EASTERN REGION DRIED FRUITS & NUTS SUBSECTOR/MARKET ASSESSMENT

Kunar, Laghman & Nangarhar Provinces, Afghanistan

15 February 2006 – 15 May 2006

Study performed by Roots of Peace for Development Alternatives, Inc. funded by USAID under the Alternative Livelihoods Program – East Region.

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1. Executive Summary

Dried fruit and nut farmers are earning a fraction of their potential in the Eastern Region of Afghanistan. Apricots, walnuts and almonds could offer excellent income potential for local farmers with relatively simple interventions. A program that complements the existing ALPS-E nursery project could expand commercial farming in the region, elevating many casual farmers to agribusiness men. The largest impact DAI-ALP can have would be to foster stronger commercialization of farming and post–harvest processing.

A Roots of Peace survey team reviewed production, processing and marketing in the Eastern Region with special focus on apricots and nuts. Three main growing regions were observed: Jalalabad irrigated areas, alluvial areas at the base of the mountains to the south, and the southern mountain range. Jalalabad is the capital city of Nangarhar province of Afghanistan and is one regional center for commerce for the eastern area production. But commerce in Jalalabad is over-shadowed by traders from Peshawar who have superior trade and value-add facilities.

1.1. Production

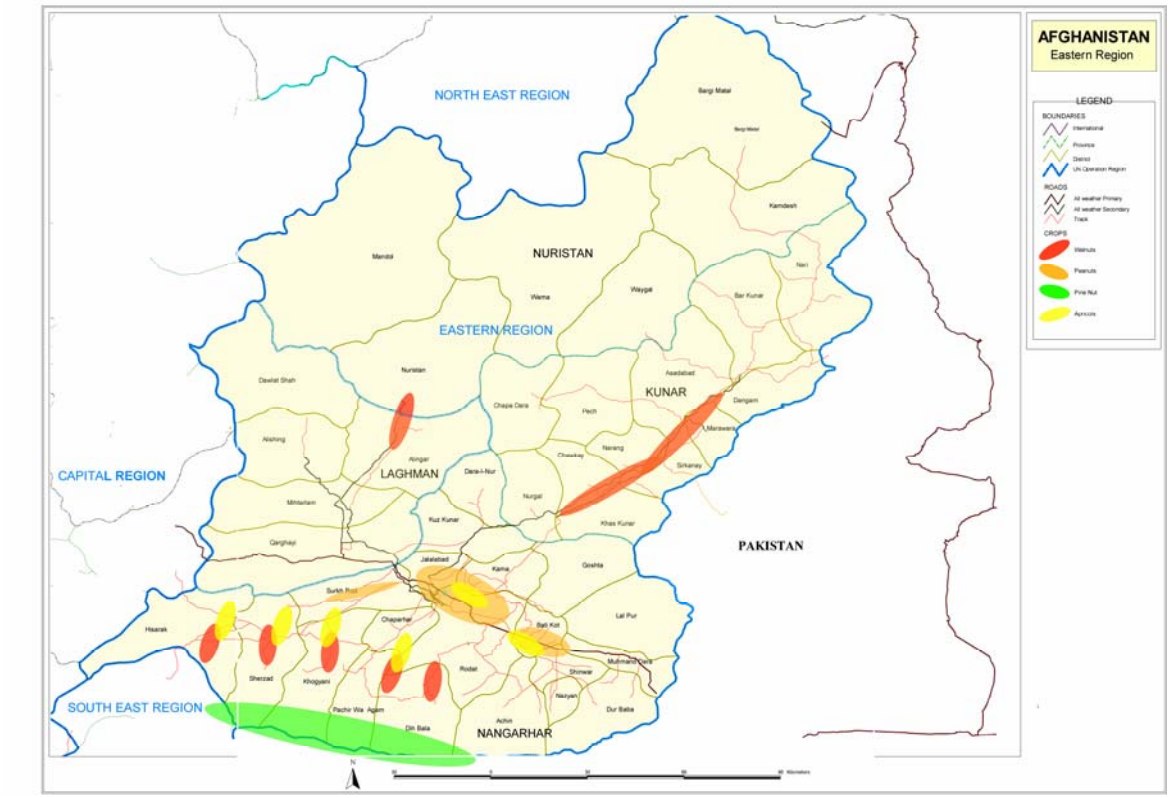
This region supports a number of fruit and nut trees whose crops can be dried or roasted as cash crops. Orchards in and around Jalalabad are dominated by small, poorly managed plots with several kinds of trees. Basic cultural methods are lacking in most cases due to lack of knowledge and in many cases simply due to lack of interest. A farmer with fifteen trees of six different tree crops will never become proficient with any one of the crops. Relatively simple interventions could show significant improvement in farm income. In many cases, interventions could help farmers increase orchard income from $0 to $71 per tree. Interventions are recommended for new and existing orchards.

It is highly recommended that a simple, inexpensive intervention be undertaken immediately to guide farmers planting new saplings from IF Hope and help them establish orchards that will survive and become real commercial operations. Establishing the orchards in the correct manner from the start will have a major impact on farmer's income for years to come. This relatively small and simple intervention would include support for farmers to establish successful commercial orchards with proper tree density, tree planting techniques and cover crop management.

For the existing orchards, simple interventions to improve cultural methods will lift yields to normal levels. This report shows that the number and density of trees planted of one variety directly impacts farm income. This is a rather simple concept that is repeatedly ignored in the Eastern Region. When farmers plant less than 10 trees, the return is typically negligible for a cash crop. Farm income becomes strong when farmers plant over 30 trees. Planting additional trees to replace other types or augment existing trees would be recommended. The survey team made an unscientific, but telling observation – farmer's children had shoes and were well dressed when their family had 30 trees or more. After visiting many orchards, we could almost predict the orchard size and health by seeing the children.

Dried Fruits - Apricots

Of all the fruit crops in the region, apricots have the best potential for increasing both fresh and dried fruit production. Apricot production has not rebounded from the prolonged conflict and almost all of the apricots grown are consumed fresh by their owners or sold on the local market.



Major dried fruit & nut growing areas

Establishment of larger orchards (50+ trees) is recommended. California orchards are planted 240 trees per hectare.

Apricots are grown in and around Jalalabad and in the southern districts. Other fruit trees currently dominate tree fruit production, with citrus as the top producer. Citrus is not considered a dried fruit candidate.

Walnuts

Walnuts are a good crop for this region because they can withstand the rugged roads and their trees thrive here. The walnut trees seemed to have survived the 23 years of conflict intact, but are not receiving adequate attention. Walnuts prefer the soils with better drainage in the river basins leading up to the mountains. The main production regions for walnuts are in the southern portion of Nangarhar Province and in Kunar. Basic interventions can improve quality and yield.

Pine Nuts

Pine nuts are a specialty crop harvested in large volume from natural stands of pine trees in the mountains of on the southern border Nangarhar Province. These nuts command a very high market price because growing areas are limited and demand is increasing. The

trees in the pine nut forests of Afghanistan are listed as a species at risk and estimates are that the variety will be extinct in the next 20 years. Over harvesting of the seeds has an obvious result.

Peanuts

Peanuts are an annual crop and their production has resumed very quickly. Peanuts are cultivated in crop rotations on irrigated land near the river. Supply of this product in the Eastern Region and in Pakistan easily meets local demand. Therefore there are relatively low prices and income potential from this ground crop.

Almonds

Almonds can be a very lucrative crop in this area. Small pilot orchards have been planted, but the variety used was low quality. Afghanistan has some wonderful varieties that could grow in the higher areas surrounding the Jalalabad basin. This crop, as you can see from Table 1, has strong commercial potential.

Table 1. **Current and Potential Farm Income for Dried Fruit and Nut Crops**

Crop	Current Income Range Surveyed	Potential Gross Income per Hectare (see note)
Almonds	No significant production	$4,750
Apricots	$0 - $2,000	$3,689
Peanuts (part of crop rotation)	$336	$950
Pine Nuts	$517	$517
Walnuts	$557 - $5,325	$4,658

Source: Potential income for almonds, apricots and walnuts are derived from average commercial planting densities in the United States (California Agriculture Statistics), local tree yields from the experienced farmers and current farm gate prices in Eastern Region. Peanut potential income is based upon USA yields (USDA, National Agricultural Statistics Service) and local farm gate prices.

1.2. Processing

Fruit Drying

Processing capacity in the region is very limited and there is no mechanized dried fruit processing. Dried fruit is not widely available since there is little fresh fruit surplus. Farmers make can sell fresh apricots for twice the price of dried apricots, so fruit is only dried if it can't be sold fresh. Fruit drying is done in the villages and its frequency is increasing as production increases. Current drying methods do not produce a high quality product. Grit becomes lodged in the dried fruit as it is dried on the ground and cannot be removed by washing later in the value chain. Training farmers how to dry fruit correctly would be an easy intervention to create a cash crop from fresh fruit that cannot be sold locally. This intervention becomes more critical as production of apricots increases because fruit that can't be sold on the local market can be dried and sold as a cash crop.

Roasting & Shelling

Existing nut roasting facilities are out of date and badly in need up upgrading. Local nut roasting enterprises rely on wood fuel, putting them at a competitive disadvantage in terms of both cost and quality. Improving the processing capacity in Jalalabad will keep more of the income from nuts in the region and will allow Jalalabad traders to participate in

increased trade. There are no mechanized nut shelling operations and all shelling of walnuts and pine nuts is done by hand.

Storage

A few storage facilities exist, but they lack any type of cooling systems or pest control. Simple improvements will allow these storage facilities to prolong the shelf life of products and eliminate insect infestations. Afghan traders must have adequate storage facilities in order to add value and compete with Pakistani export traders. Proper storage facilities will prolong the selling season for traders.

1.3. Marketing

Jalalabad traders simply do not have the infrastructure to support any sort of value-added service beyond consolidation of crop for sale to local or Pakistani markets. Most of the production is actually shipped immediately south into Pakistan, bypassing Jalalabad. The sidesteping of local traders and processors is due to a combination of factors: the close proximity of Peshawar; the poor processing and storage facilities in Jalalabad; and the bureaucratic restrictions on exports which are mostly ignored by Pakistani traders.

If they had the basic processing and storage capability, Jalalabad traders could export their products to markets beyond Pakistan. Work by Roots of Peace in other parts of Afghanistan has shown that increased export activity benefit farmers by raising local prices. Interventions that would allow Afghan traders to add value are recommended.

2. Introduction

2.1. Alternative Livelihoods Program East

Development Alternatives, Inc. (DAI) and United States Agency for International Development (USAID) executed the Afghanistan Alternative Livelihoods Program (ALP) Task order on February 15, 2005. The objective of the task order is to "Provide an approach designed to strengthen the Afghan Government's capacity to address the problem of illicit poppy cultivation and to promote improved economic opportunities and the diverse regional economic growth through a program in the Eastern Region that are the mainstays of the opium economy. "One of five major project components is Private Sector Development (PSD), which is charged with contributing to the development of both agricultural (with the Agribusiness component) and non-agricultural sectors. One major effort of the PSD is to undertake assessment of chosen sub sector so as to better target relevant support. The strategy for doing so is to increase competitiveness, performance, and growth of the private sector businesses, which is expected to contribute to the growth and improvement in economic and social conditions.

2.2. Purpose of Study

The purpose of the consultancy is to undertake a full Sub Sector/Market Assessment (SS/MA) of the dried fruit and nuts in the environs of the Eastern Region of Afghanistan, the Consultant will take an in-depth view of the sector focusing on below points:

- To determine suitable fruit for drying, and nuts for processing according to market demand and identify growing areas which are suitable for the various products.
- To understand the current condition of dried fruit and nuts, focusing on production, marketing, technical and economic analyses.
- To investigate post production from the standpoints of packaging, processing methodologies, transportation etc.
- To recommend dissemination of new technologies including irrigation, management technique for the dried fruit and nut sub sectors.
- To identify the difference of cost between fresh and dried fruit.
- A comprehensive view of the entire value chain with identification of needed support to the sub sector, utilization of and need for business service provision in developing SMEs. Particular focus on the developing of processing business for the sub sector. The end result will guide the ALP-E, PSD and Ag. Business Teams in providing support to the sub sector - resulting in a more vibrant market environment with potential for increasing the employment at all levels of the value chain.

2.3. Roots of Peace Team (ROP)

ROP has undertaken this study for DAI under their ALP-East Region Program. ROP has been working with permanent tree and vine crops in Afghanistan since 2003. ROP is based in Karte Char, Kabul, with sub-offices in Bagram, Samangan, Mazar-e-Sharif and Kandahar. ROP home office is located in San Rafael, California, USA.

ROP utilized Afghan nationals for much of the field survey for multiple reasons. The survey teams usually comprised of Peer Mohammed, Gul Mohammed, Lal Mumtaz and local contacts facilitating introductions in remote areas. This team was able to travel to districts that were considered to insecure for the expatriates, Gary Kuhn, Jorge Alvarado and Ed Hayashi, to travel. Due to Jorge Alvarado's ability to blend in, he was able to push out further than other expatriates and traveled comfortably on day trips from Jalalabad.

2.4. Areas

The team surveyed areas around Jalalabad, including Jalalabad itself, Badi Kot, Qarghayi, Mihtarlam and Surkh Rod. These districts were very accessible and the team surveyed almond and apricot orchards and crop rotation areas where peanuts would be planted. We also crossed the river and surveyed Kama extensively. Portions of the survey team were able to visit Khogyani, Panchir Wa Agam, Heserak, Sherzad and Chapahar in the south where they surveyed walnut and apricot orchards and hiked in the border mountains to see the pine nut forests. The team was not able to complete a comprehensive survey of all areas due to rotating poppy eradication areas and specific "no travel" areas. Having a complete survey of all areas would be of only slightly more value and would have put the team at risk. The team was satisfied with the access situation and were pleased to have visited the production areas.

3. Methodology

The team started by developing an initial subsector map based on all that has been learned thus far by DAI and other organizations, people in the region and initial market observations. From this initial map, the team postulated constraints and opportunities in the Subsector based upon existing knowledge, studies and initial observations.

The population and geography were analyzed with the focus on the key actors of the value chain including producers, input suppliers, distribution intermediaries, processors and marketers. We then developed questionnaires for the field survey teams. An advance Afghan market development team was dispatched in advance of the expat team's arrival. This team worked with the initial questionnaire and was also able to confirm the main production areas. When the expatriate team arrived, we already had significant feedback which allowed us to modified the survey scope and refine the questions. We continuously refined the questionnaire as we gained more knowledge of the region.

ROP conducted numerous surveys in multiple areas of the Eastern Region. The team would ask the same questions to multiple people until a consistent grouping of answers was confirmed. In the cases where we received scattered answers, the team would probe deeper to determine the variance. Our team interviewed participants involved in different phases of the value chains. Due to the inter-related nature of value chains, we were able to compare data provided from like participants, but also from different sources. Therefore much of the field data received in these surveys and used in the various charts, is not attributed to a single person or entity. Rather than list the multiple sources for each set of data, we have instead listed them in a sources section with groupings reflecting the nature of the data provided. Where specific people or organizations are identifiable for providing reliable data, they are called out in the source footer to the table or graphic.

The areas for the survey were restricted due to security issues. The team was not able to visit the Anchin District to the south due to poppy eradication actions by the government. The walnut producing districts of Kunar were not visited due to overall security concerns.

