SEED TECHNOLOGY IN IRAQ

Study Report

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Objectives of Study

The objectives of the study are:

1. Conduct an assessment of the seed processing capacity (cleaning and fungicide treatment) in the three governorates of the northern region of Iraq.
2. Determine the seed processing requirements of the region for both certified and farmer's seed.
3. Make recommendations for improving the seed processing capacity of the government for certified and improved seed, to include improvement of existing equipment and addition of new equipment.
4. Determine the commercial grain cleaning requirements and make recommendations on grain cleaning equipment appropriate for private investment.
5. Make recommendations on improvement in the management and handling of certified seed and improved seed.

Background

Wheat is the primary rainfed crop in Iraq and barley[1] is a strong second. The production of wheat suffered greatly from neglect during the last regime. Wheat production further declined as a result of the U.N. Oil for Food (OFF) program that provided free flour as part of a "basket" of food given to every Iraqi citizen every month. The demand for domestic wheat was drastically reduced and the price declined to uneconomic levels. As a result, farmers severely limited their use of improved seed, fungicide, fertilizer, and weed/pest control. Quantity and quality of the wheat crop declined dramatically. Farmers shifted significant percentages of their production to barley for livestock feed and much of the wheat crop was also fed to livestock and poultry. The seed program declined even more severely in the last two years in the transition period from the FAO program to the USAID assisted MOA program. In the absence of free fungicide from FAO and no financial incentives to invest in their wheat crops, many farmers did not treat their seed, and fungal diseases, primarily smut, have caused even larger losses.

ARDI, the principal USAID agriculture project in Iraq, is assisting the national Ministry of Agriculture and the Ministries of Agriculture of the three northern governorates of Iraq to revitalize the national wheat program through a number of important measures in support to wheat farmers. The Ministry of Trade has agreed for the 2005 harvest to buy Grade 1 wheat at an economic price that is beginning to approach the CIF price for U.S. and Australian imports of premium hard wheat. Thus, the incentive to produce higher quality and increased quantities has stimulated wheat farmers and the Ministry of Agriculture to improve productivity. Among other activities, ARDI is providing assistance to the government to procure and multiply certified seed inn the 2004-2005 crop season. ARDI is also supporting field trials throughout Iraq on wheat varieties and cultural practices. Technology transfer is

[1] Barley is grown primarily for livestock feed and seed is not usually cleaned by farmers or the MOA. At some point in the near future consideration could be given to the conditioning of barley seed.

promoted through wheat production technology demonstrations and farmer field days throughout the northern region. Cultivation, seeding, fertilizer application, weed, rodent and insect control, combine harvesting and post harvest crop management are included in the technical package. A tractor and combine rehabilitation program has started and private equipment dealers are beginning to restart sales and servicing operations. ARDI is exploring ways to assist with the organization of farmer associations and farm credit programs, as well as private sector input supply. Availability and proper handling of good quality seed is an important component of a productive wheat growing system, as with any crop, and that is the focus of this study.

Ministry officials in the three northern governorates recognize that they do not have adequate seed conditioning capacity to provide the required annual quantities of quality (certified/improved) seed and have requested ARDI assistance. Actually, the northern governorates are not equipped at this time, as they once were, to manage a certified seed program to meet international standards, but they want to achieve that level again. The only officially certified seed available in the region is imported and then multiplied at the research stations or by contract farmers using improved production practices and usually field inspections by qualified agronomists. The "certified-plus-one" generation is generally called "improved" seed. The improved seed is then distributed to farmers. In addition to their seed requirements, farmers also are not equipped at this time to clean their market grain to meet Grade 1 standards, which would allow them to receive the top price for their wheat from the Ministry of Trade or a higher market price if they sell directly to a trader or flour mill.

The wheat seed programs in the three northern governorates of Dohuk, Erbil and Suleimaniyah are in need of technical strengthening for multiplication and handling of seed. They also must upgrade the seed cleaning, treatment and storage facilities for certified/improved seed. In addition, farmers are in need of increased capacity to clean their "farmer-saved" seed as well as their market grain in order to achieve Grade 1 quality.

Seed Quality as Determined by Seed Conditioning

Why is seed processing important to wheat production? What is the return on investment in seed processing or conditioning? These are important questions to consider when proposing improvements or new seed processing facilities.

