Afghanistan Water, Agriculture, and Technology Transfer (AWATT) Program

Farm Resource Management Program in Nangarhar Province

Final Technical Report

Dr. Hamdy Oushy

Associate Professor
College of Agricultural, Consumer, and Environmental Sciences
New Mexico State University

Forage & Rangeland Management Specialist, USAID-NMSU/AWATT
E-Mail: hamdy@nmsu.edu; Office: + (575) 646-1162 USA

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**Authority**
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**Prepared by:**

NMSU-AWATT Team with CSU, UIUC, and SIUC

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# Table of Contents

Table of Figures ........................................................................................................ iii
Abbreviations and Terms ........................................................................................... v

Executive Summary .................................................................................................... 1

Introduction ................................................................................................................ 2

AWATT Farm Resource Management Program ....................................................... 2

  Program Description ............................................................................................... 2

  Program Focus ........................................................................................................ 4

  Program Objectives ............................................................................................... 6

  Expected Outcomes ............................................................................................... 6

Model Program Site .................................................................................................. 7

Program Partners ..................................................................................................... 7

Roles and Responsibilities ......................................................................................... 7

Beneficiaries .............................................................................................................. 9

FRM Program Activities ........................................................................................... 9

On Farm Demonstration .......................................................................................... 12

Applied Research and Observation Trials ............................................................... 17

  MAIL Shishem Bagh Research Farm, 2010-2011 .................................................. 17

    Egyptian Clover Yield Performance Trial ......................................................... 18

    Forage Alfalfa Observation Trial ..................................................................... 22

    Breeding Program: Synthetic Variety of Egyptian Clover ............................... 23

    Forage Fodder Beet Observation Trial ............................................................. 25

    Intercropping of Egyptian Clover and Fodder Beet ...................................... 28

    Animals Feeding Observation Trial ................................................................. 30

FRM Demonstration and Research Activities at MAIL/NVDA in 2010-2011 ............. 34

FRM Demonstration and Research Activities at the Agronomic Research Farm at Nangarhar University in 2010-2011 ................................................................. 35

  Egyptian clover Varietal Comparison Trial ......................................................... 36

Forage Preservation Program .................................................................................. 39

  Egyptian clover hay house making .................................................................... 39

  Egyptian clover hay bale making ....................................................................... 40

Capacity Building .................................................................................................... 42

FRM Training Workshops ....................................................................................... 42
TABLE OF FIGURES

Table 1. Average fresh forage yield (MTon/ha) of Egyptian clover obtained in 4 Districts in Nangarhar Province at 13 demonstration plots (farms) during the growing season of 2010-2011…………………………………………………………………………………………………………………………….15

Figure 1. Average fresh forage yield (MTon/ha) of Egyptian clover obtained in 4 Districts in Nangarhar Province at 13 demonstration plots (farms) during the growing season of 2010-2011………………………………………………………………………………………………………………………………………………….15

Table 2. