseeds, and grain legumes, 2) production research (Chinese 2-wheel tractor testing, conservation agriculture) and 3) market research in edible oils and processing technologies.

### Crop Research

Crop research was carried out under RALF02-05 from early 2005 until mid-summer 2008. The project was able to capitalize on non-RALF research started in fall 2004 on wheat and canola, and on soybean research done in 2004. Research expanded to provinces not included in the proposal, namely Saripul (made possible by a grant extension with additional funds), Takhar, and Kunduz. Research in Saripul was done on rented land managed by JDA, while research in Takhar and Kunduz was done at MAIL research stations.

In Balkh JDA carried out research on-farm (land rented from farmer and farmer involved in research), on land rented and managed by JDA (“JDA research farm”) and the MAIL station. In Baghlan, AKF carried out research on their own farm and in Badakhshan they worked on MAIL land. CIMMYT used MAIL research stations in Balkh, Kunduz and Takhar. Whenever a MAIL station was used for research MAIL staff were generally involved. After 2006 JDA moved all of its’ research off the MAIL station in Balkh due to theft in a maize trial (likely by locals living in the area). The MAIL station does not have a proper wall around its’ farm, making research very susceptible to theft. There are also other demands for the land at the MAIL station, specifically from FAO Mazar and MAIL Balkh. This made it difficult for JDA to plan research work as it was uncertain whether land would be available.

Seed was sourced from private companies worldwide, the USDA germplasm system, the CGIAR system (ICARDA, CIMMYT and ICRISAT) and land grant universities in the United States.

The project benefited from the expertise of a number of consultants, who helped with CA, the C2WT and wheat and maize research and production. Scott Justice, who made several visits to help get the C2WT research and testing established, was especially helpful. Dr. Peter Hobbs from Cornell University was also excellent in providing teaching on CA.

### *Oilseeds*

Trials were carried out in soybean, canola, safflower, sunflower, peanut, flax and sesame to determine the best varieties suited for each location in the project. Varieties were mainly evaluated for yield, but also for overall suitability for the farming system. Work in this area was carried out by JDA, AKF and the Balkh University Faculty of Agriculture (BUFA).

### *Wheat/Small Grains*

Extensive research was carried out in winter wheat, both for irrigated and dryland systems.

Research was also done on durum, barley and triticale. Varieties were evaluated for yield, disease resistance (rust) and other quality characteristics. Work in this area was done by CIMMYT and AKF.

### *Maize*

Maize research was carried out by JDA, AKF, CIMMYT, MAIL and BUFA. Work focused on identifying and adapting varieties of maize to Afghanistan's conditions.

### *Grain legumes*

Pigeon pea, mungbean and cold tolerant chickpeas were evaluated in the project locations. Work in this area was carried out by JDA, AKF and CIMMYT.

### Production Research

This area of research was primarily concerned with conservation agriculture (CA), resource conserving technologies (RCT) and low external input sustainable agriculture (LEISA). RCT, in this context, means conservation of soil, labor, fuel, time, and seed. JDA and AKF worked in these areas.

CA was a significant component of the proposal and efforts were made to develop and test machinery that would be essential for farmer adoption of CA. The C2WT was used in conservation tillage research in wheat, mungbean and safflower. A four wheel tractor drawn 0-till seed-fertilizer drill was built (based on an Indian design) and tested in two provinces. In this research area, the focus changed from pushing adoption of CA to introduction of the C2WT as a RCT, which is one of the first steps towards CA.

### Market Research

AKF conducted edible oilseed market research in the project areas. Research was also done on what types of oil presses would be suitable for the project areas.

## **Outputs**

### Crop Research

Below are tables listing trials and/or seed production done under RALF02-05.

#### *Oilseeds*

# of oilseed trials conducted	34
# of varieties identified with promise	49
by crop:	
safflower	47
canola	1
sunflower	1

#### *Wheat/Small Grains*

The following two new wheat varieties were released in Afghanistan in 2007.

Cross	Origin	Name
Weaver/4/Nac/Th. ach.//3 Pvn/3/Mirlo/Buc	23 <sup>rd</sup> ESWYT#30	Darulaman-07
PastorR/3/Kauz*2/Opata//Kauz	23 <sup>rd</sup> ESWYT#34	Ariana-07

- **Varietal testing and selection in wheat**

- Approximately 8134 experimental lines of wheat (5355), durum (1073), barley (1322) and triticale (384) were tested across different provinces in Afghanistan during 2005 to 2007.
- Around 1400 promising lines were selected and further tested during 2005 to 2007.
- In collaboration with ARIA, the following three lines of bread wheat have been identified as candidate cultivars for release considerations in 2008. These lines have been tested in multi-location sites in Afghanistan for the past four years. To further confirm their performance, these lines are being tested at 10 sites in the Uniform Yield Trial in Afghanistan

Cross	Origin
Prl/2*Pastor	24th ESWYT#47
Cric_1/Ae. sq.(205)//Kauz/3/Attila	35th IBWSN#157
SW89.5181/Kauz	35th IBWSN#228

- The following high yielding bread wheat lines with adult plant resistance or specific resistance genes were identified and are being tested in the National Uniform Trial at 10 diverse sites in Afghanistan to identify high yielding stem rust resistant varieties to the farmers in the next two years.

Cross	Origin
WBLL1*2/BRAMBLING	2 <sup>nd</sup> EBWYT#9
WBLL1*2/KIRITATI	2 <sup>nd</sup> EBWYT#10
OASIS/SKAUZ//4*BCN/3/2*PASTOR	2 <sup>nd</sup> EBWYT#14
WBLL1*2/BRAMBLING	2 <sup>nd</sup> EBWYT#17
BABAX/LR42//BABAX*2/3/VIVITSI	2 <sup>nd</sup> EBWYT#19
HPO/TAN//VEE/3/2*PGO/4/MILAN/5/SSERI1	2 <sup>nd</sup> EBWYT#27

### *Maize*

The following three (2 normal maize and 1 quality protein maize) open pollinated maize lines are being proposed for release. The release proposal is ready for submission to the variety release committee at MAIL.

Type of maize	Original entry designation	Proposed name
Normal	Pirsaback 8730	Speen Jawar-08
Normal	Sakha 9433	Zardana-08
Quality Protein	S99TLWQ HG "AB"	Jawari Mughazi-08

- **Varietal testing and selection in maize**

- Nearly 177 experimental lines of maize were tested across several sites during 2005 to 2007

### *Grain legumes*

# of grain legume trials conducted	3
# of varieties identified with promise	10
by crop:	
chickpea	5 (estimated)
pigeon pea	5

### Production Research

The C2WT tractor was shown to be more efficient and economical at planting wheat than traditional farmer methods.

<b>Planting Method</b>	<b>Time Required for planting 1000m<sup>2</sup></b>	<b>Estimated Cost</b>
Planting with C2WT cultivating seed drill	1 hour	300 Afs
Planting with Oxen & C2WT	3 ¾ hours	525 Afs
Planting with Russian 4WT & C2WT	1 ¾ hours	825 Afs

Yields in irrigated systems can be 3 – 5mt/ha, depending on the planting method used and the environment. In an on-farm demonstration in Kunduz, JDA directed seeded rice into wheat stubble and got about 3 mt/ha. Using the C2WT cultivating seed drill also allowed the planting to be about one week earlier than a neighboring farmer, who, using traditional methods (oxen, multiple soil preparations); planted one week after JDA's planting.

