# Production and Market Opportunities for Fall-Planted Onions in Southern Jordan

**Jordan Component of the Sustainable Development of Drylands Project**
**Report# 5**

**New Mexico State University**
**College of Agriculture**
**Department of Agricultural Economics and Agricultural Business**

**and**

**The Badia Research and Development Center**

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# Production and Market Opportunities for Fall-Planted Onions in Southern Jordan

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## Executive Summary

A project team of technical experts, building on the similarities between New Mexico and Jordan, partnered with a Bedouin tribe to demonstrate the feasibility of expanding the onion production practices and the market window for southern Jordan. The results of this demonstration project included defining the planting dates for short-intermediate day fall-planted onions; and the demonstration of New Mexico onion production, handling, packaging, and marketing practice. As a result of this project, the tribal leaders can better assess their options to expand their onion season, and to evaluate appropriate technology. The combined impact of this project was to provide the data and information needed to design an on-farm system for onions that could maximize the return on investment of financial resources, labor, and water.

**Background:** Sustainable economic development in the agriculture and natural resource management sector is the goal of New Mexico State University's (NMSU) work in Jordan. NMSU is a member of the International Arid Lands Consortium (IALC), which is being funded by the United States Agency for International Development (USAID) to conduct the *Sustainable Development of Drylands Project*. NMSU's partner in the region is the Badia Research Development Center (BRDC). NMSU and BRDC are conducting an agricultural water-use study that includes the Disi-Al Mudawara water basins in southern Jordan. Within the Al-Mudawara basin the farming activities and major water use are concentrated on four farms (Figure 1). Three of the four farms are commercial businesses.

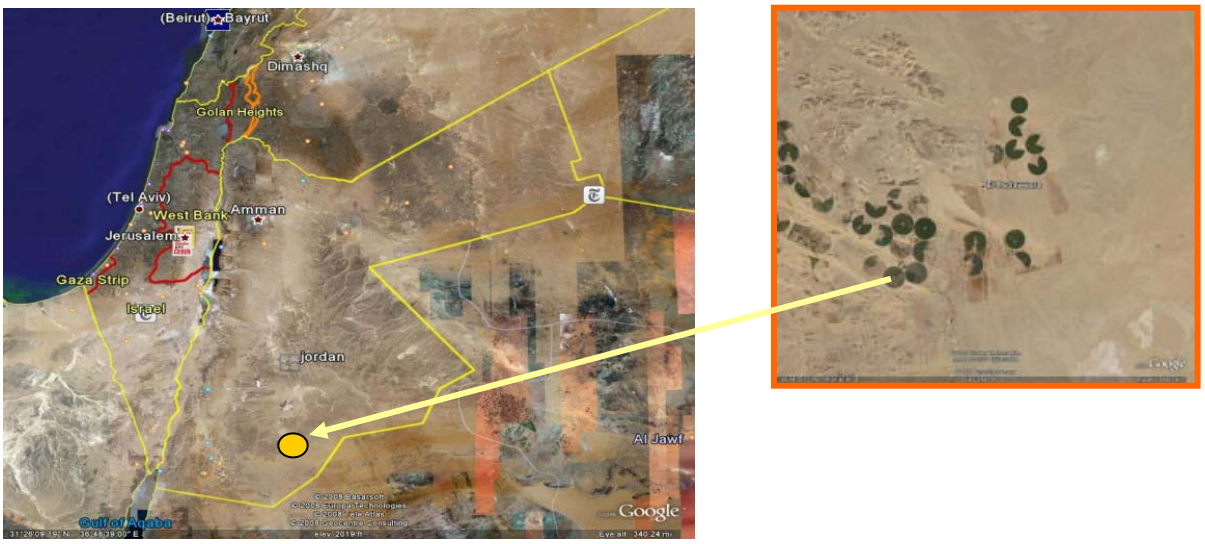



**Figure 1. Map of the Al-Mudwara water basin and the major faming activities (Google Maps).**

The fourth is a Bedouin tribal farm, managed by Sheikh Khalid Al-Atoun. In March 2007 the NMSU/BRDC team visited the region and met with local farmers to discuss current farming and water-use patterns. Pre-survey interviews were critical in understanding how local farmers made on-farm decisions and how to best obtain the water-use data. During that visit, the team met with local Bedouin leaders (Figure 2).

Sheikh Khalid manages a 500 ha farm that was given to his people by King Hussein. In 1993 he and his 1,500 member tribal community began farming operations. Since obtaining the land, the Sheikh, his family and the Jordanian government have helped establish a co-educational grade school and a clinic for his small community. The farm is a source of employment, income, and opportunity for his tribe. The irrigated portion of the farm consists of 225 ha., with approximately 35 ha. of vegetables (melon and onions), 40 ha of potatoes, and 150 ha. of fruit trees (apricots, peaches and plums) and grapes. The remainder of the land is used for livestock.

**Figure 2. NMSU and BRDC project team visiting with local Bedouin farmers in the Disi-Al Mudawara water basin in southern Jordan in 2007.**

The decision to collaborate on an onion trial came after touring Sheikh Khalid's irrigated farming operations (Figure 3.).

**Figure 3. NMSU and BRDC project team touring Sheikh Khalid's farm in March 2007.**

The team sat with him and village elders. We discussed farming, water issues, and the future of their community. The discussion was enlightening for both parties. NMSU has a very strong onion research program, a very similar growing environment to southern Jordan, and a history of expanding opportunities in onion production and sales. It was decided that an onion trial would help the tribe evaluate their alternatives, help spread their financial risk, potentially increase employment opportunities, and build ties between the Middle East and the U.S. It was decided that NMSU would provide the technical expertise and seed, Sheikh Khalid would proivide the land and all the inputs. He would also open his farm for all visitors to share in the knowledge gained by the demonstration project. BRDC would provide the in-country technical staff. The project team would plan and communicate via video-conferenceing, conference calls, and site visits by BRDC.