From constraints identified in the survey questionnaire, we determined the BDS that could address those constraints and we developed a constraints' matrix to highlight the potential interventions (see Appendix #1). The possibly interventions were analyzed. We then developed proposed programs to address the best opportunities based upon the following criteria:

In this step, all information gathered from all sources will be analyzed and a program for intervention will be designed. The following are some considerations for formulating a market led, value chain intervention program:

- Market Driven
- Sustainability
- Business-like and demand-led
- Made to Order – focused and relevant activities that are directly linked to the market need
- Participatory approaches

- Leverage existing institutions, organizations and initiatives
- Build capacity of local BDS organizations key institutions to carry on market facilitation activities
- Clear exit strategy for programs which allow for sustained activities

4. Findings

4.1. Nut Summary

The Eastern Region of Afghanistan offers a variety of climates conducive to nut trees. Given the correct altitude and the accompanying temperature ranges and winters, almonds and walnuts thrive. Ground nuts do well in the irrigated lowlands of the Nangarhar Province, while walnut trees thrive in the approaches to the steeper surrounding mountains alongside the rivers flowing out of the mountainous valleys. Almonds, although not grown in any large numbers here, will also grow well in the upper valleys of the area. Pine nuts grow naturally in the mid-elevations of the southern mountain range separating Afghanistan and Pakistan.

Walnuts are the most prevalent crop, but pine nuts have the most commercial value. Peanuts and walnuts are commercial crops, but offer significantly less return. Sanitary issues with peanuts would restrict this crop to local and Pakistani trade. Pine nuts are good source of proteins and are commercially viable crop with growing world demand. For this reason, pine nuts are one of the better opportunities with walnuts as the second opportunity. Almonds are a commercially viable crop in the Eastern Region. Current production in this area is negligible with only a couple small pilot plots. Internationally, almonds demand is growing at a steady 5% rate and they hit historic high prices this last year, exceeding $4.00 per pound.

The survey team interviewed traders, customs officers, farmers and merchants to estimate production of crops in the region. In other parts of the country customs reports provide a good estimate of production, but due to the large amount of produce that bypass the customer office, their records were insufficient.

Table 2. **Crop Production & Value**

Products	Weight	Value		
		Farm Gate	Rural trader or agent	Wholesale Trader
Pine Nuts	5,000 mt	$14,350,000	$17,900,000	$22,650,000
Walnuts	7,200 mt	$5,112,000	$5,832,000	$5,976,000
Peanuts	2,400 mt	$696,000	$744,000	$1,152,000
Almonds	negligible	negligible	negligible	negligible

Source: Based upon info from traders & exporters within Eastern Region from ROP survey.
Weights are in-shell, kernel weights.

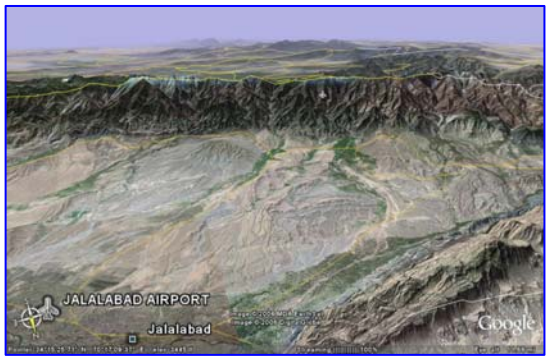
4.2. Pine Nuts

Growing in native forests to the north and south of Jalalabad, pine nuts are a leading nut product from the Eastern Region. Pine nuts have been eaten in Europe and Asia since the Paleolithic period. Pine nuts contain about 31 grams of protein per 100 grams of nuts, the highest of any nut or seed. They are also a source of dietary fiber. Pine nuts are an essential component of pesto, and are frequently added to meat, fish, and vegetable dishes. They are also used in chocolates and desserts such as baklava.

Nangarhar Pine Nuts

Korean Pine Nuts, the current standard in Western markets

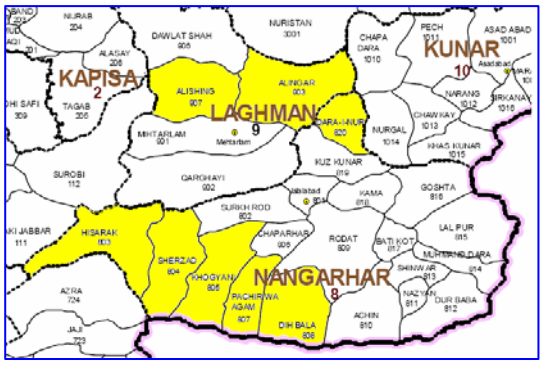
Unshelled pine nuts have a long shelf life if kept dry and refrigerated (at -5 to +2°C), but the shell must be removed before the nut is eaten; shelled nuts (and unshelled nuts in warm conditions) deteriorate rapidly, becoming rancid within a few weeks, or even days in warm humid conditions. Pine nuts are commercially available in shelled form, but due to poor storage, these rarely have a good flavor, all too often already being rancid before they are purchased. The most important species in international trade is Korean Pine, harvested in northeast China. In the United States and Mexico, the Pinyon Pines have traditionally been the most highly sought after pine nuts. The Afghan pine nut is favored in China. Pakistani roasters and traders have been servicing the Chinese market with Afghan pine nuts for the last few decades.



Looking south from Jalalabad towards Pakistan. Anchin is on the left and Khogyani is on the right.

4.2.1. Growing Region

Pine nuts grow in the mountainous regions along the southern border with Pakistan in Nangarhar, Paktya and Ghazni. Pakistan has some pine nut forests in smaller amounts in the mountains near the border areas with Afghanistan. Within Nangarhar, pine nuts grow natively in the mountains approximately 300m to 1,000m above the alluvial plain and the main populated areas below. This is roughly 2,000m to 3,000m in elevation. This mountain range reaches 4,000m in elevation. The major production areas are Nuristan, Laghman hills (Alishang and Alingar), Khogyani (Khaderkhail, Wadisar and Zawa), Hisarak (Ghowagiza and Azra), Pachir Wa Agam, Sherzad (Markikhai and Kodikhai) and



Shinwar (Haskamina and Spinghar). Our team confirmed that there are concentrations of pine nut tree forests remaining in Nangarhar in the districts of Sherzad, Pachir Wa Agam, Hisarak and Khogyani. These growing areas are along the ridge which is the southern border of Nangarhar and northern Pakistan. The ROP team visited the all the southern districts except Anchin. Security issues did not allow the team to travel to this district.

Table 3. **Pine Nut Yield & Value**

	Yield per Tree	Trees per Hectare	Average Harvest	Gross Income for Harvester
Pine Nuts	25 kg	variable	180 kg	$517

Source: Yields and harvest based upon ROP field survey in border region southeast of Jalalabad. Prices are based upon 2005 prices.

The Google Earth view (above) is looking south from Jalalabad to Pakistan. The traces of green are the areas of current agriculture dominated by wheat now, but also apricots. The pine nuts are along this ridge. We have been informed that the district of Dara-i-Nur may also have some forests of pine nut trees.

Opened pine cone on Chilgoza Pine

4.2.2. Varietals

The Pine Nuts stands are dominated by a single varietal in this region, the Chilgoza Pine. Locally it is called Gerardiana which is also its Latin name, Pinus Gerardiana. It is also known as 'noosa' and 'neoza'. It is a pine native to the northwestern Himalaya in eastern Afghanistan, Pakistan, Kashmir and northwest India.

This is a slow growing short-needled pine which grows to 10-25m tall, depending upon soil conditions and elevation. The tree is usually deep, wide and open crowns with long, erect branches. The cones are 10-18cm long, 9-11cm wide when open, with wrinkled, reflexed apophyses and an umbo curved inward at the base. The seeds (pine nuts) are 17-23mm long and 5-7mm broad, with a thin shell and a rudimentary wing.

Chilgoza Pine is well known for its edible seeds. The seeds are locally called and marketed as "Chilgoza", "Neje" or "Neja" and are rich in carbohydrates and proteins. This species is threatened. Over-cutting and intensive grazing is causing poor regeneration, which may result in the extinction of this pine species.

Chilgoza Pine in moutains of southern Nangahar

4.2.3. Typical Growing Situation

The ROP team hiked into the mountain country along the southern border. The hike started just below 1,500m. The first pine nut trees were growing at 2,100m and the trees became dense around 2,300m. The trees grow at elevations up to 3,000m, but thin out substantially at around 2,500m. These pines grow in a more scattered fashion and do not form a dense forest canopy. The ground is steep, rocky terrain with loose sandy soil. The forest covers large areas and is not confined to specific river valley locations like much of Afghan vegetation.

4.2.4. Harvest

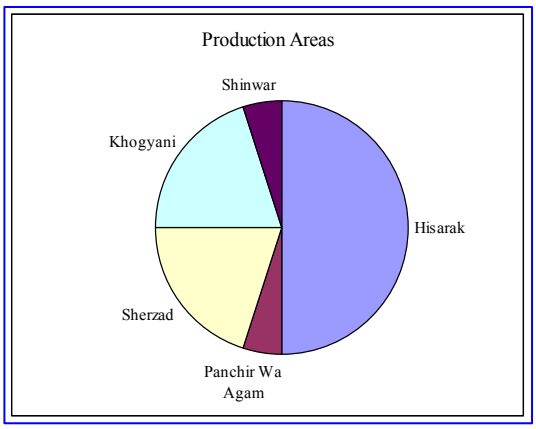
The forests are largely on public or tribal lands and are loosely managed. Management is restricted to attempts to control when and who may harvest the pine nuts. The harvesters usually have a long stick with sharp iron metal end for harvesting the pine cones. Harvesters hold one end of stick in his/her hands and cut pine cones with the sharp metal end from the pine nuts trees' branch.

Pine nuts in trader store room in Jalalabad

After the harvest, the tribesmen bring the pine cones to drying areas on the ground or the roof of their homes. The cones are placed in the sun for up to 20 days to open up the cones to remove the nuts. After the 20-day period the pine nuts can be taken out by shaking the pine cones. This is an entirely manual process. The nuts, in thin shells, are then bagged in burlap, to be carried down the mountain to be sold in the village. In some cases the pine cones are sold to traders who handle the drying process.

In the market in Jalalabad, there are pine nuts harvested early, at the right time and too late by the farmers. The nuts harvested early are lighter in weight as their kernel is not fully matured. The pine nuts harvested at the appropriate time are the 1st sort (grade). Pine nuts season starts on 7th October and ends on 20th February. The harvest time depends upon elevation with the lower elevations first, then working to the higher elevations.

Yields vary wildly depending upon management of the forests and health of the trees. 90% of the pine nuts trees produce 25kg/tree and 10% of pine nuts trees produce 14kg/tree. The difference in production can be attributed to their growing situation, as they are growing wild, but also to the harvest methods employed. Extreme abuse has been observed where the harvester actually breaks branches to get the nuts. Lesser abuse includes hitting the ends of the branches to get the clusters. Both methods have obvious impact on the new growth the following season from the damaged terminal buds.



Source: Based upon information gathered in ROP field survey.

The first grade is usually purchased by large Pakistani merchants through their agents, leaving little top quality nuts for local markets or other traders. The arrangements are made by the network of agents of Pakistani merchants exporting the pine nuts.

4.2.5. Production

There is no record of exact known volumes of pine nuts produced in Nangarhar because most are purchased by agents of Pakistani large merchants from the tribal men of the growing areas. We have made a rough estimate of total production at 5,000 mt, based upon reports from traders in Jalalabad and merchants. Jalalabad traders report a total of 950 mt shipped from Jalalabad last year. Merchants in the southern districts estimate 3 trucks leaving daily, directly for Pakistan, each containing 15 mt for 3 months during the season. ROP dispatched a survey team to the main production areas along the border. From the interviews, the team identified approximately 40% of this estimated production. The survey team did not perform a comprehensive survey as their access to the all areas on the border was restricted due to security concerns.

Jalalabad Traders

Mr. Haji Badam and Mr. Gul Sayed of Hajji Badam Nuts and Dried Fruits Store is the primary trader dealing in pine nuts. Last season they exported 400 mt of pine nuts from Alingar and 550 mt from Nangarhar. According to them, they were the only Jalalabad traders who exported pine nuts last year from Nangarhar.

The table below shows actual production data gained from direct field surveys in the main three production districts. This production volume represents about 40% of the total reported production. Panchir Wa Agam and Dih Bala were not visited due to a security decision made by ROP with information provided by DAI. These two districts, along with three districts to the north of Jalalabad also have limited production of Pine Nuts.

From this table below, you can see that production areas are concentrated and controlled by a limited number of tribes. Three tribes surveyed control almost 40% of the total regional production.

Table 4. **Pine Nut Production & Value**

Pine Nut Production in Khogyani, Sherzad and Hesarak (2005)			
Name of tribe	Pine nut production area	Number of families	Production volume (mt)
Khozakhail	Agam-Balanai	5,000	1,225
Peerankhail	Balanai-Wazir Khowar	2,500	263
Markihail	Zawa ending-Barlakhtai	1,600	49
Kodikhail	Spinshakedalai-Ghunchai Adira	2,000	10
Jabarkhail	Tomanai, Manai and Ghowara Serai	25,000	7
Marokhail	Ghowageeza, Lajgar, Jokan	25,300	7
Tutu	Kudikhail Tangai-Jokan	10,000	350
Hashpan	Kudikhail Tangai-Jokan	400	14
Kharbonai	Wazir Tangai-Markikhail Tangai	28,000	28
Total		**99,800**	**1,946**
Average		**11,089**	**216**

Source: Based upon information gathered in ROP field survey.

4.2.6. Processing

See Processing Section.

4.2.7. Current Market

The predominant buyer is an Afghan agent working for a Pakistani trader in Peshawar. Raw nuts are typically purchased by Afghan agents for Pakistani traders who take them across the border bypassing Jalalabad traders and usually without any export paperwork (see Export Issues section). The Pakistani traders then add value by roasting and shelling. In local markets, pine nuts are sold both un-roasted and roasted. There is limited commercial roasting done in Jalalabad with their inefficient wood fuel roasters. The Pakistani traders / roasters then re-export the roasted Afghan nuts in shell to China, UAE, India and Europe.

4.2.8. Pricing

Pakistani traders are currently offering the top prices for the 1st sort nuts. Since they purchase the nuts directly from the tribal areas, the best nuts never come through Jalalabad. From our survey 19% of the production passed through Jalalabad traders with the remaining amount moving straight to Peshawar.