Strip-tillage, where soil is cultivated in narrow strips for seed to be planted, showed very good promise in irrigated and dryland systems (see photos at end for strip-tillage). In irrigated systems yields in an on-farm observation (Balkh) were 3.4 – 5.8 mt/ha. In Jawzjan, a farmer used a C2WT to plant winter wheat strip-till under dryland (rainfed) conditions. Neighboring farmers told him he was crazy and that his wheat would never grow. That season proved to be dryer than normal, and the farmer's strip-till planted wheat did better than the neighboring farmers' wheat.

### Markets and Marketing

The market research provided by AKF helped to give a picture of the edible oils market, and what oils consumers demand, in the project areas. Various types of oil presses were also researched for appropriateness to the project areas. JDA sent a staff member to Lashker Gah to look at a TinyTech India oilpress that was brought in under RAMP. Although JDA had originally budgeted for a TinyTech oilpress, it was felt that oilseed research needed to be done first to justify the purchase of a press. The oilseed research done by the project provided the basis for a private company (see below) to secure funds to import a TinyTech oilpress. AKF, after conducting oilseed research, imported a hand operated press that has been used successfully in Africa. It produces high quality oil and is easy to use.

Within the last year and a half of the project a private Afghan business was started called Osiyo Hamkorlik Trading Ltd (OH). This business was specifically started to import and sell C2WTs to farmers. By 2006 JDA's work with the C2WT had shown that there was immense potential for this technology to be beneficial to farmers. Because of the way OH was registered with AISA (Afghan



Investment Support Agency), the company has immense flexibility to do agribusiness in any area. Thus, OH can buy safflower seed from farmers on contract, process the oil and then sell the oil and oilcake to consumers. This represents a completed value chain that benefits farmers in somewhat marginal areas such as the semi-irrigated lands of Jawzjan and Saripul, two provinces not originally in the project proposal. The start of OH, an output not anticipated at the outset of the project, was a direct result of JDA's research under the RALF program.

## **Contribution of Outputs**

### Oilseeds

Safflower has the most potential of all the oilseed crops for long term impact. It can be grown in irrigated and semi-irrigated areas and its' planting and harvest mirrors the winter wheat cycle. Farmers in Jawzjan who received safflower seed under contract for planting have been exceedingly happy with how well the crop grew, despite a hard year (2007 – 2008 season) with less rain and snow. Neighboring farmers, who did not receive seed, were so impressed by safflower's performance in a dry year that they complained that "Why didn't we get this seed too?" With OH buying back the seed for processing into oil (OH secured an oilpress from the TinyTech Company in India), there is now an established market pathway that farmers can benefit from. The work done by the RALF02-05 project on safflower can be extended to other semi-irrigated areas, which includes parts of Kunduz, Takhar and Saripul, and possibly other provinces. For the 2008 – 2009 season JDA is hoping to do this in several districts of Jawzjan- Aqcha, Faizabad and Mangajik. JDA will provide extension support to farmers, while OH will buy back any seed produced.

Further research is needed to improve safflower production. There are two production factors that need more research for the conditions safflower is grown under- 1) determining optimal seed rates in semi-irrigated and dryland systems, and 2) determining N and P requirements in the northern Afghanistan's alkaline soils. Experiments could be established to determine the best seed rate in semi-irrigated and dryland systems and N and P application rates (as urea and DAP). With potential funding from IFDC's FARMS program, JDA hopes to be conducting this safflower research in the 2008 – 2009 season.

Canola is another promising oilseed that fits into the winter wheat production cycle, although it must be grown under irrigated conditions. FAO did about 1 ha of seed production at the MAIL research station in Balkh, but had a very poor yield of about 400kg. It is not clear whether the poor yield was due to planting issues, or the extremely cold winter that Balk experienced in 2007 – 2008. JDA's experience with canola has been very positive, so the FAO results are mystifying.

### C2WT

The C2WT has emerged as a very promising RCT. The C2WT can plant wheat faster than traditional methods, it costs less in time and money, and farmers can plant earlier. However, sales of C2WTs by OH to farmers have been slow. This is primarily due to a lack of credit that farmers like. The Balk Savings & Credit Union (BSCU) was envisioned as the source of credit for farmers to purchase a C2WT, but farmers have said that BSCU's terms are too difficult as repayment must be made in 1 year. Farmers are telling JDA and OH that they want longer repayment times and lower "fees" on loans. OH is exploring whether it will extend lines of credit to farmers.

Another obstacle to farmers purchasing a C2WT is that it is a new, unknown technology. Many farmers think that an 80hp Russian 4-wheel tractor is needed to prepare land, even when the land

area is small compared to the capacity of the Russian tractor.<sup>1</sup> JDA has done many demonstrations and field days with the C2WT, and this has helped to convince some farmers of the C2WT's value.

### Grains, Small Grains, Maize & Grain Legumes

CIMMYT's work with winter wheat, both for irrigated and dryland systems, has enormous potential for impact for the wheat growing areas of northern and northeastern Afghanistan, as well as many other wheat growing regions of Afghanistan. Two new varieties of irrigated winter wheat were released in 2007, and there are more in the research pipeline that have excellent potential to raise yields for farmers in both irrigated and dryland systems. CIMMYT's work in identifying rust resistant varieties is extremely critical for Afghan farmers as new races of rust appear that overcome the resistance genes in existing varieties.

In maize, three varieties are ready for release. Seed production of these varieties is important to make them widely available to farmers. JDA and FAO Mazar facilitated this in June 2008 with 'Zardana-08' by getting seed to farmers in Balkh province. 'Zardana-08' was jointly selected and developed by CIMMYT, BUFA, FAO and JDA. By 2009 there should be seed available for farmers.

### Lessons Learned

#### *Conservation Agriculture*

Conservation agriculture being adopted by farmers, as a goal of the project, was too ambitious given the time and resources. JDA found there were a number of constraints to the adoption of CA-

- Lack of residue in the farming system.

In wheat production farmers sell the straw, which can earn as much as the grain, and then animals often graze the harvested wheat areas. Thus, there is little residue left on the soil surface. Adequate amounts of residue are absolutely necessary for CA to work.

- Proper machinery.

JDA did make some progress in testing machinery needed for CA, specifically the C2WT and a 4WT 0-till seed-fertilizer drill. The C2WT cultivating seed drill can be modified to plant strip till, which is a form of conservation tillage. The 4WT 0-till drill showed fairly good promise in a dryland wheat area of Kunduz, and gave good results in planting wheat in an irrigated area of Balkh.

- Level land- need laser leveling first.

Having level land is a prerequisite for CA to work. While land in some areas of Balkh and Baghlan are generally level, they are not level to the degree needed for CA to be successful. Laser land leveling, a technology successfully adopted by farmers in Pakistan and India, could have potential in Afghanistan, but it would be confined to larger plots of land as the machinery needed is fairly large and thus has a large turning radius.

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<sup>1</sup> Note: 4 wheel tractors are very suitable for the much larger dryland and semi-irrigated areas. But they are inefficient when it comes to working the many small plots that many farmers have.

- Weed control.

Without proper weed control CA will fail. JDA used RoundUp in some of its' research as a pre-plant herbicide. But, RoundUp is not widely available and farmers and input dealers must be trained in how to use it. Herbicide use must be considered as part of a comprehensive strategy of integrated weed management, and not the sole method of control.

- Mindsets/beliefs about tillage.

This is probably one of the biggest obstacles to adoption of CA. JDA saw this in workshop after workshops that were done for MAIL and the agricultural universities. People have been taught that deep plowing is always good. CA is counterintuitive to what people have been taught about soil and tillage.

- Dedicated program to see farmer adoption.

Finally, it is absolutely essential to have a dedicated CA research and testing program, with farmer participation, to see farmer adoption. This takes time, often 7 – 15 years, and significant amounts of money. Data from countries that have adopted CA shows that there is always a lag time of 7 – 15 years before CA really begins to become widespread. For example, Pakistan started 0-till work in 1984 but it wasn't until 1999 that there was widespread adoption by farmers. By 2004 there were ¾ million ha under 0-till.