The Sheikh's Al-Mudawara farm and NMSU's horticultural research farm are located along the same general latitude. Al-Mudawara is at latitude 29N and Las Cruces is at latitude 32N (**Figure 4**.). The similar latitude, coupled with the arid environment and similar elevations, provided a good starting point to evaluate horticultural crops. It allows for the testing of crops that might yield a better return on investment and financial return per cubic-meter of irrigation water. **Table 1** illustrates the climatic similarities in temperature and precipitation.


**Figure 4. Global latitude comparison between Las Cruces, NM and Al- Mudawara, Jordan. Source NMSU's** Center for Applied Remote Sensing in Agriculture, Meteorology and Environment

| Monthly Weather Averages Ma'ān Governorate Jordan- C° | | | | Monthly Averages & Records Las cruces-NM-USA - C° | | | |
|---|---|---|---|---|---|---|---|
| Month | Avg low | Avg High | Avg Precip | Month | Avg Low | Avg High | Avg Precip |
| January | 2.2° | 13.3° | 5.08 mm | January | -6.11° | 13.8° | 14.7mm |
| February | 2.7° | 15° | 4.06mm | February | -3.8° | 16.4° | 9.6mm |
| March | 5.5° | 18.3° | 3.8mm | March | -0.5° | 20.5° | 6.6mm |
| April | 10° | 24.4° | 1.27mm | April | 3.3° | 24.4° | 5.6mm |
| May | 13.8° | 28.8° | 0.508mm | May | 7.2° | 29.4° | 12.2mm |
| June | 16.1° | 32.2° | 0 mm | June | 12.2° | 34.4° | 23.6mm |
| July | 18.3° | 33.8° | 0.25mm | July | 16.4° | 35.0° | 53.1mm |
| August | 17.7° | 34.4° | 0.508mm | August | 16.1° | 33.3° | 64.0mm |
| September | 16.1° | 32.2° | 0 mm | September | 12.2° | 30.5° | 34.5mm |
| October | 12.2° | 27.2° | 3.55mm | October | 5.3° | 25.5° | 28.4mm |
| November | 7.2° | 20.5° | 3.0mm | November | 2.2° | 18.3° | 15.5mm |
| December | 3.3° | 15.0° | 2.3mm | December | -6.11° | 13.8° | 22.6mm |

**Table 1. Climate Comparison between southern New Mexico and southern Jordan. Source http://weather.msn.com**

Historically, one of the crops grown on the Sheikh's farm was fall-planted onions. This crop was harvested in late-July to early-August. The team discussed expanding the harvesting window by testing fall-planted short-intermediate day onions, the type that NMSU had developed. The advantages to expanding the onion harvest window included both lower risk and higher potential return on investment. It also lengthened the time of employment for the tribe.

A project team was identified. It consisted of the Sheikh Khalid and his farm staff, BRDC researchers and support specialists, an NMSU onion scientist, NMSU project management staff, and Jordanian graduate students attending NMSU. The team used video-conferencing and other internet-based communications systems (SKYPE) to establish a solid working relationship between the team in Jordan and the project team in New Mexico (Figure 5.).


**Figure 5. Sheikh Khalid Talking to NMSU and BRDC Project Team via Skype Connection.**

The NMSU team provided the sheikh and the BRDC research team with background materials on best practices (Appendix 1) and crop budgets for commercial onion production (Appendix 2). Extensive discussion occurred before the project was initiated to clarify farming methods, availability of inputs, the timing of inputs, data collection, and plot security.

## Project Objective

The objective of the "*Production and Market Opportunities for Fall-Planted Onions in Southern Jordan*" project was to evaluate fall-planted, low-pungency Granex-type onions as a means of diversifying farm income. This empirical study employed experiences from other geographic locations to demonstrate the feasibility of expanding onion production practices in southern Jordan.

## Materials and Methods

Given the similarities between southern New Mexico and southern Jordan, onion scientists at NMSU were confident that onion varieties developed at NMSU could be successfully planted in Al-Mudawara. NMSU had already expanded from a limited onion producing region in the early 1980's to the current (2008) situation wherein it is providing almost 60% of the U.S. summer onions (May-September). The expansion of the harvesting window in New Mexico was a direct result of the NMSU onion breeding program. The benefits to the local farmers included a longer sales window to the U.S. market, financial risk reduction due to longer harvesting season and a buffer for erratic prices, and a more stable labor pool due to the extension of work time commitments. The Sheikh's current situation with onion production was similar to New Mexico's 1980's position; his restructured goal was to work toward our current situation.

Onions (*Alium cepa*) is a bi-annual crop, that is, it normally takes two years to complete its life cycle. For commercial onion production, the planting dates are manipulated to obtain the optimal bulb size, without the seed stalk. When onions "bolt" they produce seed stalks, which is an undesirable characteristic. In the U.S. onions that bolt are considered culls. Bolting can also contribute to storage rot and smaller bulb size. Accurate selection of planting date, by variety and type, is critical to achieving maximum yield and minimum bolting.

Three short-intermediate day yellow onion varieties were tested. The onion varieties included the following: Granex Hybrid®, New Mexico Starlite, and New Mexico Chaco. Each of these varieties has been extensively tested by NMSU onion breeders. The Granex Hybrid seed was donated by Lockhart Seed Co. The New Mexico Starlite and New Mexico Chaco seeds were donated by NMSU's Onion Breeding Program.