Improving the quality of wheat seed is generally considered to be part of a quality program that would include the use of superior varieties; planting in fields that are relatively free from weed, disease and volunteer crop contamination; using accepted best management practices during the agronomic growth stages; maintaining cleanliness in tillage and harvest equipment; as well as a good seed conditioning program. It is also generally accepted that the practice of seed conditioning is the tool used to remove many of the problems that have occurred in the previous steps of the seed production chain.

The purposes of seed conditioning are 1) to remove contaminants, 2) to upgrade the seed, and 3) to size the seed. The main contaminants found in seed lots and removed fall into one of two categories, chaff and trash; and other seeds, either from other crops or from weeds. The presence of chaff and trash in a seed lot can cause planting problems that can lead to skips, reduced number of wheat plants and lower yield. It is well documented that weeds/foreign plants in a wheat field can take valuable moisture, nutrients and space and cause yield reductions and increase the amount of foreign matter in the resulting grain crop. A good seed conditioning program using good equipment with trained operators will remove the vast majority of contaminants from a seed lot.

Upgrading a seed lot is the term used to indicate the removal of any kernels of wheat that do not have the capacity to produce a healthy plant. The usual indicators of lower quality or diseased seed lots include shriveled, light weight seed; smaller sized seed; and cracked or broken kernels. A normal wheat seed conditioning facility will use processing equipment that will separate seeds by weight, width, length and thickness. This system has the ability to remove the vast majority of seeds that will not grow into healthy plant. Not only does this mean that only good quality seed will be planted but also that fewer diseased seeds will be present in the field to contaminate the subsequent crop with disease.

Research has shown that seed size has a relationship to grain yield. The removal of small and light weight seeds from the seed lot will translate to a yield increase of produced grain. Once again, the seed conditioning process will remove small and light seeds from the seed lot as part of its size grading function.

A report titled “Seed Quality” by Dr. Leroy Spilde (Annex B) is a compilation of research on the various factors that have an influence on seed quality. The report shows direct correlation between germination percentage and grain yield with a yield increase of 14 bushels, from 39 to 53 bu/acre. It is generally acknowledged the smaller and shriveled seeds generally have lower germination capacity, and those lower quality seeds would normally be removed during the seed conditioning process. Since there are other factors involved in the germination potential that will not be exhibited in physically separable characteristics, the yield increase mentioned in this report can only be partially attributed to seed conditioning.

Seed borne disease is another factor that contributes to seed quality. The report states that “infection level can be reduced with proper use of seed conditioning equipment” and goes on to note that seed emergence was increased by 4% with the use of certain seed conditioning equipment. Additionally, the report tells of yield increases of 4 to 7% from studies from the planting of medium to larger seed as compared to small seed. In this case, seed conditioning is the only way to remove those small seeds from the seed lot.

The report also cites a study where certified seed produced a 1.8 bu./acre yield increase over uncertified seed. The term uncertified seed can include seed where many different production regimes were applied, and where some of the uncertified seed was not conditioned. Since it is a requirement that all certified seed be

conditioned, it would follow then that seed conditioning probably contributed to at least some of the 1.8 bu./acre yield increase.

An additional study, "Economic Issues with Certified and Farmer-Saved Wheat Seed" (Annex C) published by the Kansas State University Agricultural Experiment Station and Cooperative Extension Service looked at the value of certified versus farmer-saved seed. Again in this case, certified seed was required to be conditioned, while the farmer practices involved in producing saved seed are not known. The report cites sources showing that at least 18% of farmer-saved seed was not conditioned. The study found increased returns over cost by using certified seed when average yields increased by only 1 bushel per acre. Since seed conditioning is a component of certified seed and not necessarily of farmer-saved seed, the relationship of seed conditioning to the increase in yield is considered significant.

It is very difficult to isolate and measure the relationship between seed conditioning and seed quality because it is one part of a normal seed production and seed quality system. Many factors interact to produce the final result. The two studies cited give evidence that seed conditioning has a positive effect on the agronomic performance and yield of the resultant crop. It is apparent that the level of management applied to wheat seed production fields in Iraq is not equal to the management level applied to wheat seed crops in the studies. Therefore, good quality conditioning on a seed crop in Iraq is even more important than in the U.S. because the Iraq crop is likely to have more weed seeds and more poor quality wheat seeds than U.S. crop, where the management practices have controlled the weeds and will have a lower number of poor quality seeds.