In the short to mid-term, attempts should be made to extend the C2WT to the rice-wheat production systems in Balkh, Baghlan, Kunduz and Takhar. The project's work in Baghlan and Kunduz has shown that the C2WT cultivating seed drill can plant wheat into rice stubble earlier, more efficiently and cheaply than traditional methods.

### *Soybeans*

Our project initially had hopes that soybeans would have promise. However, after much research and evaluation we concluded that soybeans are not an appropriate crop for most of Afghanistan. There are several reasons for this-

- The crop production cycle and available water means that soybeans do not fit profitably into the Afghan farming system.

Soybeans can be planted April – May, and then are harvested in August – September. They can also be planted as a second crop after wheat in June, and then harvested in about September – October, although yields can be lower. But, soybeans simply take too much water and overlap two cropping cycles for them to be relevant to Afghan farmers. If a farmer has water then he will grow vegetables and fruit, some irrigated winter wheat and some forages. To plant soybeans in April means that land will have to be set aside the previous October, which means it is not planted to winter wheat or planted to an early spring vegetable crop such as cucumbers or tomatoes. It also means that land will not be available for a 2<sup>nd</sup> crop such as maize, or the mid-summer planted vegetables such as cabbage and cauliflower. Farmers think in terms of what they can earn per unit area/time. Soybeans do not fare well in this thinking.

- Planting and harvest labor intensive.

Without machinery, land for soybeans must be prepared with shovels as they are planted in ridge-furrow system, and planting and harvesting done by hand. JDA did try some mechanized planting and got reasonable stands, but yields were still low.

- Low yields.

The average yields for 2005 – 2006 replicated trials conducted by JDA in Balkh were 1.2 – 1.5 mt/ha, which is low compared to yields in other countries.

- Input issues.

A key benefit of soybeans is that as legumes they can fix their own nitrogen, thus adding nitrogen fertilizer is generally not needed. A bacterial seed inoculant is needed for soybeans to fix nitrogen. This inoculant is expensive and cannot be made in Afghanistan as the raw materials do not exist. This means farmers would have to buy nitrogen fertilizer, which increases the cost of production.

- Market.

JDA had initially hoped to sell soybeans to a poultry farm in Uzbekistan that had trouble getting an adequate supply of soybeans. But because of low yields this was not possible. In Afghanistan if there is demand for soybeans, then it is probably best to import them from countries that can produce them more efficiently and cheaply.

- Cost of production too high.

With the amount of time and labor required, soybeans are not a profitable crop for Afghan farmers. In other parts of the world farmers make money from soybeans on a large scale (in terms of land area) where they have precision machinery, necessary inputs and a ready market. Afghan farmers typically have small plots of irrigated land, and there is no machinery and no market.

The lessons learned from this project's experience with soybeans are valuable in that it can strongly advise against any further encouragement of farmers growing soybeans in Afghanistan. JDA has been asked by other agencies, which have been approached by people wanting to promote soybean production, about soybean production and JDA has been able to advise against it, thus preventing the waste of development funding.

### *Business Development*

Establishing a private, Afghan company was a key to seeing technologies tested under RALF being made available to farmers. The private sector can be an excellent way to extend proven agricultural technologies to farmers. However, the private sector must have experiential knowledge of what it is selling to farmers. Too often agricultural input dealers sell a technology but have little or no idea of how to properly use it. Thus, the technology fails to make it to farmers. Or, the dealer does manage to sell the technology to farmers but then farmers become discouraged when the technology doesn't work, due to the dealer's ignorance and/or inexperience with the technology. JDA saw this when it bought a C2WT from an agribusiness dealer in Kabul. The dealer had several C2WTs just sitting unsold and he did not carry the 120cm cultivating seed drill, which is the implement with the most potential to make wheat planting more efficient and less costly for farmers. He also did not have the 80cm rotovator or proper reapers. He likely had not demonstrated the tractor to very many farmers.

The advantage of OH was that JDA had laid the foundation for farmers to successfully adopt the C2WT. OH was able to benefit from JDA's expertise in the C2WT, which makes OH better able to sell tractors to farmers and support them should issues or problems arise.

## **Contribution to Developing the Capacity of the National Institutions**

### Capacity Development Specific to CIMMYT

- **Capacity building (2005–2007) summary**

- 281 researchers and collaborators from partner institutions in Afghanistan obtained training in wheat and maize research, extension and seed production.
- 16 workshops/seminars were organized in Afghanistan
- 11 Travelling Seminars were organized in Afghanistan
- 605 researchers, collaborators and farmers received training materials
- 21 publications including 3 comprehensive annual reports were published
- CIMMYT participated and contributed to 29 meetings/seminars

Capacity building and training of national staff was given special attention. Human resource capacity on conducting wheat and maize research was enhanced. We followed up and worked closely with the Afghan researchers who received in-country training. A total of 25 researchers and production agronomists attended courses in CIMMYT regional program and Headquarters since opening CIMMYT office in Afghanistan. A number of training workshops for ARIA and partners was organized. Technical information on increased wheat and maize production was disseminated.

In country training and technical interaction has been simultaneously provided during the process of planning and conducting the experiments, collecting data, tabulation and interpretation of the results. The international trials and nurseries also facilitated training activities and provided a ground which demonstrated potential technologies. Training on field plot techniques made it possible to use the incomplete block design with 2–3 replications instead of RCBD with 4 replications. Capacity of the researchers was developed to use Alpha Lattice in PYT, AYT and NUT, and perform the statistical analysis.

In addition to training workshops, active participation was made in the meetings and advisory service was provided to MAIL and partners. Improvement on technical interaction and exchange of ideas was achieved, and various aspects of cereals research methodologies were discussed; thus making a contribution to improving the quality of research results. Information on crops, nursery and experiment management was provided; thus a contribution was made to obtain more reliable results. Direct involvement and supervision of activities resulted in improvement of quality of research results.

CIMMYT-Afghanistan managed and conducted several internal seminars/workshops and training to improve the technical skill and knowledge of the collaborators agriculture staff as well as of civil employees of MAIL. Furthermore, the project contributed to the building of human capacity in Afghanistan through formal training courses and/or workshops, informal day-to-day coaching and technical support through mentoring, and on-the-job training.

The following activities were conducted:

- Jointly with ARIA and other partners, on-the-job training focusing on regular field visits to make technical observations on crop performance, score reactions to diseases and selection of promising lines;
- Monitoring activities by project personnel to address technical problems in conducting trials and nurseries. This monitoring activity is done in a participatory way, with the project team leader assisting the partner to recognize the problems, discuss and find or suggest practical solutions;
- Everyday activities at the research stations were conducted hand in hand with ARIA, thus enhancing the NARS capacity using a learning by doing approach;
- Technical information was provided in the form of reports, training manuals and field guides. When necessary, these learning tools were translated in Dari;
- Field day travelling in Kabul, Nangarhar, Baghlan, Kunduz, Takhar and Balkh, with the attendance of agriculture staff, policy makers, donors and partners.
- Open door policy on the sites, where interested farmers can visit the research sites on station and on farm in Balkh, Baghlan, Kunduz and Takhar, and providing information on the trials; and
- Formal and informal training targeted specifically at young scientists and staff in the ARIA and from partners.

In addition to these informal activities, technical workshops and travelling seminars were organized. The details of these workshops and list of participants are described below.