These varieties were selected as indicator plants, so that NMSU's onion breeder, thousands of miles from the planting site, could make scientifically sound recommendations to the farmer. A three-planting date range was selected for the planting dates. Bracketing these dates would help define the optimum planting dates for these onion types under these specific growing conditions. The optimum planting date was defined as the date that produced the highest marketable yield and the lowest percentage of bolting. The planting dates were set at October 1$^{st}$, October 15$^{th}$, and November 1$^{st}$, 2008.

The team reviewed onion production practices with the Sheikh. A review of fertilizer, irrigation, and pest management practices on the Sheikh's farm indicated that he was already a very knowledgeable onion grower. Soil and water samples were taken from the study field to provide input for nutrient management. Fifteen random soil samples were collected from a depth of 20cm within the study fields prior to planting. The water sample was collected from the well that would be irrigating the study. Table 2. lists the results of these tests that were analyzed by the National Center for Agricultural Research and Extension (NCART), Shoubak City, Ma'an Governorate.

**Table 2. Average Pre-Plant Soil and Water Test Values for Sheikh Khalid's' Al-Mudawara Farm. Analysis Date, October 10, 2007.**

| Sample Type | Depth | Avg. pH | Avg. EC(MS/sm) | Avg. %N | Avg. % P | Avg. %K |
|---|---|---|---|---|---|---|
| Soil | 0-20 cm | 8.1 | 3.9 | .03 | 10.2 | 66.0 |
| Water | Na | 7.1 | Na | Na | Na | Na |

| Planting Date | Verities |
|---|---|
| **Oct 1** | **Granex Hybrid** |
| | **Starlite** |
| | **Chaco** |
| **Oct 15** | **Granex Hybrid** |
| | **Starlite** |
| | **Chaco** |
| **Nov 1** | **Granex Hybrid** |
| | **Starlite** |
| | **Chaco** |

**Figure 6. Plot map of planting dates and varieties.**

Based on the soils and past practices a pre-plant application of 224 kg/ha of 0-45-0 and 57 kg/ha N was applied. A pre-plant application of Dacthal® and a post-plant application of Poast ®were applied for weed control (per label rates). All irrigation was applied from overhead pivot sprinklers.

It is important to note that this was a demonstration project, and not a research study. The demonstration plots were not randomly designed, but were located in a uniform area in the field to minimize treatment differences. The test plots were laid out to accommodate the farm operating systems and the irrigation system. Within each planting date the varieties were randomly assigned (Figure 6.)

The prescribed sowing rate was 2.24 kg/ha. The planting configuration was four seed lines/ m bed width. Prior to planting, BRDC specialists worked with Sheikh Khalid's farm crew to calibrate his planter (Figure 7). This calibration helped to ensure efficient use of the demonstration seed, and to obtain a uniform plant density for the study. After each planting date, the team reviewed the planting activities. All varieties and planting dates were successfully conducted without incident.

**Figure 7. Pre-plant calibrations of disc planter by BRDC staff and Sheikh Khalid's farm**

The project team communicated throughout the growing season. The study field was well managed for water, nutrient and pest control. One-month prior to harvesting, the team met to discuss the timing of data collection and identified the data that needed to be collected. NMSU's standard procedures for onion research data collection were discussed and adopted. Data collection began after approximately 80% of the leaf drop. Three 4.2 m.sq data sub-plots, 1.4m wide X 3 m long, were established (Figure 8) in each of the main plots (a total of 27 planting date X variety data plots). The variables measured included: percent bolting/plot; plant density/plot; and individual fresh wt. /bulb. Field data was collected on May 25, 2008.

**Figure 8. Data Plot layout by BRDC Research Specialists.**

## Results

The primary objective of the demonstration study was to determine the best planting date for these indicator varieties. The measure used to determine planting date is based on percent bolting. Commercial onion production in the southwestern U.S. manages the fall-planted onions to a <3% bolting standard. More than 3% bolting leads to excessive cull losses and less than 3% reduces bulb size. On the basis of this study, planting of these varieties of short-intermediate type onions should occur around the third week in October. Table 3 lists the percent bolting, by planting date and variety

**Table 3. Average bolting by planting date and variety.**

| Planting Date | Granex Hybrid | NM Starlit | NM Chaco |
|---|---|---|---|
| October 1 | 10% | 10% | 9.5% |
| October 15 | 7% | 7% | 7% |
| November 1 | 0% | 0% | 0% |

All plot plant density, independent of variety and planting date, was very uniform. These results indicate that the equipment was properly calibrated and operated during the establishment of the test. The average plant density across varieties and planting dates was 350 plants/$m^2$. This plant population is higher than commercial fields in New Mexico. This plant population will produce a high number of pre-pack to small onions. However, for the market conditions in Jordan, this plant population produced the size onion that has the widest appeal (Figure 9.).

**Figure 9. Average bulb size for 2007-08 Fall Planted Onion Trail, Al-Mudawara, Jordan.**

All three varieties bolted more with the early planting, but they also had higher overall yields. These results are consistent with the biological relationship between length of growing season and yield. The earlier planting date had higher over-all biomass yield compared to the later plantings (Table 4); however, when adjusted for cull rate due to bolting, the average marketable yields for the Oct. 15th and Nov. 1st plantings were the same. Adjusting the planting date to the third week in October, assuming similar growing conditions, should produce the best marketable yield.

**Table 4. Average yield (T/ha) by planting date and variety, for fall-planted onions in Al- Mudawara in 2007-08.**

| Planting Date | Granex Hybrid Ton/Ha | NM Starlit Ton/Ha | NM Chaco Ton/Ha |
|---|---|---|---|
| **October 1** | 124 | 122 | 121 |
| **October 15** | 114 | 114 | 113 |
| **November 1** | 99 | 102 | 101 |

## Conclusions

This demonstration project was a success on the basis of the following criteria: 1) It defined the planting date for short-intermediate low-pungency onions in southern Jordan; 2) It demonstrated that a global multi-disciplinary team can use science and technology to help the Bedioun people make decisions that positively impact their sustainable economic development; and 3) Cultural stereotypes in both Jordan and the U.S. have been challenged by mutual cooperation and the sharing of ideas, as demonstrated by the project team.