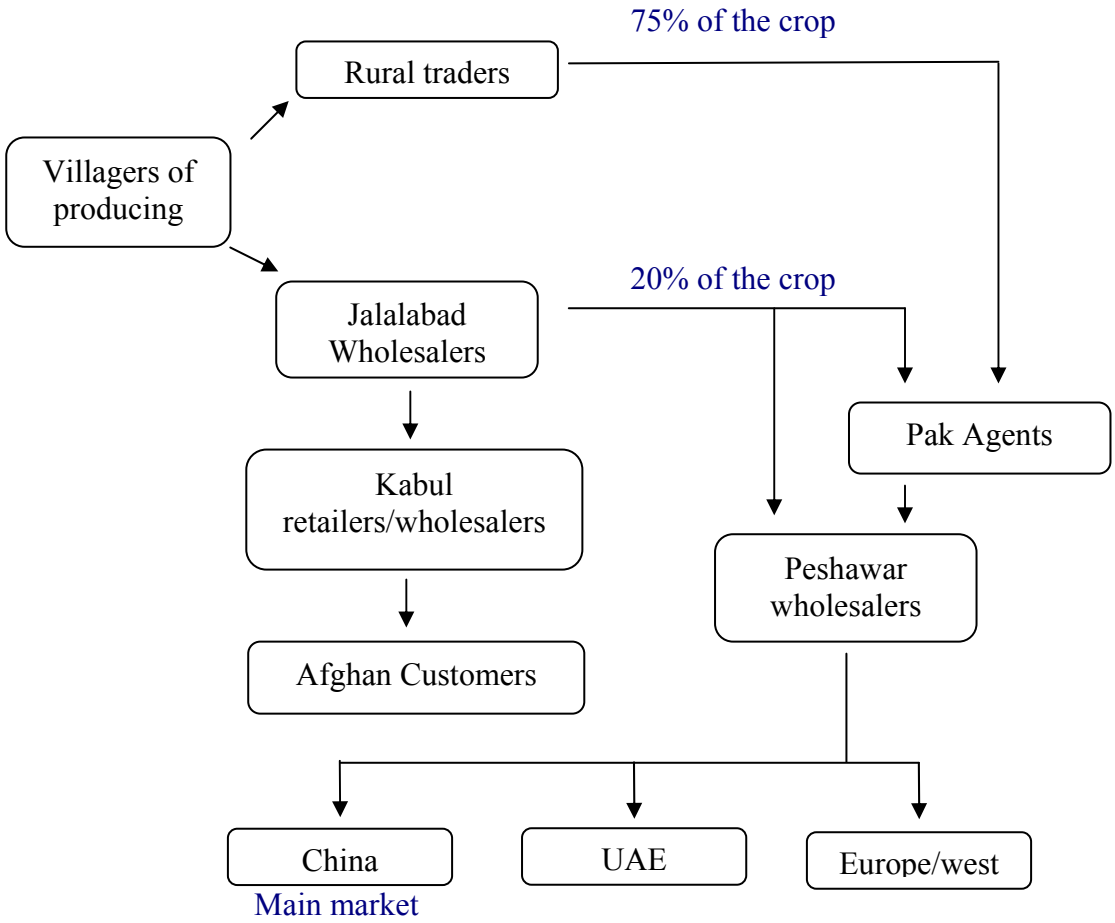
Table 5. **Pine Nut Pricing**

	Pak Rupees per 7 kg.	US$ per kg.
Peshawar 1st Sort		
Farmer's price	172	$2.87
Rural Traders & Agents	214	$3.58
Large Traders	271	$4.53
International Markets		
Roasted, Shelled, Wholesale		$16.00
Roasted, Shelled, Retail		$30.00

Source: Based upon information gathered from traders in Jalalabad and from a survey of multiple wholesale and retail distributors on the internet for international prices for Chinese Pine Nuts. US$1=Rs.59.8

4.2.9. Value Chain

Generic Value Chain for Pine nuts in Eastern Afghanistan, 2006



4.2.10. Transportation

Road is an improved dirt road from Jalalabad to Peshawar. The Pakistani government is in the process of upgrading the route to a paved road. The roads from the production areas to the main road are poor dirt roads.

Pakistani merchants pay a fixed transportation cost to their agents. This transport costs includes any customs fees. Normal transportation cost is Rs. 200/7k (US$0.48/kg) not including customs. Customs cost, if paid, is 2.5%. Bribes may be necessary to ensure shipment of goods through to Peshawar. Last season and average of three trucks left Nangarhar for Pakistan every day for 3 months during pine nuts season.

4.2.11. Quality

There are three grades of pine nuts known in the market. These grades are directly related to the timing of the harvest. Harvest at the correct time (full maturity) and you will most likely get 1st sort. Harvest early and you end up with 2nd and 3rd sort quality. Competition for the harvest usually ensures that no nuts are harvested late.

4.2.12. Impediments

1. Harvest Methods & Timing
   Current harvest methods of beating the branches and sometimes breaking the branches to get the pine cones is obviously not good for the trees and hurts future yields of the tree. Lack of management of harvest times leads to pines nuts being harvested early.
2. Regeneration of Forest
   The Chilgoza Pine grows very slowly and appears to has a low regeneration rate. In the areas surveyed, there were very few saplings and young trees. The forests are shrinking, especially in the lower altitudes that are more heavily harvested. The Chilgoza Pine forests along the Afghan-Pakistan border are on the "lower risk – Endangered Species List" and it has been predicted that this species will become extinct within the next generation.
3. Marketing
   Jalalabad traders do not have links to foreign markets beyond Pakistan. Pakistani traders typically purchase Afghan produce at depressed prices and profit from re-export.
4. Processing
   Current roasters in Jalalabad use wood fuel that does not allow for fine control of the heat. These roasters will burn some of thr nuts or be forced to do a quick roast to avoid burning. Most roasting is done in Peshawar due to the poor local roasters.

4.3. Peanuts

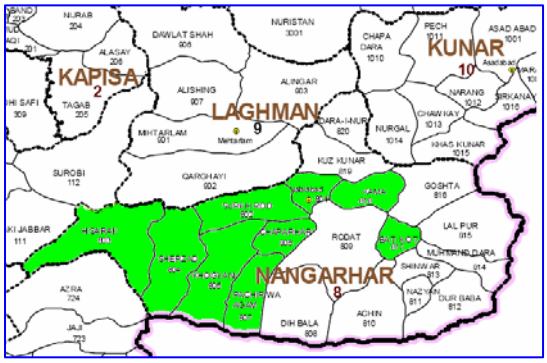
Peanuts are grown in the lowland cultivated areas near diverted water canals from the Kabul and Kunar Rivers. Farmers can plant peanuts or other crops like corn. They are grown for local consumption and for export to Pakistan. Since this study was completed during February and March, the survey team was unable to observe cultural methods and learn their impediments. Roasting of past peanut crops was observed and our focus was on the processing of the nuts.

Table 6. **Peanut Yield and Value**

	Current Yield per Hectare	Current Income per Hectare	Potential Yield per Hectare (see note)	Potential Gross Income per Hectare
Peanuts	1,175 kg	$336	3,323 kg	$950

Sources: Potential yield per hectare represents average USA yields in 2005 (United States Department of Agriculture, *GAIN Report*), prices are based upon Jalalabad trader survey.

4.3.1. Growing Region



Peanuts are grown in lowland irrigated areas in the districts of:

- Khogyani
- Sherzad
- Pachir Wa Agam
- Chaparhar
- Kama
- Hesarak
- Besod
- Badikot

Pakistan grows a varietal similar to the Afghan peanuts, possibly the same. The Pakistani peanuts are smaller than Nangarhar peanut.

4.3.2. Varietals

Peanuts in Jalalabad cool storage bunker.

One variety dominates Nangarhar peanut production. There are peanuts from Nangarhar available in Jalalabad market are known as white peanuts and black peanuts. Black peanuts are not black in color but are not as white as the white peanuts are. In fact, both are the same variety. White peanuts are dried in the sun properly after the harvest before placing them in the sacks. "Black" peanuts nuts that were not properly dried before placing them in the sacks. These peanuts change their color and appear a little darker in color. Traders mistakenly call these black peanuts, when they are all the same varietal.

4.3.3. Typical Growing Situation

Planting takes place in April/May in the low areas near rivers. Diverted water from the rivers irrigates the farmland used for crop rotations. Peanuts follow the winter wheat harvest. Farm holdings are very small plots adjacent to the farmer's village.

4.3.4. Harvest

Harvest in October/November

4.3.5. Production

One jerib produces about 235kg of peanuts in shell. This translates to about $68 per jerib per crop.
Total production for this area amounts to at least 2,400 mt per season. Normal exports are around two trucks daily to Pakistan for the two month harvest season. Each carries about 20mt for a total of 2,400 mt of peanuts exported each year.

4.3.6. Processing

Peanuts need to be roasted to stabilize the nuts for longer shelf life and improve the flavor. Limited roasting facilities are available in Nangarhar, so most of the peanuts are exported to Pakistan for roasting and re-exported to other countries and back to the Jalalabad market and other parts of Afghanistan. The FOB price of raw peanuts produced in Jalalabad is US$ 0.41/kg and the Pakistani roasted, Nangarhar produced peanuts sell for US$ 0.88/kg in Jalalabad. The Pakistani businessmen profiting on this value added to Afghan peanuts.

One of the main reasons for this value chain is the current lower cost to roast and the absence of proper storage facilities in Jalalabad. The cost of roasting peanuts is US$ 0.10 kg in Jalalabad, and US$0. 03 kg in Peshawar, Pakistan (see Nut Processing section below).

4.3.7. Current Market

Agents of Pakistani businessmen buy peanuts in small quantities to keep the farm gate price down. This practice explains the longer time for peanuts to get sold and transported to Pakistan. This also prevents collective marketing.

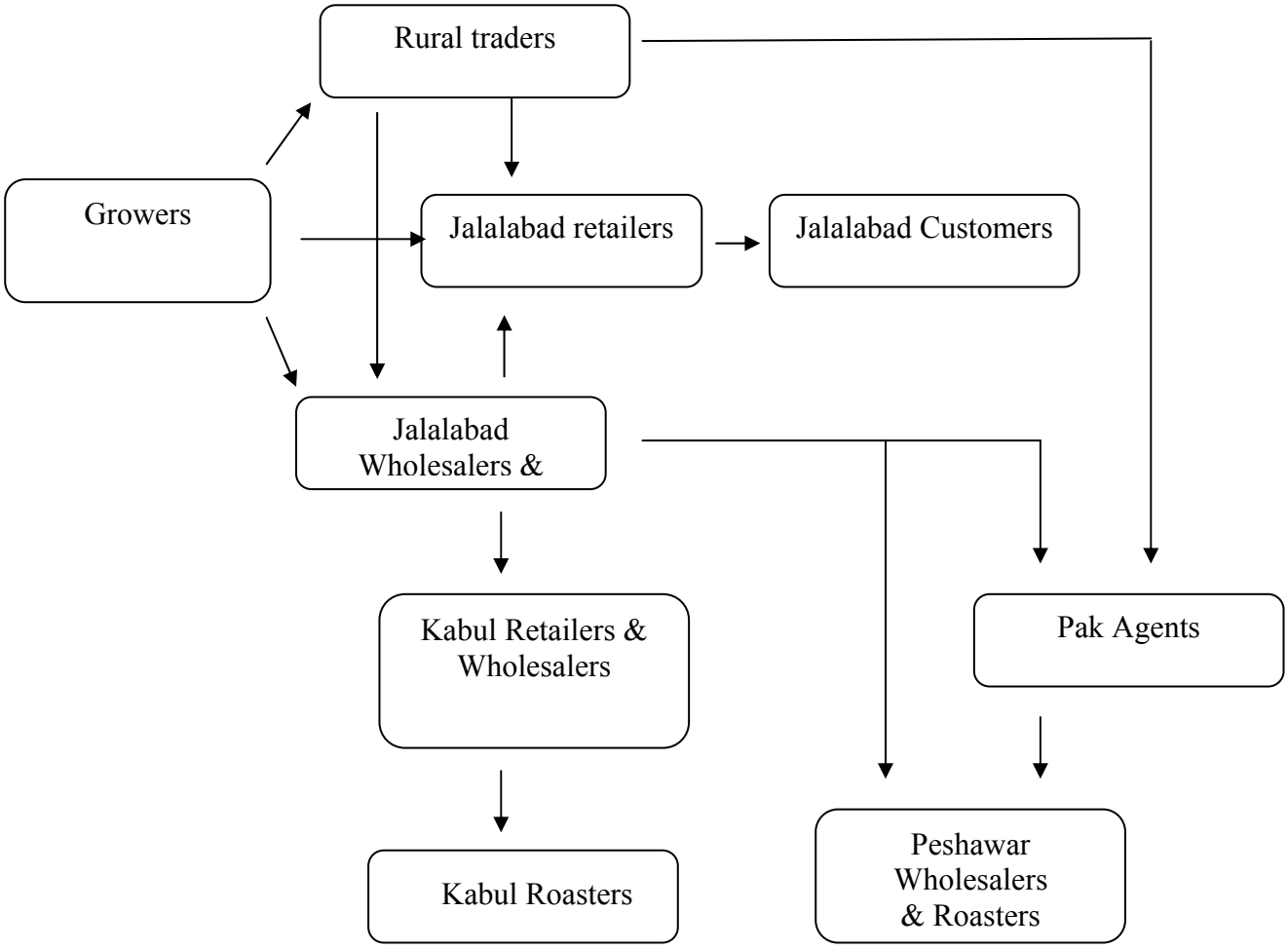
4.3.8. Pricing

Table 7. **Un-Roasted Peanut Pricing**

	Pak Rupees per 7 kg.	US$ per kg.
UN-ROASTED		
Farmers price	Rs. 120/7kg	US$ 0.286/kg
Small trader's agent price	Rs. 130/7kg	US$ 0.31/kg
Small trader's C&F Jalalabad price	Rs. 150-155/7kg	US$ 0.358-0.37/kg
Large trader's FOB Jalalabad price	Rs. 180-220/7kg.	US$ 0.43-0.525/kg
ROASTED		
Jalalabad	Rs. 368/7kg.	US$ 0.88/kg

Sources: Prices based upon Jalalabad trader survey. Currency exchange rate US$1=Rs.59.8

4.3.9. Value Chain



4.3.10. Transportation

Transportation for the hardy walnut is available and current road conditions do not deter the product quality or lessen trade. Available transport is not refrigerated. Refrigerated transport would prolong the shelf life of the nuts, but is not crucial.

4.3.11. Quality

Due to the timing of the survey, we were no able to review newly harvested peanuts. We were able to review roasted peanuts in the cool storage bunkers of Jalalabad traders. The nust appeared in good condition, and except for the un-even roasting, there were of good quality that would be marketable in the regional markets. Concerns over aflatoxins would most likely limit these nuts to this region and restrict them from western markets.

Peanut drying is done irregularly in this region, resulting in a range of color in the dried peanut. The darker colored peanuts earn slightly lower prices in the markets.

4.3.12. Impediments

Peanuts are an annual crop that is grown later in the season. The ROP survey team did not observe any production areas with peanuts as we were out of season.

1. Sanitary
   Sanitary issues (aflatoxin) prevent sale of the Afghan peanuts outside of the immediate regional market.
2. Roasting kilns are wood fuel.
   It is difficult to regulate the temperature for the roasting process using wood fuel. The result is a reduced market value due to discoloration and irregular peanut flavor.
3. Limited cool storage, no cold storage.
   Peanut shelf life can be extended for a few months if they are stored at cool temperatures.
4. Limited value-added by Nangarhar traders.
   Due to the limited storage capacity and poor roasting equipment, Jalalabad traders do not have much capability to add value to the product besides consolidation for shipment to Peshawar. This accounts for the 5% mark-up they use for peanuts.

4.4. Walnuts

Walnuts grow at around 1,200-1,500' just before the transition to the steep mountains rising up from the alluvial plain. Walnut trees send down a deep taproot and do well near streams.

Table 8. **Walnut Yield & Value**

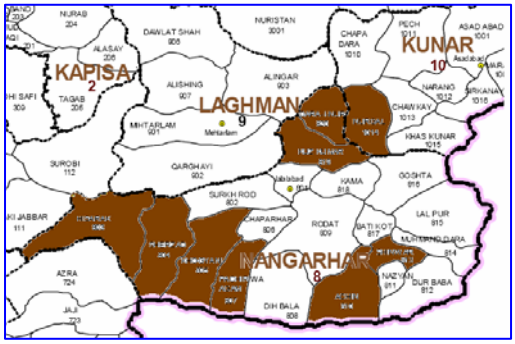
	Yield per Tree	Average Trees per Hectare	Yield per Hectare (see note)	Price per kg	Gross Income per Hectare (see note)
Thick Shelled Walnut	81 kg	81	6.6 mt	$0.53	$3,477
Thin Shelled Walnut	81 kg	81	6.6 mt	$0.71	$4,568

Sources: Yield per Tree and Yield per Hectare are based upon the average yields from the survey listed in Table 9 below. These yields are inconsistent with average US yields of 2.8 to 3.6 mt per hectare. However Afghan yields are consistent with other Central Asia yields, specifically in well cultivated valleys which average 6.5 to 7.5 mt per hectare.