### Training workshops

No	Location	Date	No. of participants	Participants Organization
1	MAIL, Kabul	May 10-29, 2008	20	ARIA, NARP/ARIA, CIMMYT
2	CIMMYT Office	April 25-26, 2007	13	ARIA, IFDC, CIMMYT
3	MAIL, Kabul			ARIA, CIMMYT
4	Seed Badambagh	June 18, 2007	3	FAO seed laboratory staff
5	Seed Badambagh	June 19, 2007	6	FAO seed laboratory staff
6	Seed Badambagh	June 22, 2007	5	FAO seed laboratory staff
7	AKF Baghlan	March 5-6, 2006	18	AKF, FAO, ARIA, Baghlan University, MAIL provincial staff.
8	Barat Hotel	March 7-8, 2006	43	Teachers and students of Balkh University, ARIA, FAO, JDA, SMEC, CADA, MAIL provincial staff
		Total	108	

## Travelling seminars

CIMMYT organized and supported travelling seminars to various provinces with the following objectives.

- Select jointly with partners promising varieties/lines (wheat, triticale, durum and barley) resistant to diseases.
- Observe and score diseases in international and national trials and nurseries.
- Discuss technical field problems and their solutions.

## Travelling seminars

S.N.	Place	Date	Participation	
			No.	Organization
1	Shishambagh Research Station, Nangarhar	April 18-21, 2007 May 6-7, 2007	5	ARIA, FAO, CIMMYT
2	Dehdadi Research Station, Balkh	May 16-17, 2007	5	ARIA, FAO, CIMMYT
3	Central Farm, Kunduz	May 13, 2007	6	ARIA, FAO, CIMMYT
4	Posi-Eshan Research Station, Baghlan	May 15, 2007	4	ARIA, CIMMYT
5	Jangle Research Station, Takhar	May 14, 2007	5	ARIA, CIMMYT
6	Urdokhan Research Station, Herat	May 28-31, 2007	7	ARIA, FAO, CIMMYT
7	Shishambagh Research Station, Farmer's Field, Nangarhar	April 30-31, 2006	8	NARS, NPO/RRAA, CIMMYT, Farmers
8	Dehdadi Research Station, Balkh	May 6-7, 2006	7	NARS, FAO, JDA, CIMMYT
9	Kunduz, Center farm research station	May 8-9, 2006	11	NARS, FAO, CIMMYT
10	Posi-Eshan research station and Baghishamal, Baghlan	May 10, 2006	7	NARS, AKF, CIMMYT
11	Urdu Khan research station, Robat Sangi, Falahat Farm and Gozra Village, Herat	May 20-22, 2006	8	NARS, FAO, CIMMYT, Farmers
<b>Total</b>			<b>73</b>	

## Field Days

Field days were organized and wheat international and national trials and nurseries were presented. Also pre-release and seed multiplication plots were observed. The participants were H.E Minister of Agriculture, Irrigation and Livestock other ministry dignitaries and staff, ARIA, donors and international organizations and news media participated at various times.

## Training outside country (CIMMYT-HQ)

Maize and Wheat improvement courses (Aug 29 - Oct 07, 2005) at CIMMYT, Mexico. Among the 11 participants, CIMMYT-Afghanistan funded 4 ARIA staff, FAO funded 5 FAO staff, and AKF funded 2 AKF staff.

1. Maize improvement course, Aug 29 – Oct 07, 05. Participants were:

- |                        |                               |
|------------------------|-------------------------------|
| 1. Gul Zaman Mangal    | ARIA, Darulaman, Kabul.       |
| 2. Mujiburrahman Arifi | ARIA, Darulaman, Kabul.       |
| 3. Ahmad Shekib Attai  | ARIA, Shishambagh, Nangarhar. |

2. Wheat improvement course, Aug 29 – Oct 07, 05. Participants were:

- |                           |                               |
|---------------------------|-------------------------------|
| 1. Ahmad Shah Ahmadi      | ARIA, Kunduz.                 |
| 2. Asadullah Habibi       | FAO, Kunduz.                  |
| 3. Abdul Wahed            | FAO, Mazar.                   |
| 4. Ghulam Mohammad Amin   | FAO, Bolan, Helmand           |
| 5. Faridullah Farid       | ARIA, Shishambagh, Nangarhar. |
| 6. Noor Mohammad          | Visa was not ready.           |
| 7. Imatbek Nikhmonov      | AKF, Badakhshan.              |
| 8. Mohammad Husain Jalili | AKF, Badakhshan.              |

### Impact on the Balkh University Faculty of Agriculture (BUFA)

JDA has had a significant impact on the Balkh University Faculty of Agriculture (BUFA) in terms of staff capacity building, exposing students and staff to applied agricultural research and improving the small farm at BUFA. By procuring additional funding from USAID QIP (Quick Impact Project), JDA installed a new submersible pump for the well, supplied basic agricultural implements, installed a fence, built a small guardhouse/office; and conducted applied agricultural research in grains, oilseeds and CA at the BUFA farm.

BUFA was not originally envisioned as part of the RALF project, but through meeting some American agricultural professors who were helping BUFA on a USAID funded project in 2005, JDA started to become engaged with BUFA.

BUFA staff and students had direct involvement with improving the maize variety 'cv6' through simple mass selection at the BUFA farm. While students may learn about plant breeding methods such as simple mass selection in class, this was the first time they actually got to do simple mass selection. 'cv6' was later named 'Zardana-08' and will be released hopefully this year. Students and teachers got to participate in hands-on agricultural research in oilseeds and grains, something they don't typically get to do. BUFA staff and students participated in RALF02-05 field days and workshops, and became involved in other areas of JDA's agricultural research and development program.

Working with BUFA has had its' challenges, as management of the BUFA farm was often poor and non-proactive. JDA had to take on more management of the farm than it wanted to, or had time for. The farm was also small (less than 0.5ha), which limited what could be done. BUFA does have a new university site, with space for a new student farm, and JDA (under the USAID funded A4 program) is working on plans to develop the farm as a student farm.

### Broader University Impact

JDA, with additional funding from the RALF program, was able to bring Dr. Peter Hobbs from Cornell University to Kabul University for about 1 week of lectures on sustainable and conservation agriculture. Dr. Hobbs had taught in previous RALF02-05 CA workshops (Balkh, Baghlan, Kunduz and MAIL Kabul), but never at the Faculty of Agriculture in Kabul. He was well received and had good attendance at his lectures. At virtually all of RALF02-05's training events agricultural



universities were well represented.

JDA, again with additional funding from the RALF program, was able give C2WT sets to 11 institutions in Afghanistan- Kabul University Faculty of Agriculture, Kandahar University Faculty of Agriculture, Balkh University Faculty of Agriculture, Herat University Faculty of Agriculture, Nangarhar University Faculty of Agriculture, Baghlan University Faculty of Agriculture, Paktia University Faculty of Agriculture and Al-Beiruni Faculty of Agriculture. JDA also provided C2WT training to 17 staff from these institutions, as well as lectures on CA. The CA principles were generally received with skepticism or outright disbelief. This is normal as everyone in the agricultural and MAIL system has been taught that plowing is always the proper way to farm.

### Country-wide Impact

Besides extending research to provinces not listed in the proposal, the project was able to expose farmers from other areas to the C2WT and oilseed crops. In June 2008 a group of mainly farmers and some MAIL staff (total of about 24 participants) from the southern provinces came to Balkh for a JDA sponsored field day. Participants got to see JDA's spineless safflower trial and use the C2WT and have their questions answered.

Under the 2<sup>nd</sup> amendment for RALF02-05 we were able to demonstrate the C2WT at agricultural fairs ("AgFairs") organized by USAID's ASAP program. JDA brought equipment to the Mazar, Kunduz and Badakhshan AgFairs in 2007 – 2008.