The culmination of this project was achieved during the two-week visit by Sheikh Khalid to New Mexico in June during the time of the New Mexico short-intermediate day onion harvest. During this visit the Sheikh and the NMSU project team had an opportunity to review NMSU onion research; and tour vertically integrated family-owned, high-yielding onion farms that grow, harvest, grade and market onions. The team also visited drip irrigation operations and was given a briefing and demonstration of a new, high-volume direct solar water pumping system being used in an agricultural application. Additional visits to agricultural and natural resource sites were included in the visit (Appendix 2).

Having concluded and evaluated the fall planted demonstration project and visited onion production fields and facilities in New Mexico; the Sheikh now has to decide how to proceed with his onion operations. The U.S. visit was helpful in defining the types of onions currently in demand in Jordan. The Sheikh was surprised to see the number of sizes and grades of the U.S. onion market. His current market is restricted to “pre-pack size,” (45-77mm diameter) onion that has a limited market in the U.S. Discussions with the NMSU technical team about the use of plant density, varieties options, and the manipulation of water and nutrients should be helpful in the Sheikh’s decision-making process.

Another benefit of the U.S. visit was that it gave the Sheikh a chance to see different levels of sorting and grading technology. Currently, his workers are hand sorting in the field. This tour exposed him to various, more efficient alternatives. He was also intrigued by both the field collection containers and the numerous packaging options we use. The Sheikh will be evaluating his options for purchasing sorting and packing equipment for his tribal farming operations.

Meetings with a U.S. seed company and the NMSU onion breeders helped to provide the Sheikh with information on how to proceed with his onion program. He has to consider the availability and cost of both hybrid and open-pollinated seed. He also wants to consider the possibility of becoming a vendor of this type of seed for Jordan. The team visited onion seed production fields and a seed cleaning equipment facility. The NMSU onion breeder consulted with the Sheikh on variety options on the basis of the results obtained in Jordan. A list of the NMSU varieties and their relative harvest dates are listed in Table 5.

**Table 5. Suggest NMSU onion varieties for spread in harvesting time season in Al Al-Mudawara, Jordan**

| Varity | Harvesting time |
|---|---|
| NuMex Camino | Very early |
| NuMex Chaco | Early |
| NuMex Starlite | Early |
| NuMex Vado | 10 days later |
| NuMex Luna | 10 more days later |

The decision to extend the onion harvesting season on this southern Jordan farm must include an evaluation of the market factors along with his financial targets. In New Mexico, our farm economy has benefited from extending the harvest window. This has kept NM in the market longer and it has spread the risk for farmers by allowing them to stagger their harvest. It is logical to expect that the response in southern Jordan might be the same.

It was beyond the scope of this study to evaluate all the Sheikh's onion options. The team discussed the need for the Sheikh to evaluate the expansion of his onion production on the basis of his production costs and a market analysis of Jordan and the region's onion needs.

Figure 10 illustrates the annual average price per ton of onions in Jordan. Figure 11 illustrates Jordan's onion production. Figure 12 illustrates Jordan's onion import quantities and the timing of those imports. Figure 13 illustrates the source and quantity of those imports.

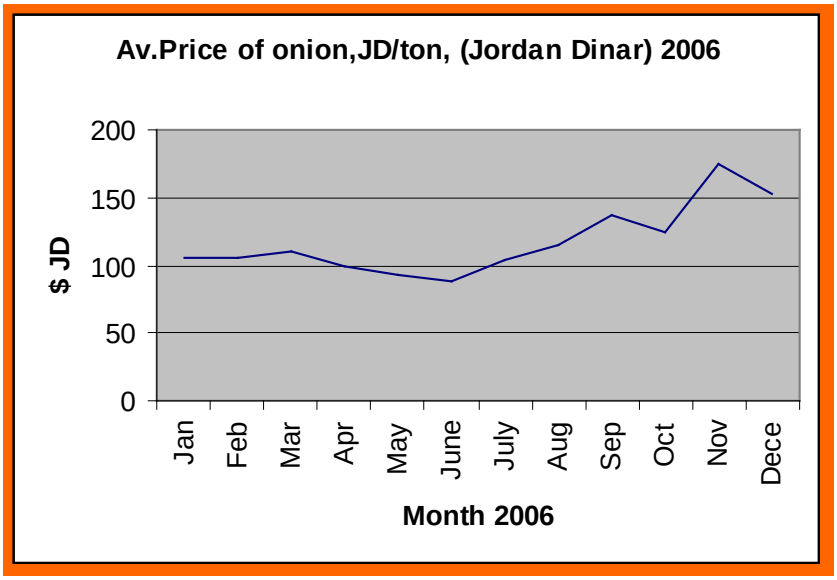



**Figure 10. Annual average price per ton of onion in Jordan. Source: WWW.moa.gov.jo/html/statistic/prod/summer_veg2006.pdf**

| Year | Quantity/ Thousand Ton |
|---|---|
| **2004** | 76 |
| **2005** | 70 |
| **2006** | 53.6 |