The following section is an evaluation of the seed processing or conditioning facilities in the northern region.

Evaluation of Current Seed Conditioning Facilities

FAO provided moveable seed processing facilities about five or six years ago.[2] A total of 17 units were distributed among the various locations in the three regions. In addition, 26 mobile seed treaters were also provided and are available for use in conjunction with the seed cleaners or independently.

Region	Number of Cleaners	Number of Seed Treaters
Dahuk	4	7
Erbil	6	9
Sulimaniya	7	10

In addition to the above mentioned units, at least two more portable rotary units are located at MOA facilities in Erbil and Sulimaniya. The Erbil unit at the research

[2] These cleaning units have been called "mobile" but in fact they are moved with great difficulty so the term moveable is used here to more accurately describe them.

station is Australian made and appears to need some repair before it can be used. The unit in Suleimaniyah is a new Syrian made machine that was brought to Suleimaniyah by a sales agent for demonstration. It appeared to be in good shape but the staff at the research center said it did not work very well. Capacity of that unit is well under 1 MT/hour.

Description of the Moveable Units

The moveable seed plants were built by Agrosaw, an equipment manufacturer in India, and they consist of four pieces of processing equipment along with necessary conveying equipment mounted on a rubber-tired trailer. During our visits we viewed three of these plants (one in each governorate), and we were assured that all the units were of similar construction. There was also one Agrosaw unit of a smaller size located at the Ainkawa Research Center.

Description of the typical equipment found on the moveable seed cleaner units:

1) Debearder: mounted above the intake hopper of the air-screen cleaner, flow can be by-passed so that seed goes directly to the cleaner. When used for wheat, a debearder usually is used to remove the occasional “white-cap” (lightly attached chaffy hull) from the seed. In wheat, the debearder is mainly used to give a nicer appearance to the wheat and has very little bearing on real cleanliness of the seed or on plantability.
2) Air-Screen cleaner: the basic machine in a seed cleaning line. It uses aspiration and screens to remove impurities on the basis of weight with respect to surface area, particle width and particle thickness. These particular units utilize three screens in a scalp-scalp-sift arrangement, along with one fan used to make top and back aspirations. Seed is discharged from the rear of the machine and flows directly into the length grader. Screenings are discharged out the side of the unit and collected in bags. Air discharge from the fan is routed to a cyclone and fine materials drop out into a small collection box that can be opened and emptied from the bottom.
3) Indented cylinder length grader: this is a two-cylinder unit that is used to lift shorter particles (smaller weed seeds and broken kernels) from the seed mass. Good seed is discharged at the end of the unit into an elevator leg and the short liftings are collected via a small auger in a bag on the side of the machine.
4) Gravity table: this machine separates on the basis of specific gravity, *i.e.* particle weight when particle size is equal. It uses fans to stratify the seed (lightest on top—heaviest on the bottom) in a fluidized bed across a deck on the top of the machine. A reciprocating motion of the deck, along with a sideways pitch and front-to-back slope cause the separation of the light particles from the heavier seed along a gradient. The result when using a gravity table is usually a slightly more attractive seed product with a slightly heavier test weight, and a possible increase in the germination level of the seed lot. The light screenings from the gravity table are discharged into a bag on the side of the unit and the good seed can either be bagged or spouted directly to the seed treater unit.

5) Conveying equipment: consists of two bucket elevator legs where a vertical belt with scoops or buckets lifts the seed product and spouts it to a bin over the next piece of equipment.
6) Trailer: all the equipment is mounted on a four wheeled, rubber-tired trailer, and aligned to provide a continuous flow of seed from the input elevator to the discharge from the gravity table. For stability, the trailer is equipped with four screw-jack legs that can be used to lift the unit off the tires so as to reduce the shaking effect that the reciprocating machine motion transfers to the trailer.

Condition of equipment

The Agrosaw units are considered to be clones of other seed processing machines built in other parts of the world. The units are of light to medium weight construction and tend to appear worn with some structural damage occurring over time. Wear on these machines will cause a decrease in their ability to make a precise separation and will lower machine capacity. Poor design and construction methods allow for spots in the machines to collect seed and impurities that might be hard to clean out and that could contaminate subsequent seed lots.

It appears that the debearder is often bypassed during seed cleaning, meaning that it is either not needed or not working well.