4.4.1. Growing Region

Walnuts are grown in the following districts:

- Achin
- Dara-i-Nur
- Hisarak
- Khogyani
- Pachir Wa Agam
- Sherzad
- Shinwar



Production is spread along the districts southeast of Jalalabad and Kunar Province. 30% of walnuts production is produced in Hisarak, 20% in Sherzad and 15% in Shinwar, 15% from Khogyani, and 20% in Kunar.

4.4.2. Varietals

There are two types of walnuts produced in East Region. There is a thin shelled walnut and a thick shelled walnut. The variation in shell thickness is not that great, but this difference is evident when one tries to crack the shells by hand.

The higher-value, thin shelled walnuts are grown in Khogyani (Wazir), Sherzad (Markikhail, Kodikhail), Shinwar, Hesarak (Ghowagiza, Azra).

Walnuts from Nangarhar. Note discoloration caused by Musk Flies

The lower quality, thick shelled walnut is the Juglans Regia variety. They are grown in Kunar (Chaghal Sarai, Asadabad and Ningalam) and in southern portion of Nangarhar.

4.4.3. Typical Growing Situation

Walnuts are mostly grown on a small scale with families cultivating up to 20 trees, but the team found many occurrences of larger orchards, a finding not observed in the case of other tree crops. Walnuts are pretty hardy trees with deep tap roots. This allow them to be a bit more drought tolerant than other tree crops and survive periods of neglect.

Larger walnut orchard in early spring in Khogyani district

4.4.4. Harvest

Walnut harvest period starts in late October and ends in February. During the harvest season, there are around 400 trucks each containing 18mt unloaded in Jalalabad from the growing areas each season, and represents 7,200 mt or $5,904,000 in commerce.

70% of the walnuts trees produce 100kg/tree and 30% of walnuts trees produce 20kg/tree. This reflects the difference between the trees managed by farmers and those that are in casual farming settings.

4.4.5. Production

These production numbers are estimates based upon surveys in these villages and direct observation. Many areas were not accessible due to security. The areas represent the largest production area, which is southeast of Jalalabad. Another major growing region is to the north of Jalalabad.

Table 9. **Walnut Production & Value**

Walnut Production Areas					
Name of tribe	Number of families	Number of trees	Yield per tree	Yield per hectare	Production
Khozakhail	5,000	2,000	150 kg	12,150 kg	300,000 kg
Peerankhail	2,500	5,000	88 kg	7,128 kg	440,000 kg
Markihail	1,600	1,250	21 kg	1,701 kg	26,250 kg
Kodikhail	2,000	5,000	140 kg	11,340 kg	700,000 kg
Jabarkhail	25,000	50,000	140 kg	11,340 kg	7,000,000 kg
Marokhail	25,300	50,000	140 kg	11,340 kg	7,000,000 kg
Tutu	10,000	2,500	35 kg	2,835 kg	87,500 kg
Hashpan	400	300	30 kg	2,430 kg	9,000 kg
Kharbonai	28,000	40,000	35 kg	2,835 kg	1,400,000 kg
Gandomak	3,000	850	35 kg	2,835 kg	29,750 kg
Total	**102,800**	**156,900**			**16,992,500 kg**
Average	**10,280**	**15,690**	**81 kg**	**6,593 kg**	**1,699,250 kg**

Source: Based upon ROP field survey.

4.4.6. Processing

There are 4 grades of walnuts depending on size and coloring. In-shell walnut shelf life is from one to 1.5 months without refrigeration. With refrigerated storage, the shelf life can be extended, opening up opportunity for sales in a higher-price season.

Walnuts are sold primarily in shell, but some are sold locally already shelled. Almost all exported walnuts are in-shell. This allows for better handling, but also a longer shelf life. They have problems cracking the walnuts manually because the meats often get damaged.

Cracking shelled walnuts is done by hand. Women will take burlap sacks of nuts home and their families will crack (mostly soft shelled) walnuts to earn money.

4.4.7. Current Market

Pakistani merchants buy the 1st grade with the help of their agents' network. Their agents look for opportunities to buy at a lower cost and will buy from anyone including the farmer to the large Afghan trader. Walnut shelf life is from one to one and half months. By February, the walnuts are already sold by the Pakistani merchants.

- About 1080mt of good quality walnuts are exported in one month.
- In the process of exporting, 2 trucks leave per day for Pakistan, each containing 18mt.

The merchants have markets for their thin shelled 1st grade walnuts but thick shelled walnuts have no specific market.

4.4.8. Pricing

Thick shelled walnuts draw 25% less in the market. These prices are mid-season. Early and late pricing can be double these prices.

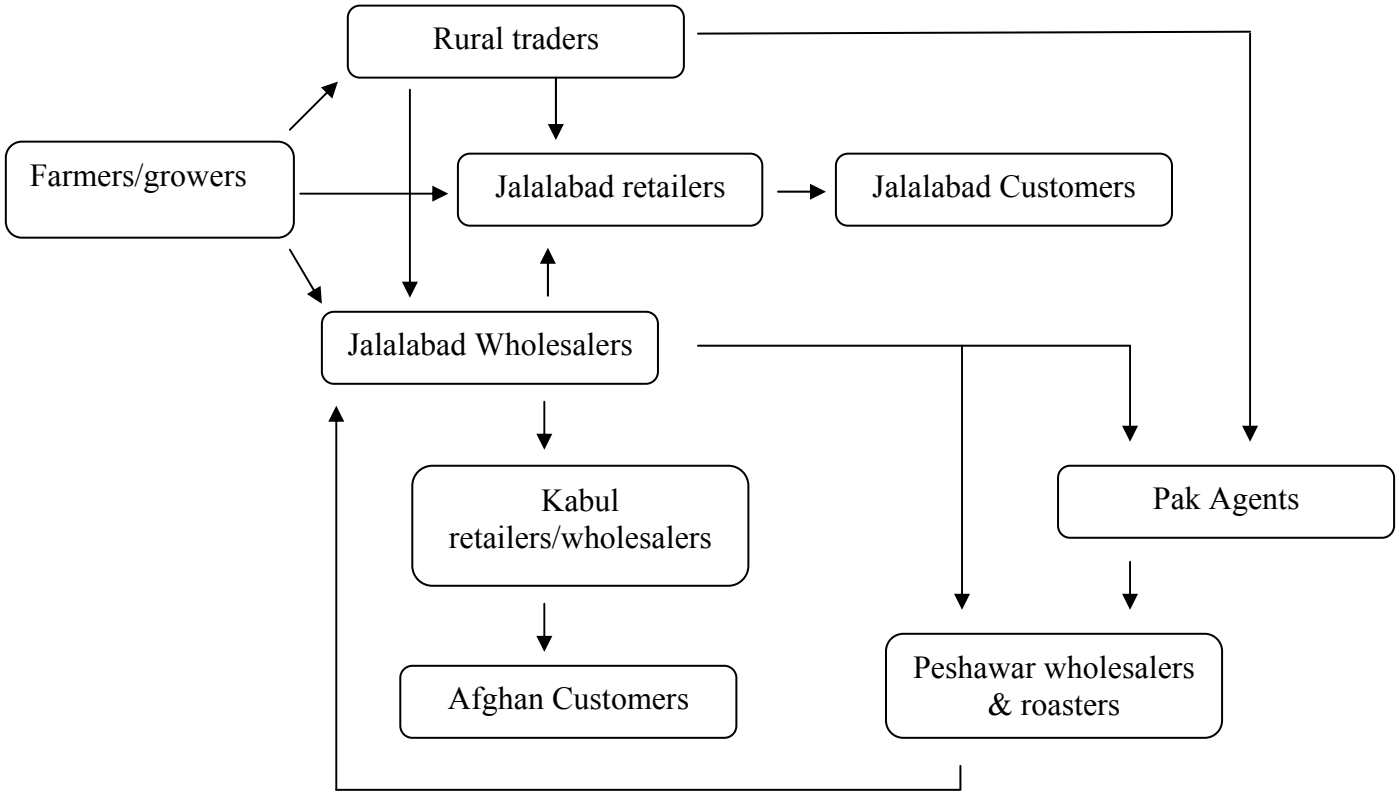
Table 10. **Walnut Pricing by Varietal**

	Pak Rupees per 7 kg.	US$ per kg.
THIN SHELLED		
Farmers price (season)	Rs. 300/7kg	US$0.71/kg
Small trader's C&F Jalalabad price	Rs. 340/7kg	US$ 0.81/kg
Large trader's FOB Jalalabad price	Rs. 345/7kg	US$ 0.83/kg
THICK SHELLED		
Farmers price (season)	Rs. 225/7kg	US$0.53/kg
Small trader's C&F Jalalabad price	Rs. 255/7kg	US$ 0.61/kg
Large trader's FOB Jalalabad price	Rs. 259/7kg	US$ 0.63/kg

Source: Based upon ROP field and trader survey. Currency exchange rate US$1=Rs.59.8

4.4.9. Value Chain

Structure of the generic value chain for walnuts in Eastern Afghanistan, 2006



4.4.10. Transportation

Transportation for the extremely hardy walnut is available and current road conditions do not deter the product quality or lessen trade. Available transport is not refrigerated. Refrigerated transport would prolong the shelf life of the nuts, but is not crucial.

4.4.11. Quality

The walnut quality in this region is good and the nuts can be sold locally and in regional markets without change. Two problems on the production end cause visual blemishes to the nut shell exterior, sun burn and husk fly. These two impediments, detailed below, do not impact the walnut meats in any way, but due to the poor presentation characteristics, the impacted walnuts will sell at a lower grade price.

4.4.12. Impediments

- Insects – Husk Fly
  Husk fly will lay eggs inside the husk and the resulting larvae will feed on the nutrients inside the husk. The result does not harm the walnut meats in any way, but does leave a dark, purplish stain on the outside of the walnut shell that is not attractive and will impact the value when the nut is brought to market.
- Insects – Tent caterpillar
  Tent caterpillar makes a web type nest at a junction branches. They are big eater and prefer to eat the young leaves and the bloom.
- Insects – Tree Borer
  Tree Borers lay their eggs in the trunk in small cracks in bark or wounds from equipment damage. The egg will hatch and burrow just under the cambium layer (bark) where it will live in the tree for up to three years before it burrows out of the bark where it will complete it`s life cycle and appear as a big ugly long horned beetle. The Tree Borer will kill back branches and possibly the entire tree.
- Insects – Aphids
  Aphids live in the wheat and are carried up the tree by ants where the ants milk them like cows. Aphids attack the new growth.
- Insects – Bees & Lady Bugs
  Farmers in this region and in most parts of Afghanistan have the bizarre belief that honey bees sap the life from the tree and that lady bugs are bad. Despite the farmer's misguided attempts at mechanical removal of these two essential insects, the bees and aphids are still present and supporting the trees. Farmers do not import bees during bloom which reduces their yields.
- Sunburn
  Excessive sun will cause staining on the shell exterior degrading the market price, but not impacting the walnut meats in any way.
- Pruning
  Poor tree care (pruning dead wood, canopy management) or more often no tree care, will eventually lead to declining yields and early tree death. The trees have become over-sized which makes it very hard to prune and harvest. Most trees are 40-50 years old.
- Fertilization
  Lack of proper nutrients leads to lower yields.

- Ground management
  Competing crops under the tree and next to the tree trunk rob the tree of nutrients and water. This ground cover from competing crops also protects bugs that can easily move from the ground cover (wheat, alfalfa) to the tree. Soil compaction is also a problem, restricting oxygen to the roots and water penetrating deep to the tap roots of the walnut tree.
- Post-harvest storage
  Farmers provide very little special care for the walnut after they have removed the husk. Jalalabad temperatures reach 100F / 37C degrees Fahrenheit in the summer. The poor storage facilities lead to increased spoilage and limit the ability of exporters to accumulate larger quantities to meet larger contracts.
- Hand Shelling
  Walnuts are sold in-shell and shelled. Walnuts are shelled by the individual farm families to supplement their income. This practice, however, results in kernel damage reducing quality and value.

4.5. Almonds

Almond trees are not widely grown in this region. There is an orchard planted with the assistance of an NGO that has almond trees. Almonds will grow well in this region, but at this point are not a major crop. Almonds are an attractive crop that has been enjoying a steady world market demand increasing at around 5% per year. Anti-oxidant properties have boosted their popularity recently. Prices spiked last season to over $4.00 per pound due to worries that the California crop was going to be negatively impacted by harsh rains during the bloom period. California accounts for over 40% of the world production. California is currently planting large amounts of new almond orchards to meet this rising demand.

Almond varietals grown in Afghanistan now are "old world" varietals with a stronger taste than the newer varietals grown in California. This is the favored taste for the regional markets. They command premium prices over "new world" almonds. Therefore, if farmers were to plant almond trees to pursue this rising market demand, consideration should be given to specific target market demand and expected increased supply of "new world" almonds hitting the market in 3-5 years from California. For Afghan farmers, the Indian Subcontinent and Middle East are natural markets and planting old world varietals would make sense to compete against the expanding supply of new world almonds.

Table 11. **Average Yields and Values from Ghorband, Parwan Province**

	Yield per Tree (in-shell, kernals)	**Trees per Hectare** (see note)	**Yield per Hectare** (in-shell kernals)	**Gross Income per Hectare**
Almond (shelled)	26 kg	250	6.5 mt	$4,750
Current international price for almonds is $2.86/kg (shelled)				

Sources: The yield is based upon in Ghorband and Mazar-e-Sharif yields. These Afghan yields are slightly higher than the yield per tree in California. The in-shell to shelled ratio used is 3.9:1. This ratio is higher than in California due to poor cultural methods. The resulting kernel yield is

similar to California. Trees per Hectare assumes commercial layout for orchard (California density). Pricing from California Almond Marketing Board.

4.5.1. Growing Region

Almonds are not widely grown in this region. Almonds can grow in different areas in the Eastern Region. A cold winter set is required, so this would favor the foothill regions just before the transition to the higher mountains to the south of Jalalabad and up into Kunar.

4.5.2. Varietals

Almond varietals can be grouped into two large groups, new world and old world. New world almonds have a lighter flavor, very consistent presentation and are dominated by the non-peril variety that is widely grown in California. The old world varietals grown in Ghorband, Mazar and Uruzgan have a stronger flavor and darker, a bit more irregular coloring. The regional market favors the old world almonds with higher prices and ready demand.

4.5.3. Typical Growing Situation

Since there are few current orchards, an intervention could establish the proper orchards from the start. Orchards in this area should be around100 trees in areas with access to irrigation into the late spring. The current planting practices for new orchards in California have in excess of 200 trees per hectare. This requires more aggressive pruning. The region with the best climatic zone conducive to almonds is in the transition zone between the relatively flat lower regions of the southern districts and the major border mountain range. The trees would therefore be planted on terraced land due to the incline.

4.5.4. Harvest

Harvest in this region would be sooner than Uruzghan or Ghorband, which are August.

4.5.5. Production

Negligible current production.