**Figure 11. Jordan's onion production (thousand ton). Source: WWW.moa.gov.jo/html/statistic/prod/summer_veg2006.pdf**

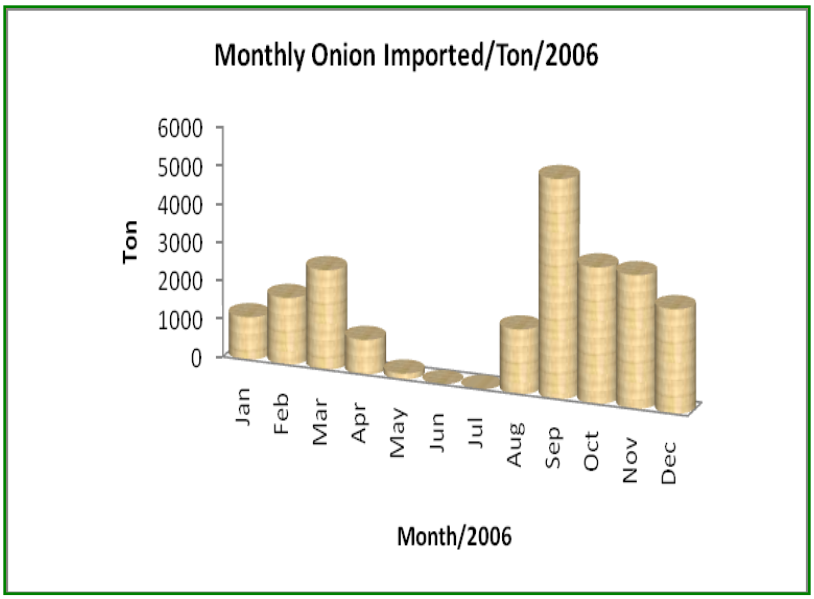



**Figure 12. Jordan's onion imports and timing for 2006. Source: WWW.moa.gov.jo/html/statistic/prod/summer_veg2006.pdf**

| Country | Quantity/ Ton |
|---|---|
| Syria | 3400 |
| Lebanon | 6827 |
| Egypt | 1547 |
| Palestin | 311 |
| Spain | 11 |
| Australia | 7 |
| China | 62 |
| India | 923 |

**Figure13. Jordan onion import sources and quantities (tons) 2006. Source: WWW.moa.gov.jo/html/statistic/prod/summer_veg2006.pdf**

During the Sheikh's visit he toured numerous family-owned farms and co-ops that were capitalizing on the "sweet" onion market. We discussed his options for exploring the market for "sweet onions" in the up-scale Jordan market and regional markets that are not as price sensitive, such as the UAE.

This year the Sheikh was able to sell all the test onions in the field to the army. Developing exclusive marketing agreements as well as growing a number of different day-length varieties in order to extend the harvest season, are also options. In the past, the Sheikh's only option for producing early harvest onions was winter transplants. He now wants to avoid this method and instead transition to direct seeding. Transplanting is labor intensive and risky. It depends on off-site production of the transplants, transplant vigor, and availability of desired varieties. While providing employment opportunities is a constant consideration in less-developed countries, the cost of operations and return on investment must also be considered. Direct-sowing and market development can be a cost-efficient and attractive alternative to transplanting.

Finally, NMSU's Public Television channel KRWG is making a short documentary on this project. It will emphasize the inter-disciplinary and multi-cultural nature of the project. This short film will illustrate the increased opportunities that exist to solve problems with a combination of science and technology, while building sound relationships between cultures. The documentary, in both English and Arabic, is scheduled to be available in Fall '08.

## Appendix 1. Bulb Onion Culture and Management

## Appendix 2. Onion Cost and Return Estimates

## Appendix 3. field data. Granex Hybrid, NM starlite, NM Chaco, for the fall planting trial in Al-Modawara. 2007-2008

**Granex Hybrid**

| Planting Date | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 1 07 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (beltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 348.0 | 82.9 | 34.0 | 9.8 | 314.0 | 53.0 | 0.2 | 12.6 | 12.6 | 126.2 |
| | P2 | 349.0 | 83.1 | 32.0 | 9.2 | 317.0 | 51.0 | 0.2 | 12.1 | 12.1 | 121.4 |
| | P3 | 345.0 | 82.1 | 37.0 | 10.7 | 308.0 | 52.0 | 0.2 | 12.4 | 12.4 | 123.8 |
| **Average** | | **347.3** | **82.7** | **34.3** | **9.9** | **313.0** | **52.0** | **0.2** | **12.4** | **12.4** | **123.8** |
| Oct 15 07 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 351.0 | 83.6 | 25.0 | 7.1 | 326.0 | 49.0 | 0.2 | 11.7 | 11.7 | 116.7 |
| | P2 | 346.0 | 82.4 | 23.0 | 6.6 | 323.0 | 47.0 | 0.1 | 11.2 | 11.2 | 111.9 |
| | P3 | 347.0 | 82.6 | 26.0 | 7.5 | 321.0 | 47.0 | 0.1 | 11.2 | 11.2 | 111.9 |
| **Average** | | **348.0** | **82.9** | **24.7** | **7.1** | **323.3** | **47.7** | **0.1** | **11.3** | **11.3** | **113.5** |
| Nov 107 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 351.0 | 83.6 | 0.0 | 0.0 | 351.0 | 41.0 | 0.1 | 9.8 | 9.8 | 97.6 |
| | P2 | 347.0 | 82.6 | 0.0 | 0.0 | 347.0 | 42.0 | 0.1 | 10.0 | 10.0 | 100.0 |
| | P3 | 343.0 | 81.7 | 0.0 | 0.0 | 343.0 | 42.0 | 0.1 | 10.0 | 10.0 | 100.0 |
| **Average** | | **347.0** | **82.6** | **0.0** | **0.0** | **347.0** | **41.7** | **0.1** | **9.9** | **9.9** | **99.2** |