### **Cost Effectiveness of Funds Spent**

90% (estimate)

### **Successful Themes Emerging out of the Project which Merit Scale-out/up**

Because of the RALF funded work in oilseeds and cold-tolerant chickpea, JDA was able secure funding from IFDC's FARMS program (USDA money). This enabled JDA to move these crops along in terms of getting them into the hands of farmers. Safflower has already made it to farmers, and perhaps by 2009 or 2010 (time is needed to produce seed) cold tolerant chickpea will be available to farmers.

JDA also secured funding to work at the BUFA farm from USAID's QIP (Quick Impact Project) Program. BUFA and JDA conducted research on oilseeds and grains at the BUFA farm. This allowed JDA to engage BUFA. This engagement has resulted in JDA being the subcontractor on the USAID funded A4 (Advancing Afghan Agriculture Alliance) program for BUFA.

Aspects that merit further research and/or expansion are-

1. On-farm testing and promotion of the C2WT cultivating seed drill in the rice-wheat systems of Balkh, Baghlan, Kunduz and Takhar.
2. Exploring packaging options for processed edible oils.
3. Investigation of market potential for organically certified sesame and flax.

4. Exploration of ways for UK agricultural universities to assist BUFA.
5. Funding of infrastructure development at BUFA's new campus, e.g. classroom, lecture halls, labs, offices and dorms.
6. Continued work in irrigated and dryland wheat, particularly on rust resistant varieties.

## **Number of Beneficiaries Reached: (approximate)**

### Directly (Farmers, NARS involved in Participatory Research)

Farmers – 20

NARS – 300

### Indirectly (Neighbours of farmers involved in PR, NARS officials who visited the research sites, etc.)

Farmers – 100

NARS – 650

### NARS – Equipment Left Behind

C2WT sets (15hp 2 wheel tractor with 80cm rotovator, 120cm cultivating seed drill, 120cm reaper, trailer, spare parts) were given to MAIL Badakhshan, MAIL Helmand and MAIL Kandahar.

The 0-till seed drill (for a 4 wheel tractor) built by JDA was turned over to MAIL Kunduz.

### Agricultural Universities – Equipment Left Behind

C2WT sets (15hp 2 wheel tractor with 80cm rotovator, 120cm cultivating seed drill, 120cm reaper, trailer, spare parts) were given to the Kabul University Faculty of Agriculture, Kandahar University Faculty of Agriculture, Balkh University Faculty of Agriculture, Herat University Faculty of Agriculture, Nangarhar University Faculty of Agriculture, Baghlan University Faculty of Agriculture, Paktia University Faculty of Agriculture and Al-Beiruni Faculty of Agriculture.

## **Constraints that affected the implementation or uptake of the results of your Project**

In general security was not an issue that affected our project, although it may have delayed some work and did at one point lead the cancellation of a DFID visit to RALF02-05's project in 2005.

## **Publications**

1. Osmanzai, M., R.C. Sharma, Gh. Ghanizada and Z. Ahmadzada. 2008. Wheat rusts in Afghanistan – An assessment of occurrence and cultivar resistance. Karana SN:38 (in press)

2. Osmanzai, M., R.C. Sharma and M.A. Osmanzai. 2008. Performance of pigeonpea in Afghanistan. Karana SN:37 March-April, 2008. Page (in press)?
3. Osmanzai, M. and M.A. Osmanzai. 2008. Introduction and technical recommendations of wheat stem rust diseases and new race Ug99 (in *Dari*). Karana SN:37 March-April, 2008. Page ?
4. Hobbs, P.R. and M. Osmanzai. 2007. Important farming systems of South Asia. Chapter 22, in Rainfed Farming Systems. Springer, Netherlands (in press)
5. Osmanzai, M, M.A. Osmanzai and A. Naemi. 2007. Role of research and technology in increased agriculture production (in *Dari*). Karana Magazine. SN:33 Aug-Sep, 2007. Page
6. Osmanzai, M and A. Naemi. 2007. Open pollinated maize varieties seed production (in *Dari*). Karana Magazine. SN.31 March - April, 2007. Page 46-47.
7. CIMMYT- Afghanistan. 2007. Annual Report, 135p.
8. Osmanzai, M. 2007. Wheat productivity and food security in Afghanistan. Paper presented at ACIAR, Canberra, Australia. July 9, 2007.
9. Osmanzai, M. 2007. Wheat and food security. Paper presented at MAIL National Conference with Provincial Directors, August 25, 2007, MAIL, Kabul, Afghanistan.
10. Osmanzai, M. 2007. CIMMYT/ARIA Collaboration. Paper presented at the Field Day, June 21, 2007. Darulaman Research Station, Kabul, Afghanistan.
11. Osmanzai, M. 2007. Annual Report: Results, Constraints and Opportunities. Paper Presented at the Wheat Program Meeting, Feb, 7-13, 2007. El Batan, Mexico.
12. Osmanzai, M. 2007. Wheat Productivity and Food Security in Afghanistan. Paper presented at the Global Wheat Meeting. February 7-13, 2007. El Batan, Mexico.
13. Osmanzai, M. 2007. Outline of Research activities of CIMMYT in Afghanistan. Paper presented at the Joint Workshop on Better Wheat Cultivation in Bamyan, Sept 17, 2007. JICA Conference Hall. Kabul, Afghanistan.
14. Osmanzai, M. 2006. Wheat productivity and improvement with emphasis on wheat based cropping systems in Afghanistan. Paper presented at the 3<sup>rd</sup> ICARDA-RALF Project Workshop, June 14-15, 2006. Safi Land Mark Hotel. Kabul, Afghanistan.
15. Osmanzai, M. 2006. Wheat productivity improvement with emphasis on seed. Paper presented at the 21<sup>st</sup> Seed Review, June 14, 2006. FAO, Kabul, Afghanistan.
16. Osmanzai, M. Wheat-based productivity improvement in Afghanistan. Poster presentation in International Plant Breeding Symposium. August 20-26, 2006. Mexico City, Mexico.
17. CIMMYT- Afghanistan. 2005. Annual Report.
18. CIMMYT- Afghanistan. 2006. Annual Report.
19. CIMMYT- Afghanistan. 2007. Annual Report.
20. Osmanzai, M. 2005. Perspectives, constraints and future approaches to wheat production and food security in Afghanistan. Paper presented at the International Workshop on Strategies for Development and Food Security in Mountainous Areas of Central Asia, June 6-10, 2005. Dushanbe, Tajikistan.
21. Osmanzai, M. 2005. Wheat production and food security in Afghanistan. Paper presented at the Workshop on Sustainable Agriculture Production, Oct 10, 05. MAAHF, Kabul, Afghanistan.
22. Osmanzai, M. 2005. Wheat trials management. Paper presented at the Training Workshop, Oct. 11, 2005. Darulaman, ARIA, Kabul, Afghanistan.

## **Internal (ICARDA or Implementing Partners) Reports**

Henning, M.J., Malik, N. 2005. Potential for oilseed crops in northern Afghanistan. ICARDA Annual Report 2005 (74-75).

Henning, M.J. 2008. Points About Soybeans in Afghanistan. (working paper in draft form)

## Appendix 1 – CIMMYT Report

### CIMMYT Report

#### RALF 02-05

#### Increased Productivity and Profitability of Wheat-based Cropping Systems to Reduce Reliance on Opium Poppy in Northern Afghanistan

#### Final Report (CIMMYT Contribution)

CIMMYT-Afghanistan initiated several activities under the RALF project in the target provinces in Afghanistan. Since the old varieties of wheat and maize, grown by the farmers, were low yielding, efforts were focused on identifying improved wheat and maize varieties suitable for wheat–maize cropping system. Besides, capacity building in terms of manpower training and improved technology dissemination activities were emphasized. The high yielding, early maturing and disease resistant wheat and maize varieties and dissemination of improved technologies are expected to greatly promote second crop after wheat in order to improve wheat based system productivity and to reduce the differential margin expected from opium poppy cultivation for the farmers in the northern provinces of Afghanistan.