The screens on the air-screen cleaners inspected were said to be the original ones supplied with the machines. Wear will cause the perforations of the screens to grow larger thereby changing the separation quality of the machine and allowing more good seed to be lost with the small screenings. There was no indication of any replacement screens in Erbil or Dohuk, but there was a crate of them in Suleimaniyah that appear not to have been opened. There was no indication that screens were changed to deal with varying seed sizes among varieties or between red wheat and durum wheat. Changing screens for different sized seed is a normal practice. One size does not fit all.

The length graders are rather simple to operate. This unit is designed to remove only short particles from the seed mass. More sophisticated length grading systems include units that remove particles both longer and shorter than the desired seed. The only potential problem with this unit could be wear inside the cylinder that would erode the lifting edge of the indent pockets, decreasing the lifting ability that would then keep more short particles in the seed mass. Noting the age and limited capacity this unit, it is doubtful that significant wear has occurred in the cylinders.

Gravity tables are intricate and complicated pieces of equipment to operate and observations from many parts of the world have shown that operators very often set these machines incorrectly. Although seed quality can be improved with a gravity table, the incremental change is often not significant, especially in seed lots where there are other limiting factors that also control seed quality. The machines observed here seemed to be in good shape, but a major problem that can occur in gravity tables is the breakdown of the air baffles inside the machine, which cannot be observed without removing the deck. At least one of the units was modified to

bypass the use of the gravity table. This bypass probably was installed because the gravity table did not have a significant effect on the final seed product and overall operational efficiency was gained with the bypass.

The elevator legs in a seed facility can be the cause of contamination and seed damage if not constructed or used correctly. A common feature in legs used in a seed plant is an added spacer washer between the bucket and the belt to allow seed to fall between and not become lodged with the possibility of it coming out later and contaminating subsequent seed lots. The elevator legs inspected were not equipped with the spacer washers.

Seed cleaning equipment must be cleaned out to prevent contamination between seed lots of different varieties. Compressed air is often used to blow seed off ledges and out of pockets in equipment. Air compressors were observed in the buildings where the equipment was stored, but there were some indications that some of the seed conditioning units were moved out of the buildings and operated on outside slabs. If that is the case the air compressors would not be readily available for use and equipment cleanout is probably lacking.

The trailers on which the cleaning equipment is mounted are equipped with strong stabilizing legs in the form of a screw jack. They provide for the trailer to be raised off of the rubber tires. However, the legs are not sturdy and indications are that they allow for a considerable shaking of the entire unit. In every case, individuals we asked said that there was considerable motion of the entire processing unit on the trailer. In some cases it appears that the stabilizing legs are not raised high enough during operation to get the weight off of the tires. In one case where they lifted the wheels off the ground and set the unit on blocks, there is still significant movement. This shaking of the trailer appears to be significantly reducing the effectiveness of the cleaning operations which depend on a solid base to achieve separation by motion. The shaking could be significantly reduced by retrofitting stabilizing braces. A set of diagonal braces on the jacks at each of the four corners of the trailer would significantly help to stabilize the unit reducing the shake and increasing the efficiency of the cleaning equipment. Local machine shops could fabricate and install the stabilizer braces.

An examination of the equipment and a look at the Agrosaw website would indicate a potential or rated capacity of these units closer to 2mt/hour. A fairly consistent figure derived from each of the regions indicates an actual operating capacity for the units in 800 to 1000 kg/hour range. The difference is most likely due to three factors; 1) wear of the screens in the air-screen cleaner or not changing screens with seed varieties of different sizes; 2) lack of proper operator training in how to achieve maximum performance; and 3) excess shaking motion of the entire unit caused by the instability of the trailer.

Seed Treatment Units

The seed treatment units are also Agrosaw brand and appear to be in generally good shape although it is difficult to judge without seeing them operate. They are

designed to use either a dry powder treatment or a liquid treatment. They have recently been using only the powder because it is most readily available. However some MOA officials believe the liquid form of fungicide is available. Certainly, if the government is doing the procurement, liquid fungicide could be specified. The liquid application system on the seed treater is self contained and automated. The powder system involves a man using a cup to pour powder treatment into a hopper that feeds it into the mixing chamber. This is an inefficient use of manpower, and is also more open to human error and potentially more dangerous to the operators due to possible spills and inhalation of treatment dust. These treaters seem to be used either in the processing line with the seed cleaners or separately to treat seed that has been previously cleaned and stored.