## NM Starlite

| Planting Date | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 1 07 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 347.0 | 82.6 | 31.0 | 8.9 | 316.0 | 52.0 | 0.2 | 12.4 | 12.4 | 123.8 |
| | P2 | 349.0 | 83.1 | 33.0 | 9.5 | 316.0 | 51.0 | 0.2 | 12.1 | 12.1 | 121.4 |
| | P3 | 350.0 | 83.3 | 38.0 | 10.9 | 312.0 | 51.0 | 0.2 | 12.1 | 12.1 | 121.4 |
| **Average** | | **348.7** | **83.0** | **34.0** | **9.7** | **314.7** | **51.3** | **0.2** | **12.2** | **12.2** | **122.2** |
| Oct 15 07 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 348.0 | 82.9 | 24.0 | 6.9 | 324.0 | 49.0 | 0.2 | 11.7 | 11.7 | 116.7 |
| | P2 | 344.0 | 81.9 | 23.0 | 6.7 | 321.0 | 48.0 | 0.1 | 11.4 | 11.4 | 114.3 |
| | P3 | 347.0 | 82.6 | 26.0 | 7.5 | 321.0 | 47.0 | 0.1 | 11.2 | 11.2 | 111.9 |
| **Average** | | **346.3** | **82.5** | **24.3** | **7.0** | **322.0** | **48.0** | **0.1** | **11.4** | **11.4** | **114.3** |
| Nov 107 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 351.0 | 83.6 | 0.0 | 0.0 | 351.0 | 42.0 | 0.1 | 10.0 | 10.0 | 100.0 |
| | P2 | 347.0 | 82.6 | 0.0 | 0.0 | 347.0 | 43.0 | 0.1 | 10.2 | 10.2 | 102.4 |
| | P3 | 343.0 | 81.7 | 0.0 | 0.0 | 343.0 | 43.0 | 0.1 | 10.2 | 10.2 | 102.4 |
| **Average** | | **347.0** | **82.6** | **0.0** | **0.0** | **347.0** | **42.7** | **0.1** | **10.2** | **10.2** | **101.6** |

## NM Chaco

| Planting Date | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 1 07 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 351.0 | 83.6 | 37.0 | 10.5 | 314.0 | 51.0 | 0.2 | 12.1 | 12.1 | 121.4 |
| | P2 | 347.0 | 82.6 | 32.0 | 9.2 | 315.0 | 52.0 | 0.2 | 12.4 | 12.4 | 123.8 |
| | P3 | 342.0 | 81.4 | 30.0 | 8.8 | 312.0 | 50.0 | 0.2 | 11.9 | 11.9 | 119.0 |
| **Average** | | **346.7** | **82.5** | **33.0** | **9.5** | **313.7** | **51.0** | **0.2** | **12.1** | **12.1** | **121.4** |
| Oct 15 07 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 349.0 | 83.1 | 27.0 | 7.7 | 322.0 | 48.0 | 0.1 | 11.4 | 11.4 | 114.3 |
| | P2 | 343.0 | 81.7 | 21.0 | 6.1 | 322.0 | 48.0 | 0.1 | 11.4 | 11.4 | 114.3 |
| | P3 | 346.0 | 82.4 | 25.0 | 7.2 | 321.0 | 47.0 | 0.1 | 11.2 | 11.2 | 111.9 |
| **Average** | | **346.0** | **82.4** | **24.3** | **7.0** | **321.7** | **47.7** | **0.1** | **11.3** | **11.3** | **113.5** |
| Nov 107 | v1 | Number of Onion per 4.2 sq m | Number of Onion per 4.2 sq m | Number of Bolting | Bolting % | Number of Onions to be Sold | Wt kg per 4.2 sq m (boltings not included) | Average Wt kg per bulb | Wt kg per 1sq m | Wt ton per 1 dn (0.1 ha) | Wt ton per ha |
| | P1 | 350.0 | 83.3 | 0.0 | 0.0 | 350.0 | 41.0 | 0.1 | 9.8 | 9.8 | 97.6 |
| | P2 | 346.0 | 82.4 | 0.0 | 0.0 | 346.0 | 43.0 | 0.1 | 10.2 | 10.2 | 102.4 |
| | P3 | 343.0 | 81.7 | 0.0 | 0.0 | 343.0 | 43.0 | 0.1 | 10.2 | 10.2 | 102.4 |
| **Average** | | **346.3** | **82.5** | **0.0** | **0.0** | **346.3** | **42.3** | **0.1** | **10.1** | **10.1** | **100.8** |

## Appendix 4. Itinerary for Sheikh Khaled U.S Visit June 14-June 30

### Sheikh Khaled Suleman Marei Alatoun's

### Visit to New Mexico State University

**June 14 – 30, 2008**

**Background: Bedouin sheikhs**

Bedouins were divided into very closely related tribes that traveled together. It was natural for these groups of people, who had the same traditions and habits, to have a social leader. This leader, or sheikh, was selected for his wisdom, knowledge and his relevant opinion about Bedouin tribes' daily life. It is a hereditary position that may pass from father to son (not necessarily the eldest) or to a son-in-law or brother.

A sheikh was and is concerned with religious and social, rather than administrative, matters. Perhaps his primary function is to mediate conflicts between tribe members. The sheikh does not make decisions alone. Usually, he confers with many tribe members, especially those with the expertise to make suitable decisions about the particular issue in question. Another role of the sheikh is to be a liaison between his tribe and the government. He is not necessarily the tribe's chief. The chief may be somebody different, and often inconspicuous to outsiders[1]. Many of the traditional functions of a sheikh are today being carried out by other governmental institutions and the courts of law.

Starting in the mid-19th century, Bedoins became less and less nomadic as King Al-Hussein Bin Talal, leader of the Hashemite Kingdom of Jordan, started to settle them into areas where they would have access to education, health services and job opportunities. King Abdullah II, like his father, continues to help Bedouin tribes settle into communities and adapt to modern life. The tribes, however, still look to sheikhs for leadership.

Sheikh Khaled manages a 1300-acre Bedoin tribal farm that he established in 1994. The farm produces fruits and vegetables, such as grapes, apricots, peaches, onions, potatoes and watermelons. His farm affords job opportunities to his community members, and thus the sheikh is playing a major role in the settlement of Modawara dwellers.