The activities and achievements under the project over the past 3-yr (2005–2007) period are summarized below. The details of the research activities and achievements can be obtained through the three comprehensive annual reports of CIMMYT-Afghanistan.

- **Varietal development of wheat and maize**

The following two new wheat varieties were released in Afghanistan in 2007.

Cross	Origin	Name
Weaver/4/Nac/Th. ach.//*3 Pvn/3/Mirlo/Buc	23 <sup>rd</sup> ESWYT#30	Darulaman-07
PastorR/3/Kauz*2/Opata//Kauz	23 <sup>rd</sup> ESWYT#34	Ariana-07

The following three (2 normal maize and 1 quality protein maize) open pollinated maize lines are being proposed for release. The release proposal is ready for submission to the variety release committee.

Type of maize	Original entry designation	Proposed name
Normal	Pirsaback 8730	Speen Jawar-08
Normal	Sakha 9433	Zardana-08
Quality Protein	S99TLWQ HG "AB"	Jawari Mughazi-08

- **Varietal testing and selection in wheat**
  - Approximately 8134 experimental lines of wheat (5355), durum (1073), barley (1322) and triticale (384) were tested across different provinces in Afghanistan during 2005 to 2007.
  - Around 1400 promising lines were selected and further tested during 2005 to 2007.

- In collaboration with ARIA, the following three lines of bread wheat have been identified as candidate cultivars for release considerations in 2008. These lines have been tested in multi-location sites in Afghanistan for the past four years. To further confirm their performance, these lines are being tested at 10 sites in the Uniform Yield Trial in Afghanistan

Cross	Origin
Prl/2*Pastor	24th ESWYT#47
Cric_1/Ae. sq.(205)//Kauz/3/Attila	35th IBWSN#157
SW89.5181/Kauz	35th IBWSN#228

- The following high yielding bread wheat lines with adult plant resistance or specific resistance genes were identified and are being tested in the National Uniform Trial at 10 diverse sites in Afghanistan to identify high yielding stem rust resistant varieties to the farmers in the next two years.

Cross	Origin
WBLL1*2/BRAMBLING	2 <sup>nd</sup> EBWYT#9
WBLL1*2/KIRITATI	2 <sup>nd</sup> EBWYT#10
OASIS/SKAUZ//4*BCN/3/2*PASTOR	2 <sup>nd</sup> EBWYT#14
WBLL1*2/BRAMBLING	2 <sup>nd</sup> EBWYT#17
BABAX/LR42//BABAX*2/3/VIVITSI	2 <sup>nd</sup> EBWYT#19
HPO/TAN//VEE/3/2*PGO/4/MILAN/5/SSERI1	2 <sup>nd</sup> EBWYT#27

- **Varietal testing and selection in maize**

- Nearly 177 experimental lines of maize were tested across several sites during 2005 to 2007

- **Capacity building (2005–2007)**

- 281 researchers and collaborators from partner institutions in Afghanistan obtained training in wheat and maize research, extension and seed production.
- 16 workshops/seminars were organized in Afghanistan
- 11 Traveling Seminars were organized in Afghanistan
- 605 researchers, collaborators and farmers received training materials
- 21 publications including 3 comprehensive annual reports were published
- CIMMYT participated and contributed to 29 meetings/seminars

- **Specific Activities in the Target Provinces**

- **Balkh**

- Collaborators – CIMMYT, ARIA, FAO, JDA and Balkh Faculty of Agriculture.
- CIMMYT conducted 20 international and national trials and tested 1823 advanced breeding lines for identifying new wheat varieties suitable for the province. More than 400 promising lines were identified and further tested. A few of these lines are being tested in advanced and uniform national trials for identifying promising varieties in the coming years.
- High yielding lines of durum were identified for the province.
- Pre-released varieties of irrigated and rainfed wheat were tested and their seed increased for varietal release purpose.

- Maintenance and purification of released varieties through progeny brows were accomplished in the region.
- **Pigeonpea** – Pigeonpea evaluation has shown that it could be an excellent replacement of poppy production in the cropping system of the state because this crop has much higher price than wheat and maize. A set of 11 advanced breeding lines of pigeonpea were tested in a replicated experiment in Dehdadi. Despite hot and dry condition in 2007, genotypes performed well. The pigeonpea genotypes significantly differed for grain yield their grain yield ranged from 2154 to 3708 kg/ha suggesting their high grain yield potential and the presence of diversity for grain yield. The local check (soybean) ranked 7 with grain yield level of 3077 kg/ha. Suggesting that many experimental genotypes produced higher yield and hence they bear potential for pigeonpea production in test site. The results show that five genotypes, 'ICPL 88039-2', 'ICPL 88039-6', 'ICPL 88039-8', 'ICPL 88039-9', and 'ICPL88039-10' are promising for further testing in north and north-east of Afghanistan.
- **Maize** – CIMMYT, ARIA and FAO collaborated on the maize crop activities. Advanced yield trials involving OPVs and hybrids were conducted and promising lines were identified for further testing.

#### • **Baghlan**

- Collaborators – CIMMYT, ARIA and progressive farmers.
- CIMMYT conducted 9 international and national trials and tested 680 advanced breeding lines for identifying new wheat varieties suitable for the province. More than 150 promising lines were identified and further tested. A few of these lines are being tested in advanced and uniform national trials for identifying promising varieties in the coming years.
- Advanced breeding lines of durum, triticale and barley were tested in the trials and promising lines were identified which are currently under evaluation.
- Promising triticale varieties were also evaluated by farmers on their fields through CIMMYT Collaborators (AKF).
- Maize– CIMMYT, and ARIA collaborated on the maize crop activities. Advanced yield were conducted and promising lines were identified for further testing.

#### • **Badakhshan**

- Collaborators – CIMMYT, AKF, ARIA
- CIMMYT conducted 11 international and national trials and tested 1279 advanced breeding lines for identifying new wheat varieties suitable for the province. More than 175 promising lines were identified and further tested. A few of these lines are being tested in advanced and uniform national trials for identifying promising varieties in the coming years.
- Progeny head-rows grown in progeny blocks for seed production.
- Collaborative agronomic experiments were conducted.
- Wheat fertility management experiments were conducted.
- Seeding date trials on promising varieties were conducted to determine optimum sowing time for wheat in the province.
- Conservation agriculture practices were evaluated to provide the farmers options for efficient wheat management practices.

#### • **Kunduz**

- Collaborators – CIMMYT, ARIA, FAO

- CIMMYT conducted 17 international and national trials and tested 1723 advanced breeding lines for identifying new wheat varieties suitable for the province. More than 380 promising lines were identified and further tested. A few of these lines are being tested in advanced and uniform national trials for identifying promising varieties in the coming years.
  - Promising lines of durum and barley were also identified which are being further evaluated.
  - Promising rainfed adapted wheat genotypes were identified.
  - Progeny rows and progeny blocks of commercial and potential wheat varieties were harvested for seed multiplication
- **Takhar**
    - Collaborators – CIMMYT, ARIA, FAO
    - CIMMYT conducted 9 international and national trials and tested 1052 advanced breeding lines for identifying new wheat varieties suitable for the province. More than 170 promising lines were identified and further tested. A few of these lines are being tested in advanced and uniform national trials for identifying promising varieties in the coming years.
    - Promising lines of durum and barley were also identified which are being further evaluated.
    - Promising rainfed adapted wheat genotypes were identified.
    - Progeny rows and progeny blocks of commercial and potential wheat varieties were harvested for seed multiplication

## **Training and Capacity Building**

Capacity building and training of national staff was given special attention. Human resource capacity on conducting wheat and maize research was enhanced. We followed up and worked closely with the Afghan researchers who received in-country training. A total of 25 researchers and production agronomists attended courses in CIMMYT regional program and Headquarters since opening CIMMYT office in Afghanistan. A number of training workshops for ARIA and partners was organized. Technical information on increased wheat and maize production was disseminated.