Seed Conditioning Requirements

Wheat seed requirements were defined by regional MOA officials based on total wheat planted annually. The annual seed needs in the governorates are shown in the table below. These requirements could change as more farmers use seed drills and reduce their seeding rate. Also, if yields increase significantly, farmers may plant fewer hectares and may increase the area of other crops in the wheat rotation such as chickpeas and lentils. Those crops will then need seed cleaning. The current requirements are a good starting point and will no doubt change over time.

Region	Annual Wheat Seed Requirements (MT)
Dohouk	15,000
Erbil	25,000
Sulimaniya	30,000

Most individuals interviewed for this study agreed that the seed cleaning season runs from generally from July into November with considerable local variation. It was agreed that a cleaning day usually would last at least 10 hours. If we consider that there are 100 operational days in that time period it could be calculated that for each 1 MT/hour of machine capacity, a seed conditioning unit will process 1000 MT/season. (1 mt/hour x 10 hours/day x 100 days/season = 1000 mt/season) . Therefore, the total seed cleaning capacity for Dahuk should be 15 mt/hour, Erbil 25 mt/hour and Suleimaniyah, 30 mt/hour.

Production of certified/improved seed

The production of improved seed of needed varieties involves extra care to insure that varietal mixtures and weed contamination do not occur. This seed production requires the use of specialized seed production techniques as well as fields free from harmful weeds and volunteer wheat plants, oversight (monitoring and inspection) by responsible parties, seed testing and product labeling. All this added effort involved in wheat seed production makes the use of certified or improved seed impractical for planting for all of the wheat planted in the country. In addition, it can be a financial burden to expect farmers to purchase the higher priced improved seed

on a yearly basis. A common and most widely recommended practice in the wheat industry is to purchase and plant certified or improved seed in one season and then save some of the seed from the crop and replant the progeny of that seed for each of the next three seasons before purchasing new seed. Many farmers will purchase new seed for 25 percent of their seed requirement each year, in that way avoiding a major expense all in one year. The acquisition of new seed is also an opportunity for a farmer to obtain a new improved variety with desirable characteristics he wants such as resistance to certain disease or perhaps increased drought tolerance.

Seed policy

There has been a national seed policy and law in the past which addressed the usual subjects of import-export standards, certification standards, field and laboratory inspections, protection of patents on certain genetic material and other intellectual property, and other regulatory matters designed to protect the rights of businesses and consumers. The northern region has been separated from the national seed policy and law in recent years and has operated without a formal law and implementation policy. The FAO seed program procedures and the MOA procedures on the handling of seed in the northern region substituted for law and formal policy. With formation of the new national and regional governments new seed laws and regulations are expected. A certification program with appropriate regulation will no doubt be installed to manage cereal grains and other field crops. In the meantime, MOA presumably will continue to implement its programs and deal with policy issues on an individual basis as needed during the transition period. A legal framework for plant and animal genetics and an accompanying policy are subjects which ARDI could consider for assistance in the future.

MOA strategy

Given the MOA strategy to advocate the replacement of farmer-saved seed every fourth year with certified or improved seed, then one-fourth of the total seed requirement in each region will have to be certified or improved seed. Since certified seed is not yet produced in the northern region, the conditioning requirement for new seed is for “improved” seed only at this time. Conditioning of improved seed to near certified standards requires high quality equipment and trained operators who are able to get a high level of performance from the machines. Since the multiplication of imported certified seed is done at the central research farms in or near the capital cities of the three governorates, or on the nearby farms of contracted seed multipliers, it is logical to locate one high quality 5-ton seed cleaning facility on or near to the central research center in each governorate.

Farmer-saved seed

Farmer grown seed that will be used by the grower for replanting or for selling to neighboring farmers should also be cleaned and for operational ease and efficiency, seed conditioning units should be located in close proximity to farmers’ production areas. In most cases the recommendation would be to have a seed cleaner unit within 10-20 km of all significant production. In many cases a 1 mt/hour unit would

be the appropriate size. However, in some areas with a higher concentration of wheat production, a 2plus mt/hour unit are more appropriate.