4.5.6. Processing

There are no almond shelling lines in the Eastern Region. A new shelling system is being installed in Kabul. Shelling operations are available in Peshawar. Nuts in this region are currently hand shelled by women.

4.5.7. Current Market

The limited volumes of lower quality almonds are sold locally.

4.5.8. Pricing

Not enough of a data sample to establish pricing.

4.5.9. Value Chain

No market established due to low volumes.

4.5.10. Transportation

Almonds are very transportable over the rough Afghan secondary roads. Almost all transport used for produce in this regions is not refrigerated, limiting the shelf life.

4.5.11. Quality

An NGO introduced a varietal that is not highly demanded in the regional markets. Therefore the limited production in this area is considered lower quality.

4.5.12. Product Impediments

Negligible data for the Eastern Region, but it could be assumed that the impediments will be similar to other regions within Afghanistan. The primary impediments in the other regions, listed in order of impact are:

- Poor pruning
- Lack of use of bees during bloom
- Poor fertilization amounts and timing
- Poorly timed irrigation
- Insects and disease

4.6. Fruit Summary

ROP has surveyed the major growing regions and seen the following tree fruits:

Citrus	Mulberry
Guava	Cherry
Apricot	Plum
Fig	

Of these fruits, only apricot and fig are viable candidates for drying and have enough quantity to be considered. Most of the other trees were growing in private gardens as opposed to commercial orchards.

Figs are considered a fruit that should be shared, so their commercial value is questionable. Mulberries are produced throughout Afghanistan and have very low commercial value. Therefore we focused on apricots.

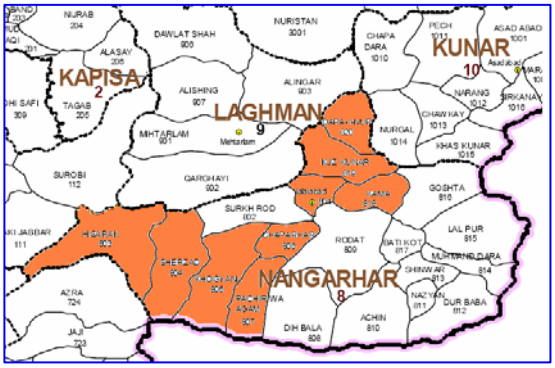
4.7. Apricots

This region has lost a substantial amount of it's' production due to the severe drought (~1996 through 2004) and irrigation system disruption due to the multiple conflicts since 1978. As a result, many of the trees have died and been used for firewood.

4.7.1. Growing Regions

Grown in the districts of:

1. Khogyani (Wazir, Kaga)
2. Sherzad
3. Hesarak
4. Dara-i-Nur
5. Khaiwa
6. Jalalabad (Besod)
7. Pachir Wa Agam
8. Kama
9. Bakikot (in Umberkhana)



4.7.2. Varietals

There are three apricot varietals grown in the region:

- Ameeri – Larger size, good taste, having yellow and red color flesh (fruit meat inside skin). Pit also tasty like an almond.
- Qaisi – Medium size, very sweet taste, yellow flesh color.
- Shaker Para or White Qaisi– Smallest in size, sweetest taste, 67 grams per apricot

4.7.3. Typical Growing Situation

The study team observed small scale orchards ranging from 2 to 50 trees. This is a problem and should be addressed. Commercial agriculture requires focus and investment. The first two categories below should not be considered commercial agriculture. Category #3 is a farmer that should be helped to category #4 which is true commercial agriculture. This is one area that is recommended for an immediate intervention.

Table 12. **Typical Apricot Farmers**

	Effort	Trees	Income per tree	Total Income
#1 Home Gardener Mixed tree garden	Nothing beyond irrigation	2-5	Negligible	Negligible
#2 "Wheat" Farmer Growing wheat with some apricot trees added	Nothing beyond what the wheat receive	20	Not producing yet	Not producing yet
#3 Casual Farmer Focus on apricots, but not financially committed	Committed field	50	$17	$1,000
#4 Apricot Farmer Focus and investment in apricots	Committed field, time and money for ag inputs	30	$67	$2,000

Sources: Based upon ROP field survey.

4.7.4. Harvest

Harvest takes place in May/June in the hotter areas and June/July in the cooler, higher elevation areas. Fruit is harvested and packed into wood crates with straw. Two size crates – 7kg and 14 kg. Crates distributed to farmers each year by Pakistani traders.

4.7.5. Production

Apricots production is rebounding from the conflict years. New plantings of orchards are taking place throughout Nangarhar. Farmers are getting tree saplings from IF Hope and directly from Pakistan. New plantings of apricots trees were done two years ago in Kama (Arbaban, Sadda, Qala-e-Akhond and Dargalai) and again this year. These plantings have been done on a bigger scale than in the past, but still very small for commercial production.

The majority of apricot production is in the southern districts, although planting is now taking place throughout Jalalabad, Kama and Bandicoot.

Table 13. **Apricot Production**

Apricots Production in Khogyani, Sherzad and Hesarak				
Name of Tribe	Number of Families	Number of Trees	Yield per Tree	Production
Khozakhail	5,000	2,500	55	137,500
Peerankhail	2,500	3,000	58	174,000
Markihail	1,600	9,375	88	825,000
Kodikhail	2,000	5,000	60	300,000
Jabarkhail	25,000	50,000	50	2,500,000
Marokhail	25,300	50,600	52	2,631,200
Tutu	10,000	2,000	54	108,000
Hashpan	400	250	30	7,500
Kharbonai	28,000	20,000	55	1,100,000
Gandomak	3,000	138	30	4,125
Total	**102,800**	**142,863**		**7,787,325**
Average	**10,280**	**14,286**	**53**	**778,732**

Sources: Based upon ROP field survey.

Table 14. **Potential Commercial Apricot Production**

	Yield per Tree	Trees per Hectare	Yield per Hectare	Gross Income per Hectare
Apricot	53 kg	240	12.7 mt	$3,689

Sources: Yield per tree is based upon Table 12 above. The Trees per Hectare represent commercial density for orchards found in the USA, since as few orchards are planted in proper patterns. The resulting Yield per Hectare is consistent with California yield levels (9.6 to 14.8 mt per ha).

Production at current levels is used almost entirely for the fresh market. Due to the market dynamics (see chart below), farmers are encouraged to sell all their production as fresh fruit. Estimates by farmers and traders are around 75% of the total production is for the fresh market with the remaining being consumed at home and some dried. In order to establish a larger dried apricot market, there must be a surplus of fresh fruit. Current production in Nangarhar is consumed locally. Even more distant production areas Khogyani, Sherzad and others, still consume what they produce locally with some driven to Jalalabad and Peshawar.

4.7.6. Processing

Apricots in the rural areas are primarily sold fresh as the market demand exceeds supply. As a result, a small amount of fruit is dried. Basically it is the remaining fresh fruit that is not consumed or sold locally. This fruit is halved, pitted and sun-dried on roofs or on the ground. Sulfur is not used in the drying process, so the color is not uniform and bright. No sulfur use also means mold which leads to loss. The bigger problem is grit that becomes embedded in the fruit during the drying process and cannot be removed later by processing techniques employed by traders. Volumes of dried fruit are relatively low due to low crop yields and sufficient demand for the fresh fruit locally. So the problem of lower quality

dried fruit is not an issue in the local markets. Should increased production provide quantities of dried apricots for export, then this will become an issue in higher-priced markets beyond Pakistan.

4.7.7. Current Market

There are three varietals. Of the three apricot varietals, the market clearly favors the sweeter White Qaisi fruit. Brix levels on this fruit are rumored to reach the high 20s, very sweet. Since demand far exceeds supply, farmers are able to sell their produce locally. The value chain is reduced to the simplest form – farmer sells to retailer or consumers. The limited amounts of dried fruit do move through the more traditional local trader-wholesaler-retailer model.

4.7.8. Pricing

Table 15. **Varietal Comparison**

	Pak Rupees per 7 kg.	US$ per kg.
Fresh apricots whole sale Qaisi varietal	Rs.67-73 / 7kg	US$0.16-$0.18 / kg
Fresh apricots whole sale White Qaisi	Rs.100-120 / 7kg	US$0.24-$0.29 / kg

Source: Based upon ROP trader survey and farmer interviews. Currency exchange rate US$1=Rs.59.8.

Currently, the regional apricot supply is not adequate to satisfy the Jalalabad market. Hence, most fruit are sold in fresh form on the local market and are not supplied to other local markets. Apricots are not exported in quantity: last season only 3.3mt were exported to Pakistan. However, a very small quantity is dried and supplied to the dry fruits market of Jalalabad.

4.7.9. Fresh versus Dried Fruit

The effective price difference is 2:1 in favor of fresh. The fresh to dry ratio for apricots is 8:1 resulting in a drier than normal (California standards range from 6:1 to 8:1) dried fruit. With the dried apricot price 4 times that of fresh; the result is 2:1 for fresh. That is, if you start with 8 kg of fresh apricots, they will sell for around $0.25 per kg, for a total of $2.00. If you dry them, the result will be 1 kg of dried apricots, which sell $1.00.

Apricots are dried on the farms after harvesting. The higher quality fruit is selected for the fresh market. Current practice results in an unclean product mixed with foreign material such as stems, grit and dirt. Drying times vary resulting in varying fruit moisture content. Dried apricots are generally sold as received from the farms, since there are no established cleaning operations existing in Afghanistan. In a few cases, they are blow-dried and washed, but with inferior results.

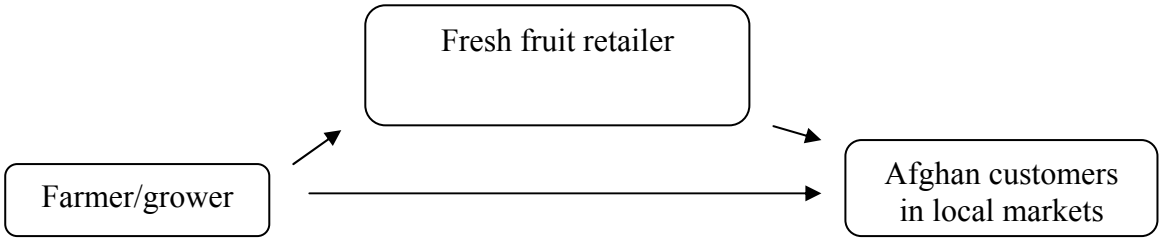
Table 16. **Fresh versus Dried Apricot Pricing**

	Pak Rupees per 7 kg.	US$ per kg.
Fresh apricots whole sale White Qaisi	Rs.100-120 / 7kg	US$0.24-$0.29 / kg
Dried Apricots whole sale White Qaisi	Rs.400-600 / 7kg	US$0.95-$1.14 / kg
Dried Apricot price per fresh fruit. Effective price for initial weight of apricots to make 1kg of dried apricots (assuming 8:1 ratio of fresh to dried apricots) Calculation: dried apricot price divided by 8	Rs. 50-60 / 7kg	US$0.12-$0.14 / kg

Source: Based upon ROP trader survey and California drying averages, see Appendix 1. currency exchange rate US$1=Rs.59.8

4.7.10. Value Chain

Here is the structure of the extremely simple value chain for fresh apricots in Eastern Afghanistan, 2006. Production is limited, so the local markets absorb all production that comes on the market.



4.7.11. Transportation

Non-refrigerated transport in small trucks and 10-ton trucks is possible. Traders and farmer/traders have good access to this transport. Secondary roads in this region are in bad shape. The ability for farmers or traders to transport perishable fresh fruit that are susceptible to bruising, like apricots, is directly proportional to the distance required to be driven on the secondary roads. Poor packaging materials, no refrigerated transport and the high potential for delays create a high risk situation for the farmer or trader. Farmers in and around good roads have the ability to reach the major regional and international markets. Farmers farther than 10 miles down a poor road cannot participate in the regional fresh fruit market and can either sell their fresh produce locally or dry their fruit.

4.7.12. Quality

Since the season for apricots is later in the year, the team was not able to sample the quality of the fresh fruit and could only sample last year's dried apricots. The dried apricots were sweet and very tasting, but the fruit was discolored and not uniform in color, and the grit content was high and embedded in the fruit indicating problems with the drying process in the field. Cleaning the fruit in Jalalabad would not remedy the grit or the color problems. This must be done at the field level.

4.7.13. Impediments

Basic problems exist with the apricot trees surveyed. These problems were consistent with other tree crops in the area.

- Cover crop competition
  The survey team observed winter wheat and alfalfa being grown amongst the apricot trees, competing for resources. The alfalfa is considerably worse than the wheat as it has deep roots and tends to drain the soils of nutrients and minerals. Wheat acts as a vector for insects and should be cleared from the base of the trees.
- Lack of pruning
  Dead wood, water sprouts and conflicting branches need to be pruned
- Sun burned bark
  Poor canopy maintenance results in too much sunlight on the bark.
- Bees
  No use of bees during bloom period.
- Fertilizer
  Not using right amounts and timing is incorrect.
- Diseases
  Leaf curl virus
- Insects
  Tent caterpillar, aphids, brown scale
- New orchard plantings
  New orchards are being planted in haphazard manners with poor layout that do not optimize planting area. Orchards can be planted in denser organization to increase $ per hectare.

4.8. Figs

Figs are not considered a commercial product due to references in the Islamic teachings to sharing figs with your neighbors. If you grow figs, your neighbors could take the fruit and you would be expected to give it to them. In other parts of Afghanistan, figs are traded fresh and dried.

Figs are produced in Kama, Khaiwa and Besod Districts. The season starts on 22nd June and ends in July 22nd. Figs are sold in limited numbers as fresh fruit only. It is not exported and also not supplied to other local markets of Afghanistan. Other areas within Afghanistan do dry figs, but in Jalalabad, the fig is considered almost a public asset, therefore commercialization may be difficult. ROP team did not pursue dried figs any further.

4.9. Oranges, Citrus, Peaches, Guava, Persimmon & Loquat

These fruits are typically sold as fresh fruit only, or juiced. There are some minor exceptions. Sour orange peel is dried and added to rice to improve odor. It is also used in Jam and to make vinegar. Lemons are sometimes used by Arab countries in a dried manner to add to tea, but this is a niche market. These fruits are juiced and could be considered for this type of processing. Since fresh fruit juicing was outside of the scope of this project, the ROP team did not pursue these crops for potential expanded commercialization.

4.10. Plums, Cherries

These fruits are dried and marketed in other parts of Afghanistan and throughout the world. There are not significant volumes of these crops to warrant further study.

4.11. Mulberry

Mulberry trees are grown in many areas of Afghanistan and the fruit is a product consumed by locals with some export potential. Mulberries are consumed fresh, but a significant portion is dried and consumed during winter months alone or very often mixed with nuts and other dried fruits in a trail-mix type of food locally called Talhone.

Good quality mulberries are produced in Sherzad, Pacheeragam, Hesarak and Achin. The mulberries produced in these areas are seedless and seeded but only the seedless verities are dried. Since mulberries are prevalent and production easily meets demand, the commercial value is low. Therefore ROP did not investigate this crop any further.

4.12. Nut Processing

Both peanuts and pine nuts require roasting to stabilize the product and enhance flavor. Roasted nuts will have a much longer shelf life and their flavor in improved. Both are roasted in-shell. Roasting is a relatively simple process taking approximately 30 minutes per batch. Commercial roasting in Peshawar is a bit more advanced than commercial roasting in Kabul and Jalalabad. The primary difference is the fuel used for the heating process. In Peshawar, gas is used. In Jalalabad, wood is the fuel used. This difference impacts both the quality and the cost of the roasting. With wood fuel the heat is not easily regulated, resulting in hot spots and un-even roasting. The resulting product can have discoloration of the light colored nuts. Wood fuel requires more labor to constantly cut and prepare wood and stoke the fire. Jalalabad roasters also use more vegetable oil to prevent burning. Roasting pine nuts is a more precise effort beyond most wood fuel roasters.