In country training and technical interaction has been simultaneously provided during the process of planning and conducting the experiments, collecting data, tabulation and interpretation of the results. The international trials and nurseries also facilitated training activities and provided a ground which demonstrated potential technologies. Training on field plot techniques made it possible to use the incomplete block design with 2–3 replications instead of RCBD with 4 replications. Capacity of the researchers was developed to use Alpha Lattice in PYT, AYT and NUT, and perform the statistical analysis.

In addition to training workshops, active participation was made in the meetings and advisory service was provided to MAIL and partners. Improvement on technical interaction and exchange of ideas was achieved, and various aspects of cereals research methodologies were discussed; thus making a contribution to improving the quality of research results. Information on crops, nursery and experiment management was provided; thus a contribution was made to obtain more reliable results. Direct involvement and supervision of activities resulted in improvement of quality of research results.

CIMMYT-Afghanistan managed and conducted several internal seminars/workshops and training to improve the technical skill and knowledge of the collaborators agriculture staff as well as of civil employees of MAIL. Furthermore, the project contributed to the building of human capacity in

Afghanistan through formal training courses and/or workshops, informal day-to-day coaching and technical support through mentoring, and on-the-job training.

The following activities were conducted:

- Jointly with ARIA and other partners, on-the-job training focusing on regular field visits to make technical observations on crop performance, score reactions to diseases and selection of promising lines;
- Monitoring activities by project personnel to address technical problems in conducting trials and nurseries. This monitoring activity is done in a participatory way, with the project team leader assisting the partner to recognize the problems, discuss and find or suggest practical solutions;
- Everyday activities at the research stations were conducted hand in hand with ARIA, thus enhancing the NARS capacity using a learning by doing approach;
- Technical information was provided in the form of reports, training manuals and field guides. When necessary, these learning tools were translated in Dari;
- Field day traveling in Kabul, Nangarhar, Baghlan, Kunduz, Takhar and Balkh, with the attendance of agriculture staff, policy makers, donors and partners.
- Open door policy on the sites, where interested farmers can visit the research sites on station and on farm in Balkh, Baghlan, Kunduz and Takhar, and providing information on the trials; and
- Formal and informal training targeted specifically at young scientists and staff in the ARIA and from partners.

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## Traveling seminar

CIMMYT organized and supported traveling seminars to various provinces with the following objectives.

- Select jointly with partners promising varieties/lines (wheat, triticale, durum and barley) resistant to diseases.
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- Discuss technical field problems and their solutions.

## Traveling seminars

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| 4. Gul Zaman Mangal    | ARIA, Darulaman, Kabul.       |
| 5. Mujiburrahman Arifi | ARIA, Darulaman, Kabul.       |
| 6. Ahmad Shekib Attai  | ARIA, Shishambagh, Nangarhar. |

2. Wheat improvement course, Aug 29 – Oct 07, 05. Participants were:

- |                            |                               |
|----------------------------|-------------------------------|
| 9. Ahmad Shah Ahmadi       | ARIA, Kunduz.                 |
| 10. Asadullah Habibi       | FAO, Kunduz.                  |
| 11. Abdul Wahed            | FAO, Mazar.                   |
| 12. Ghulam Mohammad Amin   | FAO, Bolan, Helmand           |
| 13. Faridullah Farid       | ARIA, Shishambagh, Nangarhar. |
| 14. Noor Mohammad          | Visa was not ready.           |
| 15. Imatbek Nihmonov       | AKF, Badakhshan.              |
| 16. Mohammad Husain Jalili | AKF, Badakhshan.              |

**Training Materials Obtained, Produced, Discussed, Explained and Provided to the Collaborators and Partners in Afghanistan in 2005, 2006 and 2007.**

No	Title	Copy	Collaborators
1	Wheat Diseases and Pests	100	ARIA, FAO, NPO/RRAA, CHA, IFDC, AWRC, PADCO, AKF
2	Nutrient Deficiencies and Toxicities in Plants	80	ARIA, FAO, AKF, JDA, BCA, NOP/RRAA, CHA, IFDC
3	Rust Scoring Guide	40	ARIA, FAO, AKF, BCA, IFDC, ACTED, NPO/RRAA
4	Wheat Diseases and Pests (Persian)	80	ARIA, FAO, AKF, JDA, BCA, ACTED, IFDC, CHA
5	Trials Management	30	ARIA, IFDC, NPO/RRAA
6	Maize Diseases	20	ARIA, FAO, AKF, JDA, BCA ACTED, NPO/RRAA
7	Maize (OPV) Seed Production (English and <i>Dari</i> )	150	ARIA, FAO, AKF, LDA, BCA ACTED, NPO/RRAA, Farmers
8	CIMMYT Annual Reports 2005 and 2006	40	ARIA, MAIL, FAO, AKF, JDA, BCA, JICA
9	Instructions for the Management and Reporting of Results of the Wheat Trials and Nurseries	16	ARIA, IFDC, Partners
10	Practical Plant Nematology: A Field and Laboratory Guide	3	ARIA, Faculty of Agriculture Kabul, MAIL
11	Information on Ug99	6	ARIA, Partners
	<b>Total</b>	<b>565</b>	

## Seminar and Workshop Presentation

1. Inception workshop for the project on “Strengthening Seed and Plant Health Inspectorate Capacity”, TCP/AFG/3101. Sept 16, 2007. Kabul, Afghanistan.
2. Fall Campaign for 2007-2008, Ministry of Agriculture, Irrigation and Livestock. Conference Hall. August 23-25, 2007. Kabul, Afghanistan
3. Clean Germplasm Systems. Perennial Horticulture Development Project (PHDP). July 4, 2007. MAIL Conference Hall. Kabul, Afghanistan.
4. Seminar on Wheat Improvement in Afghanistan to Research Staff of ARIA 2007. MAIL Conference Hall, Kabul, Afghanistan.
5. National Symposium on Dissemination of Research Results of RALF 02-07. July 3, 2007. Kabul University, Kabul, Afghanistan.
6. Member of Technical Workshop Group (TWG) for MAIL’s Preparation of Implementation and Investment Plan (IIP). June 27, 2007. Kabul, Afghanistan.
7. Second Seed Group Review Meeting (SGR). May 21-23, 2007. Mazar, Afghanistan.
8. Seminar 3: Perennial Horticulture Development Project (PHDP). March 28, 2007. MAIL Conference Hall. Kabul, Afghanistan.
9. Inception Workshop for the Project Variety and Seed Industry Development GCP/AF/045/EC. March 12-13, 2007. Kabul, Afghanistan.
10. Forum on Competitive Research Funding Mechanism, Lesson Learned from RALF. January 18, 2007. MAIL, Kabul, Afghanistan.
11. Open Seminar of the Research Plan of ARIA for Coming 5 Years. Dec 25, 2006. MAIAH, Kabul, Afghanistan.
12. Fourth RALF Program Workshop. November 19-21, 2006. ICARDA, Kabul, Afghanistan.
13. Seminar on Wheat Improvement in Afghanistan to Research Staff of ARIA November 13, 2006. MAI Conference Hall, Kabul, Afghanistan.
14. International Symposium on Wheat Yield Potential: Challenge to International Wheat Breeding. March 20-24, 2006. Days Inn, Ciudad Obregon, Sonora, Mexico.
15. International Wheat Seminar. February, 20-21, 2006, Faisalabad, Pakistan.
16. Science Forum. January 23-27, 2006. CIMMYT, El Batan, Mexico.
17. Sustainable Agriculture Workshop. October 10-11, 2005. MAAHF, Kabul, Afghanistan.
18. RALF Projects Workshop Markets, Market Processes, Marketing, National and International Context. November 20, 2005. MAAHF, Kabul, Afghanistan.
19. RALF Symposium on Medicinal Plants - Research, Cultivation, Conservation, Processing and Marketing. November 19, 2005. MAAHF, Kabul, Afghanistan.
20. 20<sup>th</sup> Seed Review Group Meeting. November 17, 2005. FAO, DA, Kabul, Afghanistan.
21. Afghanistan National Seed Policy Signing Ceremony. September 13, 2005. MAAHF, Kabul, Afghanistan.
22. International Conference: Development of the Key Direction of Agriculture Science in Kazakhstan, Breeding, Biotechnology and Genetic Resources. Aug 4-6, 2004. Astana, Kazakhstan.
23. National Forum on Seed Policy, Strategy and Plan. Apr 13-14, 05. MAAHF, Kabul, Afghanistan.
24. WIG Meeting. Mar 30- Apr 1, 2005. Cd. Obregon, Sonora, Mexico.
25. National Consultation on Seed Policy in Afghanistan. Feb 27, 05. MAAHF, Kabul, Afghanistan.
26. Healing Wounds - How the International Research Center of the CGIAR Help Rebuild Agriculture in Countries Affected by Conflicts and Natural Disaster. Feb 25, 2005. Intercontinental, Kabul, Afghanistan.
27. Third FHCRAR Steering Committee Meeting. Feb 23-24, 2005. Intercontinental, Kabul, Afghanistan.