Since the smaller 1-ton units would be much less likely to condition improved seed, the same level of precision of the cleaning equipment would not be required as with the 5-ton units. In addition, the small machine operators will probably be generally less experienced, so a less sophisticated cleaning equipment set-up is recommended. For those same reasons, length graders are also not included in the proposal for the small 1-ton units. For the 2 to 3- ton units only length graders that remove short particles are recommended. Length graders for the removal of long particles are not included.

Debearders and gravity tables

The existing 17 moveable Agrosaw units are equipped with debearders and gravity tables. This proposal does not advocate including debearders and gravity tables in the seed conditioning lines of the units recommended here. The positive effect of the use of the debearders and gravity tables on the final quality of seed output is not significant in these circumstances and is not worth the extra investment. In the case of the gravity table, the correct usage requires an operator with a high level of skill and experience. If it is determined in the future that either of these pieces of equipment is necessary, they can be added without much difficulty.

In addition to the proposed new seed conditioning units, the existing Agrosaw units should continue to be used in the seed conditioning system. This would mean acquiring new screens and adding braces to stabilize the trailers from excess shaking. The equipment would also benefit from a heavy maintenance to improve efficiency and increase longevity.

Proposed Equipment

In order to be consistent the following factors were assumed to be basic assumptions when making the recommendations for seed conditioning units.

1) Provide good quality seed: All seed conditioning machines should be able to process seed up to normal seed quality standards.
2) Capacity to clean all seed to be planted: The goal was to provide ample seed conditioning capacity to process all of the potential wheat seed (certified, improved and farmer seed) that will be planted in the country.
3) Use machines to maximum capacity: Don’t get more machines than needed and distribute the machines around the govenorates so that all wheat producing areas are included.
4) Cleaners within easy distance of all farmers: Each wheat growing farmer should have a seed cleaner within a reasonable distance of his farm so that he will not see it as inconvenient to get his seed cleaned.
5) Develop private enterprise: Not all the machines will be government owned, but instead provide a mechanism for individuals to establish a business enterprise.

6) Equipment complexity vs. operator skills: Provide equipment that can be easily used, moved and stored by operators of varying skill levels.
7) Continue to use existing machines: The current Agrosaw units are still serviceable and should continue to be used. These machines will most likely need some maintenance, screens and parts and ARDI should assist the MOAs in keeping them serviceable.

Three sizes of seed conditioning units are recommended and described below.

1) **5 mt/hour unit** for processing certified and improved seed and farmer seed.
    - Three or four screen air-screen cleaner with hopper feed, capable of coarse scalp, coarse sift and close sift (preferably split sift bottom shoe), top and bottom aspirations with bottom fan similar to Clipper Conquest 1360.
    - Length graders (cylinder or disc models) capable of removing material both shorter and longer than the seed similar to Carter Day 2523 over 2527 machines.
    - A seed treater capable of applying both liquid and powder treatment.
    - All units should be sized to match the capacity of the air-screen cleaner and placed on stands if applicable.
    - Screenings from air-screen and length graders will flow into bags hung at the discharge spouts.
    - Input to the system will be through a moveable dump pit similar to Rapat CU with Incline feeding a 25-30 mt/hour elevator leg similar to Universal D3-1000 feeding a 15 mt covered surge bin with a rack and pinion gate above the air-screen.
    - After exiting the cleaner, a vibratory conveyor moves seed to a second bucket elevator and to a surge bin over the length graders.
    - The leg discharge can allow the seed to either go into the surge bin or exit the system.
    - Clean seed discharges from the length grader and goes to the seed treater surge bin via a third elevator.
    - Discharge from the treater flows into a fourth elevator leg that goes to the bagging bin.
    - Bagging bin has a minimum of 5 MT capacity and discharges to a hand operated bagger/scale.
    - Seed would be bagged and bags closed with a sewing machine.
    - Seed legs like the Universal C3-200 or equivalent are recommended.
    - Elevator legs and conveyors should be capable of handling seed without the addition of admixtures and be easily cleaned.
    - The system should include a cyclone or other method of handling the fan discharge for the air-screen.
    - Bins should be designed into the system with specifications and drawings included so the bins could be locally built to save cost.
    - Generator.

    This unit would have to be permanently located in a building to protect it from the elements and bolted to a solid 10 to 15cm reinforced poured concrete floor.