**Introduction**

Sheikh Kalid's visit to New Mexico State University was part of a joint applied economic development project conducted by NMSU and the Badia Research and Development Center (BRDC) that commenced in late 2005. A team of NMSU and BRDC experts visited Sheikh Khaled's farm in 2006 and identified an opportunity to help improve onion production. Las Cruces and Modawara, where the farm is located, are at the same latitude and share similar climates. NMSU sent three onion seed varieties to plant at the Modawara farm during the 2007 planting season.

Planting and harvesting activities were followed up by NMSU and BRDC experts. Internet conferencing facilitated the follow-up activities. The most important outcome of the onion planting experiment was the determination of the best planting time to avoid bolting. To give Sheikh Khaled the

[1] www.jordanjubilee.com/meetfolk/bedouin.htm

opportunity to see the applications and technologies used in New Mexico onion production, NMSU team members invited Sheikh Khaled to visit NMSU under a cost-sharing arrangement with the BRDC.

**June 14 - 15**

Sheikh Kalid's visit began in Chicago, Illinois, to provide an opportunity for him to experience a large, U.S. urban center with climate, architecture, and cultural and economic activities very different from those he would find in New Mexico.

On June 14, Sheikh Khaled was met at Chicago's O'Hare Airport by Mr. Ismaiel Abuamoud and Mr. Daher Al Serhan. Mr. Abuamoud is a graduate student at NMSU; Mr. Al Serhan is a Jordanian Bedoin who has lived in Chicago for 15 years. The group later met for dinner with Mr. Mwafaq Al Serhan, a PhD student at the University of Wisconsin at Madison.

June 15 was spent touring geographic, economic and cultural landmarks such as Lake Michigan, Adler Planetarium, Buckingham Fountain in Grant Park, the Navy Pier and Sears Tower, which at 1,450 feet and 110 stories high, is the tallest building in North America and the third tallest building in the world.

**June 16**

Sheikh Khaled and Mr. Abuamoud arrived at El Paso International Airport at 12:20 pm and were met by Mr. Raed Halalsheh, and Mr.Ahmad Al Hammouri, Jordanian graduate students at NMSU. On the drive to Las Cruces, the Sheikh saw parts of the City of El Paso and the American-Mexican border. At 7 pm, Sheikh Khaled had dinner with Mr. Richard Phillips, Director, Project Management Office,College of Agriculture and Home Economics.

**June 17**

Mr. Phillips, Sheikh Khaled and Mr. Abuamoud met with Professor Lowell Catlett, Dean of the College of Agriculture and Home Economics and Professors Joe Corgan, Jim Libbin and Jeanne Gleason. Professor Catlett welcomed Sheikh Khaled, and they talked about his visit to NMSU and the NMSU/BRDC onion project that had been implemented at his farm in Jordan. The Dean gave Sheikh Khaled a hat with the NMSU logo.

After the meeting Mr. Phillips, Dr Corgan, the Sheikh and Mr. Abuamoud toured the NMSU onion research field. They were met by Dr. Raja'y Mohyi, an NMSU researcher, and Mr. Gary Worth, Director of News and Public Affairs for KRWG-TV. Mr. Worth taped the tour for a documentary that he is producing about the NMSU/BRDC project. Dr. Raja'y showed the Sheikh different experiments, and Dr. Corgan and Dr Raja'y explained about the varieties planted, the irrigation and fertilizing systems, the steps in producing seeds, the equipment used to produce seeds, the equipment used in planting and harvesting and proper seed-storage

conditions. Following the tour, the group met with an onion-seed specialist who is working for a commercial seed company. Sheikh Khaled discussed seed production, onion- bulb planting times, onion harvest times, drying and seed storage. The Sheikh said that this important information may enable him to save thousands of Jordan Dinars annually and that he intends to experiment with these new methods on the tribal farm. Finally, the group visited the field in which NMSU is experimenting on seed production by open pollination.

**June 18**

One of Sheikh Khaled interests was to learn about producing silage for the tribal farm's sheep and as a commercial enterprise. At a 7:30 am breakfast meeting, Dr. Chris Loest provided general information about silage production and how to produce it using simple methods. After this meeting, Mr. Phillips, Dr. Corgan, Sheikh Khaled and Mr. Abuamoud traveled by car for 2 ½ hours to Carzalia Valley Produce, near Columbus, N.M., a few miles from the U.S.-Mexico border. Mr. James Johnson, the company's vice president, welcomed them and conducted a tour of the packing facility. Carzalia Valley Produce, established in 1918, is the home of Carzalia Sweet Onions. In addition to onions, the company produces cotton, chile and wheat. We started the tour where the facility receives onions from the field. The company uses advanced equipment to dry the onions then sends them to computerized belts that sort them according to size; they are subsequently sacked. About 200 workers under a shaded area complete the non-mechanized part of the work. An additional 200 workers harvest onions in the field. Sheikh Khaled commented that what he saw in this company motivates him to be a specialist to produce onions on his farms and to use similar equipment to minimize labor costs. After this tour, Mr. Johnson invited the NMSU group and two buyers who had come to the farm to buy his products, to have lunch at the Pink Store in Palomas, Mexico, just a hundred feet from the border. After lunch, Mr Johnson gave a field tour of his farms, highlighting the irrigation and fertilizing systems. Mr. Johnson also showed the group a mechanical harvesting machine in operation on a neighboring farm. Mr. Abumoud videotaped the working machine so that the Sheikh could show it to workers on his farm in Jordan.

During the evening, Mr. Raed Halalsheh, a Jordanian PhD student studying animal science at NMSU, took Sheikh Khaled on a tour of the NMSU sheep, cattle and horse barns to give him some ideas about feeding methods used.