Kabul roasters use gas with their roaster. With pine nuts, Kabul roasters do a quick roast of about 15 minutes as opposed to a 30-45 minute roast that brings out the better flavor. This quick roast eliminates potential discoloration from over-roasting. Kabul traders also like this quick roast as the resulting nut retains more moisture and therefore more overall weight for the resale.

The second impact is on cost. Gas fueled roasters need only one laborer, while the wood fuel roasters need four laborers. More oil is used with wood fueled roasters to protect the nuts from burning.

The pine nut situation is similar to the above, as manual roasting in Afghanistan is more costly and results are poor since they lack the proper equipment and fuel for roasting. Pakistan has equipment for roasting, shelling and packing mechanically. Pine nuts are more susceptible to burning during the roasting process.

A visit to a roasting operation in Kabul revealed a similar situation. Using bottled gas, their pine nut roasting costs for 1000 kg/day were $40 for fuel, and $11 for labor totaling $51/day/1000 kg. This is cheaper than the wood used in Jalalabad.

Roasting process reduces the weight by reducing the moisture in the nuts. The normal reduction is from 7kg of un-roasted pine nuts to 5kg of roasted nuts. This weight loss is more than offset by the increased price and shelf life for roasted nuts.

Table 17. **Peanut Roasting Cost Comparison**

Cost Item	Jalalabad		Pakistan	
	Amount	Cost (US$/Day)	Amount	Cost (US$/Day)
Skilled Roaster	1	$8.36	1	$5.02
Helpers	3	$10.03	0	0
Fuel	700kg	$66.89	287m^3	$20.06
Vegetable Oil		$16.72		$3.34
Total Cost (1000kg/day)		$102.00		$28.42
Cost per kg		$0.10		$0.03
Potential Trader Margin				
Un-roasted Peanuts		$0.47/kg		
Roasted Peanuts		$0.88/kg		

Sources: Costs based upon ROP survey of roasters in Kabul and Jalalabad. Fuel cost for Pakistan is from Pakistan Oil and Gas Regulatory Authority.

4.12.1. Shelling

Shelling is done manually locally at a rate of 20 AFs/kg for both peanuts and pine nuts.

4.12.2. Impediments

- Wood fuel versus propane
  Roasters are using wood fueled roasters which are not competitive with Pakistani traders using propane fueled roasters.
- Cost comparison to Peshawar
  Cost of propane may be less in Peshawar.
- Lack of mechanical shelling for pine nuts results in irregular quality of the shelled meats and higher production costs.
- Lack of cold storage
  Difficult to queue nuts to be processed and store after roasting and shelling.

Cleaning raisins in Jalalabad. Same process as with nuts.

4.13. Dried Fruit Processing

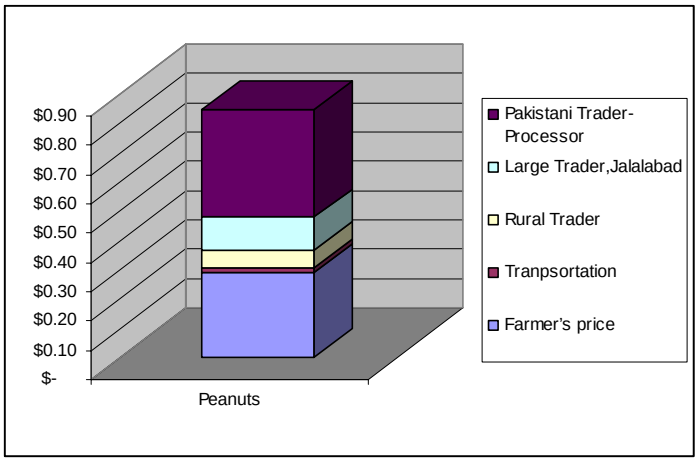
There is no large scale dried fruit processing in the Eastern Region. Individual traders and retailers attempt to clear foreign material from the fruit and remove some dust, but this is done in a limited, manual manner with baskets. Due to rather small volumes of dried fruit produced in this region, there is no real demand to develop larger capacity and more efficient dried fruit processing operations. The production must come first.

4.14. Traders

The traders in the Eastern Region are similar to most other parts of Afghanistan, with the exception that the produce of the region really has two market hubs – Jalalabad and Peshawar. The border is often a blurred line that does not separate activity. Only a small minority of goods are run through the customs office and the minor customs fee paid. Pakistani traders and their agents buy directly from Jalalabad traders, but more often they purchase direct from rural traders and directly from the farmers, then ship the produce directly over the border for processing, repacking and re-export to higher value markets. The seventy Jalalabad traders are at a distinct disadvantage as they can provide only minor value add in the form of produce consolidation at a central location for shipment south. The traders have little capacity for extended storage, so they are forced to move the product quickly on to Peshawar or into local markets. Their margins are therefore rather thin, 5% in most cases.

Most value add takes place across the border in Peshawar. Afghan traders ship nuts in burlap bags, which are then roasted, shelled, cleaned, salted or coated, graded and then re-packed for international markets.

Table 18. **Peanut Value Chain**



Source: Interviews with multiple traders in Jalalabad.

The study team has interviewed a number of traders and has grouped them by their size and markets. As in other areas of Afghanistan, there are numerous middlemen in the channel, each moving the product a small distance.

Table 19. **Trader Chain**

Trader Group	Buy	Sell	Value Added
Rural Trader	Buy from farmers	Sell to market wholesalers	consolidate small lots of produce, transport to markets
Local Traders	Buy from Rural Traders and farmers	Sell to retailers	wholesale to local retailers
Export Traders	Buy from Traders	Sell to International Traders (Pakistani)	consolidate produce for Pakistani traders
Pakistani Agents and International Traders	Buy from farmers, Local Traders and Export Traders	Sell to international Traders in other countries	transport to Peshawar, process, pack, store and re-export
Local Retailers	Buy from Rural and Local Traders	Sell to end consumer in local markets	retail sales

Source: ROP trader survey.

It should be noted that this table represents the majority of transactions. Farmers can sell directly to all traders and even directly to consumers. In addition, it is common for Pakistani Agents to bypass Jalalabad Export Traders and work directly with Rural Traders and even farmers. Each crop is a bit different. With this system, an excessive amount of the ultimate consumer price in the international markets is retained by the international Traders in Pakistan, who also add the most value post-harvest by cleaning, roasting, packing, storing, marketing and shipping the products to distant higher priced markets.

4.14.1. Rural Traders

Rural Traders are typically farmers also who will bring their products to market along with those of their village. These Rural Traders will then sell to the Local Traders who act as wholesalers for local markets, or they will sell to Export Traders who will then sell to Pakistani Agents or Traders. Rural Traders bring their products to market in pick-up trucks and are paid in cash.

4.14.2. Medium Traders

Medium Traders will only sell their produce locally. They will import some produce from other regions of Afghanistan or import produce from Pakistan, but no exports to other regions or countries. This group of traders account for around 100 mt/year of nuts and dried fruits. They buy from local rural traders and other regional traders from different parts of Afghanistan. They average 7mt of each of raisins, peas, peanuts and dried mulberries and of some other products not grown in Nangarhar. They also sell a lower quantity of Nangarhar Almond grown on trial basis with the assistance from an NGO. Their primary customers are the local retailers.

4.14.3. Large Traders

These traders average around 70 mt per year in total export and import to/from other Afghan regions. There are 10 other large merchants dealing in the dried fruits and nuts. Each sells about 21 mt of nuts and dried fruit per year. These merchants roughly account for 273 mt per year in Jalalabad. These Large Traders sell locally and export. Their primary business focuses on walnuts, peanuts and pine nuts.

The Large Traders are not satisfied with the quality of some varieties of the products and continually advocate for the need to plant improved varieties of the nuts and fruits in the current production areas.

The Large Traders need assistance in marketing to potential international markets other than Pakistan. They would also support the implementation of extension services to be in their production areas to assist the farmers.

4.14.4. Local Retailers

Local retailers purchase from Local Traders and sell to end consumers. They average 7 mt per year. They deal in all Afghan nuts and dried fruits supplied to them by the domestic small traders from all over Afghanistan. Red and green raisins are supplied to them from Ghazni, Kandahar and Shomali. Green raisins are also supplied to them from Kandahar and China. The local traders are satisfied with the quality of nuts and dried fruits they get from the farmers and small traders.

Qari Noor Sadique Dried Fruits Store (retailer)

Nut & dried fruit traders will deliver the produce to the retailer. The local retailers only add 5% profit to the delivered cost of produce.

Table 20. **Local Retail Prices**

Product	Pak Rs. per 7kg	US$ per kg
Almond		
Class 1	2,100	$5.00
Class 2	1,500	$3.58
Peanuts	220	$0.52
Pine Nuts	3,200	$7.64
Walnuts	400-550	$0.95-$1.31

Sources: ROP trader survey. See Sources section below. US$1 = Rs.59.8

Local Retailers provide some added value by manually cleaning their products to remove packing straw, dust and stones. They use hand shakable curved straw made plates for throwing away the straws and stones if any and also clean the produce from dust by winnowing the produce.

They use sacks and polyethylene plastic pouches packaging for sales. They don't have cold storage facilities and usually they store the Nuts and Dried Fruits produce in their store rooms from 1 to 2 months. Local Retailers buy/sell the produce on a cash only basis.

Export Merchants

There are 10-12 larger and 30 smaller Exports Traders in Jalalabad dealing mainly in peanuts and walnuts. Only one or two large Export Traders trade pine nuts.

These Export Traders export their nuts and dried fruits to Pakistan only and do not participate in the local market trading. Each trader averages around 60 mt per year. The 30 small Export Traders trade around 5 to 6 mt per year. They source their nuts from domestic Rural Traders and the farmers. The smaller Export Traders export to Pakistan and will also sell locally.

All the Export Traders are not satisfied with quality of the raw nuts supplied to them by the Rural Traders and farmers. The markets that the Export Traders serve are considerably more demanding than the local markets.

Table 21. **Export Trader Pricing**

Product	Unit Price in Pak Rs.	US$ per kg.
Pine nuts	3,100/7kg	$7.40/kg
Walnuts	480-530/7kg	$1.14-1.27/kg
Peanuts	190-200/7kg	$0.45/kg

Source: ROP trader survey. US$1=Rs.59.8

Typically the Export Traders add 5% profit to the delivered cost of the nuts, but they also check prices in the Kabul market and in the Pakistani markets.

Usually the Export Traders do not process the nuts any further than a simple grading. They grade by size, quality and maturity. During the grading, they manually remove straw, and perform a quick clean to remove dust and stones. To clean, the Export Traders use hand shakable, curved straw made plates for eliminating the straw and stones, pictured to the right.

The Export Traders pack the produce in burlap sacks. They do not have cold storage facilities so they can only store the nuts and dried fruits produce in their store rooms from 1 to 3 months with increasing amounts of spoilage and infestation after 1 month.

Normally they buy/sell the produce, paying/receiving cash on the spot after looking at the quality of the raw or finished produce. In some cases they work on credit for up to 2 months. They do not sell on commission basis and they do not sell on a Letter of Credit basis.

4.15. Cross Cutting Issues

4.15.1. Limitations on Ag Inputs

4.15.2. Fertilizer

- Lack of understanding on correct time and amounts to apply.
- Quality of fertilizer from Pakistan. The research team was often told that Pakistani agriculture input suppliers mix inert substances into the fertilizer which dilutes the strength. Frequent testing may be required.

4.15.3. Known Impediments for Post-Harvest

4.15.4. Processing

- Both pine nuts and peanuts sub-sectors are constrained by the lack of good roasting equipment and technology as compared to Pakistan. As a result, most of the un-roasted peanuts are exported to Pakistan where the roasting costs are much lower and then re-exported to Afghanistan at twice the cost. Lack of application of an economical fuel source in Jalalabad is the main reason for this disparity and is compounded by the lack of equipment for shelling and packaging as used in Pakistan.

- Lack of facilities to support trade. There are no facilities for cold storage, shelling, poor roasting equipment and poor packaging options. The current Industrial Park does not yet have these capabilities.

4.15.5. Storage

Some of the dried products purchased during the season are stored in three underground facilities in different market areas within the city. These provide a slightly longer storage period being less exposed to the hot weather, however far less than if refrigerated.

Lack of cold storage facilities has probably the most significant impact on limiting the potential income of the Afghan merchants, resulting high waste factors, curtailed sales volumes and season lengths, poorer product quality, and lower return to the farmer. The long period (8 months of hot weather) is a major detriment to product shelf life and quality.

Entrance to underground storage in Jalalabad

Underground storage in Jalalabad

Limited electrical power is a constraint affecting both cold storage and processing facility considerations. While not insurmountable, the added cost of fuel to operate electrical generators not required in locations outside of Afghanistan creates a competitive disadvantage.

Raisin heat damage

Infested dates

"Raisin ball" caused by excessive heat

Infested chick peas

Once the products are delivered by the farmers, they are placed in various "storage areas" until ready to be sold. Some of the storages consist of underground concrete cubicle storage rooms with metal sliding doors, but these are limited in number and capacity. There are also above ground storage buildings, but more common are open storage yards where the sacked product is piled outdoors and sometimes canvas-covered. Pesticides and/or fumigants are not used, and evidence of infestation was observed in both stored chickpeas and raisins from last year's crop.

4.15.6. Transportation

Poor road conditions that result in prolonged exposure to hot weather and increased product deterioration and damage of both inbound raw material and outbound processed goods.

4.15.7. Credit

Lack of any financial support. There are no financial agencies supporting traders. Little private sector investment from the potential businessmen.

4.15.8. Marketing

Since there is limited capability to add value in Nangarhar, traders simply consolidate their product and ship on to Pakistani traders who add value and are able to re-export to target markets. Until Jalalabad traders have the ability to stabilize the product (roast or dry) and accumulate product (cold storage), they are not in a position to market their products beyond Pakistani traders. They cannot reach the intended target markets and are limited to a meager 5% margin.

4.16. Exports to Pakistan

Overly bureaucratic export paperwork and export customs processes are a burden few traders accept. The traders typically bypass the process and ship directly to Peshawar. Most of the fruit & nut consignments get transferred to Pakistan by smuggling them through agents so customs officials do not know the identity of the large traders/exporters. The export fee is 0.015% of invoice value as administration cost of their office, which is not a large deterrent. Rather it is the paperwork that has to be processed in Jalalabad, then in Kabul. This process causes delays that lead to spoilage. Traders smuggling their crop out to Pakistan are not motivated to move their product through Jalalabad.

The table below shows the trades registered last year for legal export. As you can see the volumes are minute as compared with the regions capacity.