Some of the Agrosaw units are now located in buildings with roofs and heavy wire mesh walls. That type of building is suitable for the new 5-ton units as well, the open air design is desirable for operating in the summer heat and it allows for the dust to be blown away. For purposes of protection from the elements this type of building is generally adequate. If rain blows in from the side, the equipment could be covered with a tarpaulin. To accommodate surge bins under the roof, the eave height of the building would need to be about 30 feet. [see specifications in Annex I for building dimensions and equipment layout.

2) **2plus mt/hour unit** for processing farmer seed and locally grown improved seed.

- A three screen air-screen cleaner with feed hopper capable of scalp and split sift seed flow; with single aspiration similar to a Clipper Eclipse 334.
- Length grader (disc or cylinder) capable of removing short particles from the seed mass similar to a Carter Day #3.
- Seed treater using liquid treatment, similar to Gustafson Model OFT.
- Bagging system similar to Taylor OM2.
- A small bucket elevator or auger is required to feed a small surge bin above the air-screen. Appropriate elevators are required to handle seed through the system, feeding into small surge bins above subsequent equipment.
- Screenings from equipment would flow from the outlet spouts into attached bags.
- Unit should be designed so that it can be used in a building or on an outside pad but moveable so that it can be pushed or slid into a storage area for the off-season.
- Generator

3) **1 MT/hour unit** for processing farmer seed.

- Two or three screen air-screen cleaner with scalp-sift or scalp-split sift flow and single aspiration similar to Clipper Eclipse 324.
- Auger or other means of filling the treater surge hopper.
- Seed treater similar to Gustafson OFT,
- Simple 2-way valve bagger, sewing machine and scale.
- Generator

Each 1-ton unit is intended to be moveable—able to be transported from village to village in order to accommodate the seed cleaning needs of each area. This unit of this scale is intended to be small enough to be lifted by four individuals and loaded into a pickup or trailer to be moved to another location. The recommendation is to supply (sell/grant) these units to local village associations, farmers or entrepreneurs to operate as a private business. The project would provide training in equipment operation and business management. The unit owner/operators would develop a seed cleaning business in their local and neighboring villages.

Privatization of seed processing

The 1-ton units, as mentioned, are suitable for small towns and villages and are particularly appropriate for private ownership. The 2plus-ton units could also be privately owned and operated. The initial 2plus-ton units proposed in this study are recommended to go to larger MOA district stations in order to give good geographic coverage to each governorate for the improved seed requirements. It is recommended that ARDI identify a private equipment dealer in the region to sell and service additional seed cleaners in the 1-ton and 2-3 ton sizes. Individuals or groups could acquire a cleaner and create a profitable business of cleaning farmer-saved seed or grain destined for the Ministry of Trade or the commercial market. For example, if the purchase price for Grade 1 wheat is $200./mt and for Grade 2 it is $180./mt, there is ample incentive for farmers to clean their grain and to pay a reasonable fee to seed cleaner operator for the service. Individuals, partnerships or local farmer associations are all possible seed cleaner operators. It is envisioned that eventually private seed companies will be multiplying and cleaning certified seed that is inspected by the seed board and tested in a laboratory.

Concrete pads for handling seed

The usual practice of storing seed or market grain intended for conditioning is to dump it on the ground in piles. This method can cause problems with dirt, contamination, rodents, birds, insects, etc. Installation of concrete pads at the location of the conditioning facility would significantly contribute to seed quality and operating efficiency. These pads should be sized to the storage needs of the village and to the cleaner capacity. These would be part of the installation of a new unit.

Spare parts and other components

All equipment would be ordered with a supply of common spare parts. Air-screen cleaners would include a dress of screens for wheat, durum, and chick peas with extra wheat and durum sifting screens. Sewing machines and platform scales would be supplied locally by the project. Generators must be included with all units to supply power if local power is not available. Electrical panels to easily switch the power source service to a generator are required.