**June 19**

Dr. Corgan, Dr. William Gorman, Sheikh Khaled, Mr. Worth and Mr. Al Hammouri visited Barker's Onion LC at 9 am to view the company's onion processing, packaging and marketing operations. In the afternoon,

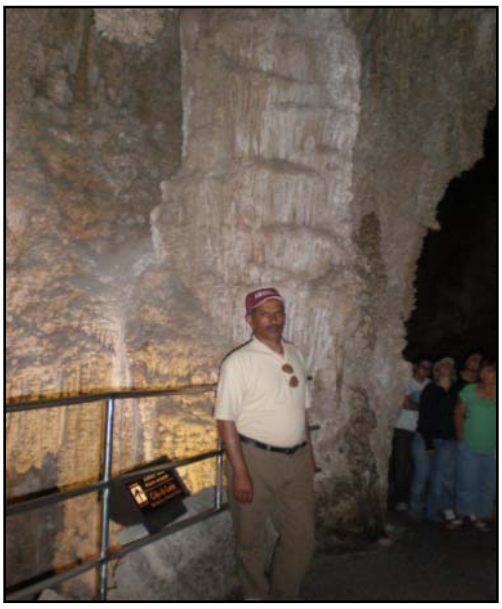
the group went to Hatch to visit another onion processing facility. Sheikh Khaled commented that the machines used in this facility were more relevant to his work since they are simpler than the ones used by Carzalia Valley Produce.

**June 20**

Since it was a Muslim holy day, there was no official schedule. Mr. Abuamoud took the Sheikh to the mosque. Afterward he met with students from various Arab countries at Mr. Abuamoud's house on campus.

**June 21 - 22**

Mr. Raed Halalsheh, Mr. Ahmad Al Hammouri, Sheikh Khaled and Mr. Abuamoud traveled to Carlsbad, N.M., to visit Carlsbad Caverns National Park. Enröute to Carlsbad they visited White Sands National Monument, Ruidoso, N.M., and the Living Desert State Park, as well as some silage production sites. At the Caverns, the group walked down 750 feet underground to reach the largest room of the Caverns, spent about 2 ½ hours walking through formations of calcite crystals, then returned to the surface via an elevator. This trip provided an excellent opportunity for the Sheikh to view ways in which the U.S. manages various cultural and natural resources to balance preservation with the need of nearby communities to derive economic benefit from these resources.



**June 23**

Mr. Robert Foster was the guide for a visit to Sun Pumps Company at Stafford, Ariz. about 3 hours west of Las Cruces. Sun Pumps produces solar-powered water pumps and controllers for irrigation and other applications. This state-of-the-art technology helps to lower the cost of energy used for pumping water. Mr. James Allen, Sun Pumps' president, gave Sheikh Khaled an estimation of the cost of having a similar system on his farm in Jordan. Sheikh Khaled estimated that this technology could save half of his current irrigation pumping costs. Mr. Allen conducted a tour of his lab where he is working to develop the products.

**June 24**

Mr. Phillips, Dr. Bernd Maier, Sheikh Khaled and Mr. Al Hammouri went on an irrigation technique tour and visited dairy farms between Las Cruces and El Paso. Sheikh Khaled saw the process of milking and feeding cows, and how water is cleaned and reused to irrigate alfalfa. In addition, Sheikh Khaled visited a vineyard and apricot orchard.

**June 25**
Sheikh Khaled was interviewed by reporters from KRWG-TV and K-FOX News. During the interviews, he answered questions and talked about his experiences during this visit, and how much of what he learned will help him to improve his work. The K-FOX news interview was broadcast as part of the 9 pm news program.

**June 27 - 29**
Sheikh Khaled met with Ms. Kari Bachman and Ms. Linda Schulz from NMSU to talk about his experience as a Bedouin tribal chief and about women's roles in the Bedouin community. Sheikh Khaled, Mr. Al Hammouri and Mr. Abuamoud met with Dr. Corgan at his house to review some information regarding onion production, and to get more information from Dr. Corgan about seed production. The Sheikh spent the remainder of the trip visiting with Jordanian and other NMSU Arab students and buying some gifts for his family and friends in Jordan.

**Conclusion**
During his visit Sheikh Khaled met with experts in different fields and learned about:

- onion seed production,
- onion planting,
- onion harvesting and packaging,
- onion varieties,
- fertilizing and irrigation,
- solar energy for water pumping,
- new grapes varieties,
- silage production, and
- natural and cultural resource management.

In addition, Sheikh Khaled built good social relations and friendships with American people and Arab students. He said that he will try to apply as much as he can of what he learned on his farm, and he is looking forward to visiting NMSU again.

**Sheikh Khaled said, "**I learned a lot. NMSU showed me advanced irrigation systems; chemical and organic fertilizers; and pest control methods. Moreover, they showed me advanced agricultural product processing and marketing. I am so pleased to see advanced mechanization and tools in the agricultural field. I appreciate the intensive field tours which enriched my knowledge. Finally, I would like to thank New Mexico State University and Jordan Badia Research and Development Center (BRDC) who sponsor projects that accrue great benefit to both countries. Also, I would like to thank the College of Agriculture and Home Economics, represented by the Dean of this great college. In addition, I would like to thank Mr. Rich Philips for making me feel so welcome and for his wholehearted efforts in BRDC/NMSU cooperative projects."

The Sheikh also thanks Dr. Corgan for his valuable assistance. And he thanks everyone else he met with during his visit.

Disclaimer

The ideas and views expressed in this report represent the views and opinions of the authors and do not necessarily represent the official view of the organizations participating in either the *Sustainable Development of Drylands Project* or the funding sources, USAID-Washington and USAID-Jordan. Comments relating to this report should be addressed directly to the authors.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