Table 22. **Trades Processed through Government Export Procedure**

Invoice Date	Name of Trading Company	Name of Export	Quantity (mt)
23rd Sartan, 1384 (14 July, 2005)	Ayaan Ltd.	Dried coriander	5.5
		White cumin	4.9
		Dried onions	2.5
16 sartan, 1384 (7 July, 2005)	Hayatullah Kamran Ltd.	Dried coriander	39.76
16 asad, 1384 (7 August,2005)	Sami Zahid Ltd.	Coriander seeds	12.6
		Dried onions	1.2
5 asad, 1384 (27 July, 2005)	Eshan Sadiq Ltd.	Coriander seeds	76.5
		White cumin	5.6
1/8/1384 (23 Oct, 2005)	Humraz Ltd.	Walnuts	21.0
		Pine nuts	24.5
		Prune	33.6
		Peanuts	12.0
8/8/1384 (30 Oct, 2005)	Humraz Ltd.	Peanuts	200.0
		Walnuts	25.0
		Pine nuts	25.0
17/8/1384 (8 Nov, 2005)	Ahsan Sadiq Ltd.	Pine nuts	50.0
		Peanuts	20.0
		Raisins of Shomali	13.0
		Walnuts	50.0
		Cumin	12.0
28/8/1384 (19 Nov, 2005)	Humraz Ltd.	Walnuts	100.0
		Pine nuts	100.0
		Peanuts	100.0
28/8/1384 (19 Nov, 2005)	Sami Sohail Ltd.	Walnuts	20.0
		Pine nuts	20.0
		Peanuts	60.0
29/9/1384 (30 Nov, 2005)	Humraz Ltd.	Pine nuts	200.0
		Peanuts	100.0
Total			1334.6

Source: Ministry of Commerce, Jalalabad Customs House, Islamic Government of Afghanistan.

5. Conclusions

Interventions for Apricot and Almond farmers and producers stand out as most likely to be successful in providing a benefit to the region. The matrix below shows the criteria used to make that evaluation. The crops were rated on the criteria using information from the survey and international market sources. Ratings range from 0 to 4, with 4 meaning that the crop would see the most benefit from intervention.

CROP / CRITERIA	Almonds	Apricots	Peanuts	Pine Nuts	Walnuts	Notes
Unmet Market Demand	3	4	1	3	2	Fresh & dried apricots are consumed in rural areas leaving little excess to serve regional markets. Worldwide almond demand growing at 5% per year.
Potential to Reach a Large Number of Farmers	2	3	3	2	3	Program can initiate large increase in commercial orchards.
Potential for Employment Generation	3	3	2	0	2	Employment generation from increased production, quality and marketable products.
Potential for High Degree of Value Added	2	4	3	3	1	Shelling lines and improved fruit drying will lead to the possibility of reaching more international markets.
Use of Appropriate Technology	4	4	3	2	4	Upgrading cultural methods of production, new equipment for nut processing, improved drying with apricots.
Women Represented in the Sub-sector	3	4	1	2	1	Women are frequently involved in post-harvest processing.
Potential for Multiplier Effect	2	3	2	1	1	Includes possibility to affect construction of processing & cold storage facilities.
Potential for Leveraging Private Sector Investment	4	4	2	0	1	New orchards, new nut processing.
TOTALS	23	29	17	13	15	

The team has reached the following conclusions about the nut and dried fruit sub-sector in eastern Afghanistan:

- Orchard farmers are currently earning sub-standard incomes, but simple interventions could substantially increase their incomes.
- Farmers are planting their new saplings from the IF Hope Project incorrectly, stunting their growth and prolonging the non-fruit bearing stage.
- Pine nut harvesters will eventually be out of business.
- Jalalabad traders have little value to add and little ability to reach higher priced international markets.
- Poor fruit drying techniques limit market options.

5.1. Production Assistance – Almonds, Apricots, Walnuts

Almond, apricot and walnut farmers need help to establish new orchards and turn their existing fields into successful commercial operations.

5.1.1. Depressed Income

Almond, apricot and walnut farmers in the Eastern Region are not using the full potential of their land and earn lower incomes as a result. The main issues facing farmers are a lack of technical knowledge, poor attention to crops, and money or willingness to invest in land and other resources.

Due to prolonged conflict and displacement, basic tree care knowledge has not been handed down from father to son in the last generation. In rare cases, farmers are managing their small orchards and earning a respectable income, but most of them are guessing about some activities and ignoring others. One of the most important practices in tree cultivation is the use of bees, but farmers in this region actually believe that the bees are draining the life from their trees. This ignorance also extends to lady bugs, but most importantly, the farmers do not understand that tending to their trees will mean an increase in income.

Many farmers are reluctant to expand their orchards in order to achieve the economies of scale needed to make a profit. This problem was most prevalent with apricot farmers. The walnut farmers already have relatively large orchards. This reluctance has held back farm income, creating further reluctance to investment in expansion.

Lack of attention to the trees is most likely caused by a lack of knowledge about how to care for them. When a farmer has a broad mix of trees, he will most likely not have adequate knowledge of how to care for any one tree crop. These tree crops respond extremely well when cared for. When a farmer ignores his trees, poor yields of substandard quality are the result.

In order to earn a living from their orchards, farmers must first commit to being commercial farmers.

5.1.2. Incorrect New Plantings

Recipients of the free tree saplings from the IF Hope Project are not planting them properly, which will prolong the non-bearing adolescent years of the trees. In addition, the farmers are not planting with the correct density or quantity to create a viable income.

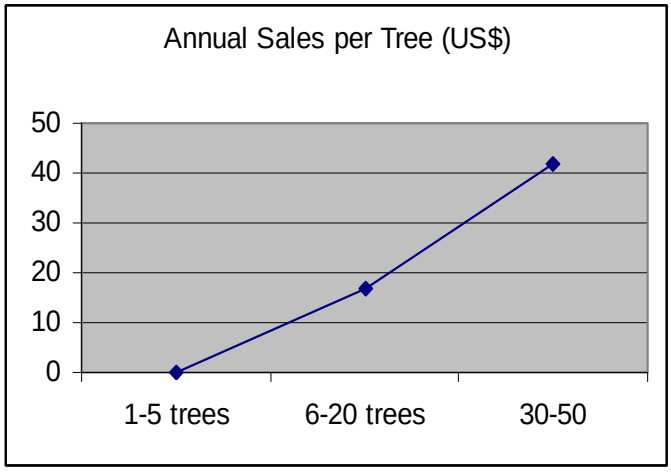
IF Hope's nursery program is a fantastic start to help the farmers in this region. But their program only covers the saplings and has little resources for field extension work. The farmers need additional field assistance in planting the trees correctly. The current planting practice will insure slower than normal growth rates, higher failure rates and reduced yields. Current problems observed are:

- Minimal ground preparation and small, rounded holes with shear sides
- Planting trees too low without correct raised apron
- Planting cover crops immediately adjacent to trees, which allows pests direct access to the trees and competition between cover crop and tree roots for water and minerals

INCORRECT: Apricot sapling planted in winter wheat field. 8 tree "orchard" in Kama.

CORRECT: 1 meter clearance around based of apricot tree. 30 tree orchard in Batikot

Farmers are not approaching the creation or expansion of new orchards in a business like manner. Simple economic dynamics, like that more trees will mean more income, tend to be ignored. The number and density of trees are both too low. Farmers should not be planting 6 to 8 trees because such an orchard will not allow the farmer to focus appropriate resources in care and management. The minimum is definitely above 15, but is probably closer to 30. With 30 trees, the farmers would consider themselves farmers. The team visited multiple orchards with 30 to 50 trees where the farmer's income was over $2,000. Small scale farming with less than 20 trees will almost guarantee low quality fruit and low yields. The result is product that is not marketable or will only bring a small return. This negative experience will likely have a negative impact on the farmer's willingness to expand production.



Afghan Customer

Note that income per tree increases as the farmer increases the number of trees in his orchard. With 30 trees, a farmer is doing very well. We have found that there is a direct relationship between the yields and the number of trees in Afghanistan. The more trees a farmer has, the more inclination he has to

Second year Chilgoza Pine seedling at IF Hope nursery in Jalalabad.

invest in their well being, leading to higher yields and better returns. The orchards of 1-5 trees typically receive no additional attention besides occasional irrigation.

5.2. Diminishing Pine Nut Harvests

The years of conflict have been particularly difficult and destructive in the areas that produce pine nuts. Khogyani and Ahmadzai tribesmen, the two local tribes who control the pine nuts forest region, have adapted some measures to control access to the pine nut forests during harvest time, but they have little to no management of harvest methods. Branches are broken or beaten to get closed pine cones off the tree. This slow growing tree with a very low propagation rate is losing the battle for survival and is predicted to become extinct within one generation. The Himachal Pradesh State Forest Department in India has been working on artificial regeneration.

5.3. Jalalabad Traders have Limited Capacity to Add Value

Jalalabad fruit and nut merchants are overshadowed by those across the border in Peshawar. With a limited capacity to store, roast, shell and pack their products, these traders can add little value to the product. Probably the highest priority for the dried fruit and nut merchants is the need for cold storage facilities. The area experiences hot weather for about 8 months each year and suffers extremely high waste factors resulting from the lack of proper storage. A second priority would be competitive roasting ovens. And finally, modern nut processing equipment is also needed. Right now all nut shelling is done by hand because there are no mechanized sizing, shelling and cleaning line in the Eastern Region.

This lack of capital equipment means that a large percentage of nuts bypass the Jalalabad traders entirely and the raw nuts that do come to the city cannot be held long. The resulting margins are thin and access to markets beyond Pakistan is restricted. The Pakistani traders import Afghan nuts, then add value and re-export them to distant markets. Both Afghan traders and farmers would see higher prices and better margins with direct access to markets beyond Pakistan. For instance, pine nuts are in high demand in China. Chinese importers could easily be identified and matched with Jalalabad exporters. Income generated from the added value in Afghanistan and increased income in Afghanistan would also multiply into the local economy instead of Pakistan.

5.4. Poor Fruit Drying & Cleaning

Current fruit drying techniques do not meet international standards. Current production is low and most apricots are sold fresh in the local village or consumed fresh by the tree owners or their neighbors. Therefore most apricot trees are not considered a cash crop. As production increases with improved yields (hopefully through an extension system) and additional plantings (IF Hope ALP Program), there will be additional fruit for drying. This presents an opportunity for farmers to grow apricots as a cash crop.

Dried fruit can withstand the poor roads to markets, but fresh fruit cannot. In the near future, dried apricots can become a stronger commercial product. Simple interventions will allow rudimentary improvements that will support increased dired fruit to be sold in Afghan, Pakistani and Indian markets. Additional drying improvements would be required for export markets beyond Pakistan but would become justified with greater volumes.

6. Recommendations

Farmers in the Eastern Region can dramatically increase the quality and quantity of their fruit and nuts with better planting and cultural methods. These farmers should make a transition to a commercial focus on their orchards. Traders can participate in the value-add process and multiply local income by building capacity. The study team recommends the following interventions:

- Instructions for planning new or expanded orchards
- Instructions for planting new fruit and nut trees
- Orchard creation oversight
- Fruit and nut tree extension team
- Sustainable pine forestry
- Improve the competitiveness of Afghan traders
- Shelling lines
- Gas fueled roaster for peanuts and pine nuts
- Improved village level fruit drying
- Central dried fruit processing – delayed intervention

6.1. Instructions for Planning New Orchards

This region is at a key juncture. Establishing new orchards correctly and renovating existing orchards will significantly reinforce successful farming practices. Farmers can make very good incomes with apricots, walnuts and almonds.

Farmers need basic instructions on how to plan a new orchard. Orchards are a long-term investment and they need to be established properly. Inter-cropping provides crucial near-term income for the farmers. The selection and management of inter-crops and cover crops is key to the development of the orchard. Farmers are currently planting competitive crops that invite harmful pests to the adolescent trees.

Costs for this service include designing the document and printing.

6.2. Instructions for New Plantings

An immediate improvement would be to create a simple, illustrated tree planting guide (4-8 pages) to distribute with the trees. Very simple instructions with few words (translated into Pashto) and many pictures to show illiterate farmers how to start the trees correctly. This guide would illustrate the following topics for planting new saplings:

- site selection
- ground preparation
- tree planting
- fertilization
- cover crop management
- irrigation

The impact would be faster growing trees (bearing fruit sooner), less tree loss (keeping the orchard a consistent age) and real orchards (not mixed gardens with only a couple trees for

each crop). This will improve the chances for the establishment of commercial apricot farmers.

The instruction brochure should have mostly pictures with little text (translated to Pashto). The literacy rate of farmers in the rural areas of this region is extremely low. This brochure could be provided along with trees from IF HOPE.

Costs would include designing the document and printing.

6.3. Orchard Creation Oversight

The instruction manuals are a good start to help farmers plan and plant successful new orchards, but it is recommended to develop an extension service that will further support this effort. The extension team would coordinate with the IF HOPE Nursery to manage the distribution of saplings to qualified farmers who are planting a commercial orchard. Trees and inputs should not be provided to farmers who will make the required investment to make a commercial orchard. There should be an approval process in place which requires reviewing the proposed orchard site before and after planting. GPS readings could be taken to allow for follow-up. Perhaps agricultural inputs or other subsidized items could be delivered with approval of planting layout and withheld in the case of non-compliance.

This is an enforcement program to get the local farmers to follow the program's intentions – enough trees to create a viable commercial farm that implements proper planting procedures.

It is premature to establish extension agents linked to traders, because these extension agents would be focused on long-term work. We recommend the extension agents be direct employee of the implementing organization.

Cost components will include the salary for two Afghan nursery agents and their vehicles (motorcycles). This recommendation could be conducted by the fruit and nut tree extension team recommended in the next section.

6.4. Fruit & Nut Tree Extension Team

ALP-E should immediately initiate an extension system to support the revitalization of existing trees. The extension team should focus on the basics:

- Pruning
- Pest & disease management
- Cover crop management & soil compaction
- Fertilization
- Bees
- Irrigation (including small-scale water storage in the hills to catch spring snow melt for use at critical times)

Costs would include 6-8 Afghan extension agents. These extension agents should be funded by a combination which allows for a sustainable solution. A mix of merchant funded agents and NGO funded agents is recommended. MAAHF extension agents could also be incorporated with a per diem compensation system. A final option is to have input suppliers providing agents. This should be discussed further with the implementing

organization to align with ALP-E objectives. Additional costs, such as motorcycles and an Afghan manager with an SUV, should be born by the implementing ALP-E partner. An expert expatriate specializing in stone fruit would be needed at key intervention times (early spring and fall harvest time) for a total of 4-6 months of time. The extension team should map the existing and potential growing regions for apricots and almonds.

6.5. Sustainable Pine Nut Forestry

It is recommended that actions be taken now to stave off the decline in production that is anticipated when the current generation of larger trees begins their natural die-off (over harvesting of seeds means there are few smaller trees does not replace the previous generation). Interventions could include establishing a tree nursery and introducing better harvest methods to protect the terminal branches, which would not only protect the tree but increase the following year harvest as well.

The tribes should be encouraged to control the forests. They would become the caretakers of the forest — as opposed to being only takers. There are currently no controls on who can enter the forests, and this may require government regulation to restrict harvest to those who invest in the forest and care for its future.

Cost would include a full-time Afghan forestry manager, supported by an expatriate forestry specialist to create the conservation plan and monitor performance. An NGO, (IF HOPE or another) could establish a tree nursery in the most advantageous location. IF HOPE is growing some Chilgoza Pines in their Jalalabad nursery, but with only minor success. A local tribesman could start a nursery in a cooler mountain location as a business.

This region is extremely volatile. Any intervention would have to be with close cooperation from tribal leaders and rely heavily on an Afghan implementation team.

Both these two interventions could gain supplementary funding from carbon sequestration credits or conservation organizations like Conservation International or the Sierra Club.

6.6. Improve Afghan Trader Competitiveness

The traders in the Eastern Region need help with capacity and market development. It is recommended that any intervention include improvement of cool storage and establishment of cold storage. Complementing the traders' increased capacity to handle larger volumes over longer periods, the program should include market development to connect Afghan traders directly with target markets.