The Recommended Plan for Unit Distribution

As described above, a combination of seed conditioning units of different sizes, both new and existing is recommended for each region. The goal is to achieve the theoretical capacity as outlined earlier in this report, but factors such as exact seed supply in each area, operator expertise and operator initiative will all contribute to the actual seed conditioning output. Exact areas or villages where the equipment is to be placed will be determined by MOA officials. The location of the privately owned 1-ton units may depend on where local owner/operators live. The wheat seed requirements stated here are based on MOA estimates of the average number of hectares of wheat planted annually in each governorate. It includes both improved seed from multiplication programs and farmer-saved seed. The planting rate used in the calculation is 120kg/ha. Various factors, particularly weather, of course, will change the actual amounts planted in any given year. The number of seed conditioning units of the three different sizes recommended are considered a

minimum requirement using the formula stated above: [10 hours operation per day x 100 days seed cleaning per season = 1000 seed cleaning hours per unit per season.] For a number of reasons certain units may not be able to achieve this level. In addition it is expected that some units will be used also to clean the grain crop going to the Ministry of Trade or the commercial market. It is recommended that the 1-ton units and possibly the 2-plus ton units be promoted to private owner/operators to create the capacity to clean the grain crop for farmers on a fee basis.

		Recommended Base Number Conditioning Units			
Region	**Seed Needs (mt/hr)**	**5 MT**	**2-plus mt**	**1-mt**	**Agrosaw (1^{+}mt)**
Dohouk	15	1	2	4	4
Erbil	25	1	2	9	6
Sulimaniya	30	1	4	9	7

Rehabilitation of Existing Seed Cleaning Units

The limited length of this consultancy allowed only for time to give a quick examination to three of the existing Agrosaw seed conditioning units. These units were stored for the winter, so there was no opportunity to see them in operation. Only two operational problems were described by those who know the machines: excess unit shake and worn out screens. It is very possible that there are other mechanical problems, but those problems cannot be easily assessed without operating the units under load during the seed conditioning season.

MOA seed cleaner operators said that screens were not changed and new screens were not readily available. It is recommended that the MOAs do a survey of all the seed cleaners and create an inventory of good screens that are available for use. Each location should be supplied with screens of the sizes needed to clean this year's wheat crop. Contact with the Agrosaw manufacturer can be made at their website <www.osawagro.com> and screens can be ordered. One research station director said that most spare part requirements for the Agrosaws can be purchased locally or fabricated in local shops. A more complete assessment of the condition of each machine should be made during the seed processing season as a part of an on-the-spot operator assessment and training program. At that point problems can be noted, parts ordered and maintenance scheduled.

Project Implementation

The implementation of the Wheat Seed Processing Improvement Project would come under the management of the Ministry of Agriculture for the northern region expected in 2005. The 5-ton units will be located at the Agricultural Research Centers in each Governorate. A MOA office of Seed Processing Management is recommended for the northern region management responsibility for the technical operation and maintenance of the MOA seed conditioning facilities. A qualified engineer with equipment operation and maintenance experience should be

employed and then trained by ARDI in the United States. The engineer would train and supervise the seed cleaner operators.

ARDI would provide technical assistance and training to the MOA for the overall implementation of the project. The Research and Extension Directorate would continue to be responsible for seed multiplication of improved varieties. Agricultural Services will continue to be responsible field operations.

ARDI would procure the equipment using the normal competitive practices prescribed by USAID. A seed processing consultant would be provided by ARDI to work with the seed processing engineer to supervise equipment installation and provide operator training. A building contractor would be engaged through a competitive bidding to construct the buildings and the pads and install the equipment.

Project components

Four components are recommended for implementation of the project.

1. Heavy Maintenance of the Agrosaw seed cleaners
2. Procurement of the recommended equipment and spare parts for the three types of seed cleaners and treaters.
3. Installation of the new seed cleaners including rehabilitation of three buildings for the 5-ton units and concrete pads for the other units.
4. Training
    a. Project engineer and field maintenance mechanics
    b. Seed cleaner operators and maintenance staff
    c. Seed multiplication contractors
    d. Extension service on cleaning and treatment and storage of farmer-saved seed.
    e. Field to staff to promote 1-ton units for private operation in the villages.
    f. Farmer association workshops- could be added to a production and harvesting program of a farmer association.
    g. Workshops to teach farmers and farmer association manages how the handle the business activities involved with operating a seed conditioning service.

ANNEXES

Annex A- Principles of Separation and Seed Cleaning, Jim Stanelle, 2004
Annex B- Seed Quality
Annex C- Economic Issues with Certified and Farmer-Saved Wheat Seed
Annex D- Glossary of Terms
Annex E- Consultant's Scope of Work
Annex F- Estimated Costs of Proposed Project
Annex G- Summary of Procurement Requirements with Specifications
Annex H- Future technical assistance requirements
Annex I- Drawings for 5-ton units.