28. RALF Workshop. Feb 22, 2005. Stara Hotel, Kabul, Afghanistan.
29. CIMMYT-ICARDA meetings. Feb 6-9, 2005. Holiday Inn, Amman, Jordan.

## **Publications, Reports and Papers**

23. Osmanzai, M., R.C. Sharma, Gh. Ghanizada and Z. Ahmadzada. 2008. Wheat rusts in Afghanistan – An assessment of occurrence and cultivar resistance. Karana SN:38 (in press)
24. Osmanzai, M., R.C. Sharma and M.A. Osmanzai. 2008. Performance of pigeonpea in Afghanistan. Karana SN:37 March-April, 2008. Page (in press)?
25. Osmanzai, M. and M.A. Osmanzai. 2008. Introduction and technical recommendations of wheat stem rust diseases and new race Ug99 (in *Dari*). Karana SN:37 March-April, 2008. Page ?
26. Hobbs, P.R. and M. Osmanzai. 2007. Important farming systems of South Asia. Chapter 22, in Rainfed Farming Systems. Springer, Netherlands (in press)
27. Osmanzai, M, M.A. Osmanzai and A. Naemi. 2007. Role of research and technology in increased agriculture production (in *Dari*). Karana Magazine. SN:33 Aug-Sep, 2007. Page
28. Osmanzai, M and A. Naemi. 2007. Open pollinated maize varieties seed production (in *Dari*). Karana Magazine. SN.31 March - April, 2007. Page 46-47.
29. CIMMYT- Afghanistan. 2007. Annual Report, 135p.
30. Osmanzai, M. 2007. Wheat productivity and food security in Afghanistan. Paper presented at ACIAR, Canberra, Australia. July 9, 2007.
31. Osmanzai, M. 2007. Wheat and food security. Paper presented at MAIL National Conference with Provincial Directors, August 25, 2007, MAIL, Kabul, Afghanistan.
32. Osmanzai, M. 2007. CIMMYT/ARIA Collaboration. Paper presented at the Field Day, June 21, 2007. Darulaman Research Station, Kabul, Afghanistan.
33. Osmanzai, M. 2007. Annual Report: Results, Constraints and Opportunities. Paper Presented at the Wheat Program Meeting, Feb, 7-13, 2007. El Batan, Mexico.
34. Osmanzai, M. 2007. Wheat Productivity and Food Security in Afghanistan. Paper presented at the Global Wheat Meeting. February 7-13, 2007. El Batan, Mexico.
35. Osmanzai, M. 2007. Outline of Research activities of CIMMYT in Afghanistan. Paper presented at the Joint Workshop on Better Wheat Cultivation in Bamyan, Sept 17, 2007. JICA Conference Hall. Kabul, Afghanistan.
36. Osmanzai, M. 2006. Wheat productivity and improvement with emphasis on wheat based cropping systems in Afghanistan. Paper presented at the 3<sup>rd</sup> ICARDA-RALF Project Workshop, June 14-15, 2006. Safi Land Mark Hotel. Kabul, Afghanistan.
37. Osmanzai, M. 2006. Wheat productivity improvement with emphasis on seed. Paper presented at the 21<sup>st</sup> Seed Review, June 14, 2006. FAO, Kabul, Afghanistan.
38. Osmanzai, M. Wheat-based productivity improvement in Afghanistan. Poster presentation in International Plant Breeding Symposium. August 20-26, 2006. Mexico City, Mexico.
39. CIMMYT- Afghanistan. 2005. Annual Report.
40. CIMMYT- Afghanistan. 2006. Annual Report.
41. CIMMYT- Afghanistan. 2007. Annual Report.
42. Osmanzai, M. 2005. Perspectives, constraints and future approaches to wheat production and food security in Afghanistan. Paper presented at the International Workshop on Strategies for Development and Food Security in Mountainous Areas of Central Asia, June 6-10, 2005. Dushanbe, Tajikistan.
43. Osmanzai, M. 2005. Wheat production and food security in Afghanistan. Paper presented at the Workshop on Sustainable Agriculture Production, Oct 10, 05. MAAHF, Kabul, Afghanistan.
44. Osmanzai, M. 2005. Wheat trials management. Paper presented at the Training Workshop, Oct. 11, 2005. Darulaman, ARIA, Kabul, Afghanistan.

## Appendix 2 - Photos

**June 2, 2008 Field Day at JDA's research farm in Dedadhi, Balkh province for southern farmers and southern MAIL staff.**









**C2WT and CA workshop held by JDA in Mazar for agricultural universities (Kabul, Balkh, Baghlan, Kandahar) and MAIL staff from Helmand and Kandahar.**



Assembling the tractors that participants will receive after the workshop. This helps people to understand how the tractor works and with repairs later on.







Getting a demonstration of operating the C2WT.



Participant trying out the cultivating seed drill.



## Other photos



Farmer in Jawzjan examining a safflower production field towards the end of May. This field was irrigated only 1-2 times. Work in Jawzjan was funded by IFDC FARMS, but RALF made it possible for safflower to get to the point of contract production. Demand for safflower seed for planting is expected to increase significantly for the 2008 – 2009 season.



Safflower contract farmer in Jawzjan province in semi-irrigated area (1-2 irrigations give to field). Again, this situation was made possible by the initial work done with safflower under RALF02-05.





On-farm strip tillage demonstration using C2WT cultivating seed drill in irrigated wheat, Balkh province.



Strip-tillage established winter wheat in Balkh province.





Blade setup on C2WT cultivating seed drill for strip-tillage.



Blades are only where seed will drop from opener.





BUFA students selecting best maize plants at BUFA farm in Mazar. Ears from these plants were saved and then further selected for ear and seed quality.



BUFA students selecting maize ears for quality. BUFA helped develop the OP maize variety 'Zardana-08.'





BUFA student selected maize ears.



‘Zardana-08’ maize ear.