The program should support modifications to existing underground cool storage facilities. This would include closing the existing openings, and adding swamp coolers with solar driven fans. It is estimated that two or three facilities would be required, in the range of 10,000 square meters each. Actual needs have to be quantified on the basis of additional product volumes, and the current volumes of product lost due to spoilage and infestation. There are 3 main underground storage facilities in the Jalalabad dried fruit market area. They have some potential for improvement and longer term use if supplied with economical cooling systems such as swamp coolers. This would extend the storage life of products by one or two months and would be much cheaper and substantially faster than building new cold storage facilities.

Separate but related to the above is the issue of infestation presently being experienced in all three cool storage facilities. Fumigant use is essential, and must be an acceptable type for this location in close proximity to populated areas.

A short-term marketing expert could work with local traders to identify regional markets and coordinate trade missions and test shipments. Packaging, sanitary issues and export logistics must be organized to meet the demands of the target market. Once initial sales are organized, the marketing specialist should change from initiator to facilitator.

Costs include a possible subsidy for swamp coolers and fumigation systems for the three main cool storage facilities. A market development expatriate could organize trade delegations and seller-buyer meetings in Afghanistan and in the target markets.

6.7. Shelling Line

Whole shelled walnuts are currently exported to Pakistan where value-added processing is done. Afghan processors could add that value and directly access stricter international markets if they had top quality shelling systems and sanitary certification. The program should seek to automate shelling of walnuts by supporting the construction of a sizing, cracking and cleaning line to enable walnut meats to be marketed in the international market. The amount of walnuts produced in the region warrants the investment to in the shelling line. ROP is supporting the construction of three shelling lines in Afghanistan with partial subsidies. ROP has organized three processor associations that allowed merchants to pool their capital and afford this large investment. The project, funded by RAMP, provided a partial subsidy for the cost of the shelling lines and building construction. The ALP contract may not allow for subsidies, so credit may be required to undertake such an intervention. This intervention would require the addition of cold or cool storage facilities to store processed and unprocessed nuts.

Costs will include a part-time Afghan business development specialist to support the development of the processor association and possible subsidies for equipment.

6.8. Gas Fueled Roasters for Peanuts & Pine Nuts

It is highly recommended that the program introduce the use of propane heated roasters. This simple intervention would allow Jalalabad roasters to compete with Peshawar roasters and allow Jalalabad traders to market their product to countries other than Pakistan. Converting existing wood fuel roasters to propane fuel would be fairly easy and allows for more accurate temperature control. The Jalalabad roasters would save money on labor and oil. The program would start with an initial pilot and then push for wider adoption once the benefit becomes clear.

Cost would include possible subsidy of the pilot propane fueled roaster, an Afghan business development specialist and one short-term, expatriate food processing specialist.

6.9. Village Level Drying Technique

Current drying techniques yield products that can only be sold in the relatively depressed markets of Afghanistan and Pakistan. Ay improvement of dried fruit quality must be market-driven. Experience has shown that pushing better drying techniques on farmers is not as effective as pulling them along with higher prices. The introduction of a grading system by buyers is essential. The team recommends the establishment of initial cleaning

and drying practices that will allow farmers to produce dried fruit acceptable for domestic markets, leaving the second stage of cleaning for a time when the local market is saturated and prices have fallen. This initial stage is easier to implement, easier to convince farmers to try and can yield favorable results in the first harvest.

Current drying practice:	Halve, pit, and sundry on ground or roof.
Village level drying improvement:	Clean, halve, pit, sulfur (for color preservation and mold protection), sun dry on paper on roof, package, store in cool, dry shaded room.
Central processing improvement:	Same village level procedure as above, but includes an additional light cleaning to reduce embedded grit, eliminate foreign matter, and get better uniformity in moisture content.

Field extension work would be required to show the improved village level techniques to apricot farmers and enable them to create a cash crop from their trees. Numerous field days in the village would be necessary to show these basic methods. The results should be instantly noticeable as the use of sulfur will preserve the color better and the resulting fruit will be more attractive. The key tasks for this intervention would be:

- Fruit Preparation: Proper cleaning and preparation of fruit for drying
- Sulfur: Sulfuring is used to preserve color primarily, and may be in the form of a spray such as a bisulfate solution. This is sometimes done in a sulfur house, where the product is placed in an isolated room with burning sulfur powder or gas for 4-6 hours.
- Drying Surface: Apricots are dried on the ground and roofs of houses. Drying the fruit on paper or cement will reduce grit.
- Moisture Content: Use of portable moisture meters is essential to insure proper moisture range of the final product prior to packaging and shipment.

Peaches being dried in California

These activities would compliment field production assistance. If the extension team were already in place, no additional costs would be necessary, except for some instruments and sulfur. Marketing extension work would connect Jalalabad traders to villages participating in the drying. This connection would assure farmers are connected with a market for their products.

6.10. Delayed Intervention - 2nd Level Drying Technique

The quality of the Afghan dried apricots is generally good, but they are not cleaned sufficiently and are too low in moisture. A central cleaning line consisting of a warm water soak tank followed by a rotary brush washer is needed to maximize fruit quality. Product can be air-dried on trays before packaging to minimize cost. The facility should have a quality control laboratory to properly evaluate raw and finished quality products, as well as proper storage and sulfuring techniques.

This intervention would require washing, drying and packaging equipment, along with proper storage facilities. This extra cleaning is only a market requirement for export beyond Pakistan. Since current low production levels favor fresh fruit as opposed to dried fruit, this intervention should be considered for later work.

7. References

Altai Consulting, *Market Sector Assessment in Horticulture*, Ministry of Commerce, UN Development Programs
June 2004

California Agricultural Statistics Service
1994-2004 Almond Tree Yields

Duke, James A., *Handbook of Energy Crops*
Juglans regia L. English walnut, Carpathian or Persian Walnut
1983

Estrada-Valle, Juan Manuel, *Perennial Horticulture in Eastern Afghanistan: Subsector Overview and Implementation Strategy*, Development Alternatives, Inc.
January, 2005

FAOstat.org

Marini, Richard P., Extension Specialist, Horticulture, *1988 - 1995 Apricot Variety Evaluations in Virginia,* Publication Number 442-761
Virginia Tech
June 2001

Pakistan Oil and Gas Regulatory Authority Ordnance, 2002 (VII of 2002), Notification 31 December 2005

United States Department of Agriculture, *GAIN Report*
August, 2005

U.S. Department of Agriculture, National Agricultural Statistics Service, *California Fruit & Nut Review, Volume 26, Number 4*
California Field Office
April 17, 2006

U.S. Department of Energy, *Natural Gas Annual 1999*
DOE/EIA-0131(99) (Washington, DC), table 94
October 2000

Vachun Z., *Production Weight and its Variability in 24 Apricot Genotypes Over Six Years*
Mendel University of Agriculture and Forestry, Brno, Faculty of Horticulture,
Lednice na Moravě, Czech Republic
April 10, 2002

8. Sources in Afghanistan

Government Meetings
Ministry Of Agriculture, Jalalabad
Chamber of Commerce of Afghanistan in Jalalabad
Ministry of Commerce, Jalalabad Customs House
- Nadeem Ullah Obaidi

ROP Field Survey
Field Visits by Agriculture Assessment Team to the following districts
- Kama
- Jalalabad
- Bati Kot
- Khogyani
- Sherzad
- Kuz Kunar
- Surkh Rod
- Qarghayi
- Dara-i-Nur

From Khozakhail
- Zaher Khan (Farmer/Tribesman)
- Sayed Agha (Farmer/Rural Trader/Tribesman, Phone # 0799-593272)
- Lal Sayed (Farmer/Tribesman)
- Muhammad Gul (Farmer/Tribesman)
- Attaullah (Farmer/Tribesman)
- Lala Gul (Farmer/Tribesman)
- Shiekh Ahmadzai (Farmer/Tribesman)
- Janat Gul (Farmer/Tribesman, Phone# 0799-836549)
- Najeeb (Farmer/Tribesman)
- Zerat Gul (Farmer/Tribesman)
- Momin (Farmer/Tribesman)
- Wahidullah (Farmer/Rural Trader/Tribesman, Phone # 0799-379935)

From Peerankhail
- Malak Gulzar Jan (Malak/Farmer/Tribesman)
- Hajji Nasrullah (Farmer/Tribesman)

From Ahmad Khail
- Sayed Ahmad (Farmer/Tribesman)
- Naziffullah (Farmer/Tribesman)

From Markihail
- Dr, Fazal Karim (Farmer/Tribesman)
- Amirullah (Farmer/Tribesman)

From Kodikhail
- Hajji M. Wali (Farmer/Tribesman)
- Hajji Jamal (Farmer/TribesmanPhone#0799-189212)
- Muhammad Yusaf (Farmer/Tribesman)

From Hesarak area
- Dad Muhammd (Farmer/Tribesman)
- Noor Alam (Farmer/Tribesman, Phone # 070-155465)
- Hajji Jan Alam (Farmer/Tribesman)
- Haqmal (Farmer/Tribesman, 0799-547680)

- Bismillah (Farmer/Tribesman)

ROP Trader Survey

Fresh Fruits and Vegetables traders Association of Nangarhar (FFVTAN)
- Mr. Haiji Gul Murad (President)
- Mr. Ghulam Qader (Vice President)

Dried Fruits Association of Nangarhar
- Ajmal (President)

Meetings with Traders in Jalalabad
- Gul Rehman (peanut exporter)
- Hajji Malik (peanut exporter)
- Malem Khan Agha (peanut exporter)
- Aslam (peanut, walnut, pine nut exporter)
- Hajji Badam and Gul Sayed (nuts and dried fruits trader and exporter)
- Sardar Eshan, Qari Noor Sadique Dried Fruits Store (nuts and dried fruits retailer)
- Hajji Badam (exporter and domestic trader)
- Gul Rehman (exporter and domestic trader)
- Qadeem (domestic trader)

Discussions with Retail Merchants
- Qari Noor, Sadique Dried Fruits Store
- Haji Badam, Nuts and Dried Fruits Store

US Producer

Traina Farms, Modesto, California USA
- Joe Traina

DAI Team
- Juan Estrada
- Noor Alam

Appendices

Appendix #1 Impediments Matrix

Constraint	Service and Target	Existing Provision of Service
APRICOTS		
1. Minimal or poor pruning techniques	FARMERS: General extension services, including working with local ag input suppliers to ensure they stock proper tools for pruning.	1. MAAH
2. Poor planting techniques	FARMERS: General extension services and/or simple guide books	1. MAAH 2. NGO
3. Insects in apricots and walnuts - tent caterpillar - scale - wood boring beetle	FARMERS: General extension services and/or simple guide books	1. MAAH
4. No use of bees to promote pollinization, mechanical removal of ladybugs	FARMERS: General extension services and/or simple guide books to promote the value of good insects	1. MAAH
5. Orchard size too small	FARMER: Educate on commercial approach to farming orchards. NURSERY: Focus new tree subsidies on real commercial farmers.	1.NGO (IFHOPE) provides trees. 2. Traders
6. Low yields	FARMERS: Orchard extension services could provide basic guidance to establish core cultural methods	1. MAAH 2. Ag input suppliers
7. Trees not shaped - too high - poor structure	FARMERS: Orchard extension services could provide pruning guidance	1. MAAH
8. Dried fruit discolored and gritty	FARMERS: Orchard extension services could provide post-harvest handling and drying support	1. MAAH 2. Export traders
9. Secondary roads in disrepair	GOVERNMENT: improved dirt roads would allow transit of fresh fruit. FARMER: dried fruit is the alternative	1. No immediate activity planned for production areas.

ALMONDS		
10. Low number of orchards	NURSERY: provide more saplings. Current production areas should be surveyed and potential crops for each micro-climate identified to farmers	1. Nursery 2. MAAH
11. Poor cultural methods	FARMER: provide basic extension to improve cultural practives	1. MAAH
WALNUTS		
12. Insects in walnuts - ring worm - tent caterpillar	FARMERS: General extension services and/or simple guide books	1. MAAH
13. Low yields	FARMERS: Orchard extension services could provide basic guidance to establish core cultural methods	1. MAAH
PINE NUTS		
14. Harvesting methods are damaging trees and reducing forest	FARMERS: Introduce non-destructive harvest methods	1. No current support
15. Roasting technology in Jalalabad is not adequate to roast pine nuts	PROCESSORS: Upgrade roasters with new fuel source	1. Export traders 2. Roasters
16. Pakistani agents bypass Jalalabad traders	TRADERS: Must provide value add and connect with international markets beyond Pakistan	1. Export traders 2. Roasters
PEANUTS		
17. Low income due to low market prices	TRADERS: Supply meets demands	1. Export traders
18. Roasting technology in Jalalabad is not competitive with Pakistani roasters for peanuts	PROCESSORS: Upgrade roasters with new fuel source	1. Export traders 2. Roasters
CROSS-CUTTING		
19. Limited cool and no cold storage	TRADERS: Upgrade storage facilities with swamp coolers and measures to reduce spoilage loss	1. Traders 2. Provincial Government

Appendix #2 Dehydrated Products

Most all fruits and vegetables can be dehydrated, however some do not produce the desired quality or use attributes as others. Some also require such sophisticated technology that costs become prohibitive to produce a quality product without a well established market demand. Most of the more common fruits and vegetables being dehydrated on a commercial basis are listed below:

Table 23. **Characteristics of Commonly Dehydrated Fruits & Vegetables**

Raw Material	Ave Initial Moisture (%)	Ave Bulk Density (Kg/Cum)	Ave Yield (Kg In/Kg Out)	Ave Final Moisture (%)	Blanching Required	
					YES	NO
FRUITS						
Apple	88.0	615	10 to 1	15-23, 2.5	x	
Apricot	85.0	320	6-8 to 1	15-23, 3-5		x
Banana	76.0			2.5 -4		x
Cherry	83.0	673	10 to 1	5-7		x
Grape	81.0		4-5 to 1	10-14		x
Peach	86.5	610	6-8 to 1	15-28, 3-5		x
Pineapple	82.0	406		3-5		
VEGETABLES						
Cabbage	93.0	641	11.5 to 1	4-5	x	
Carrot	88.2	644	11 to 1	4	x	
Celery	93.7		17.5 to 1	4	x	x
Corn, Sweet	73.9	448	9 to 1	5	x	
Garlic	66.0	453	3 to 1	6.5		x
Leek	90.5		9.5 to 1	4-5		x
Mushroom	93.0		13 to 1	10		x
Onion	88.0	730	8 to 1	4		x
Parsley	92.0		10 to 1	4-5		x
Peas, Green	74.3	567	3.7 to 1	4	x	
Pepper, Chili	91.5	240	5 to 1	3, 7-8		x
Potato	80.0	640	7 to 1	4-5	x	
Potato, Sweet	68.5	640	5 to 1	4-5	x	
Tomato	96.0	560	16 to 1	4		x

Appendix #3 Pine Nut Forest Locations

These are the locations the survey team visited to review the pine nut forests. The team hiked to these locations in the mountains. There was no roads these locations.

Table 24. **Pine Nut Forest Locations**

GPS Readings for Production Areas			
Location	Coordinate N	Coordinate E	Max Elevation (m)
Kaga (Khozakhail)	34.25861	70.18973	1746
Peeralkhail	34.18957	70.17252	1746
Markikhail	34.23916	70.04731	1746
Sherzad District	34.24302	69.99305	1746
Kudikhail (Hills)	34.20906	69.95781	2303
Gandomak	34.28439	70.01630	2303
Zawa	34.18773	70.11099	2303

Source: Direct observation by ROP team.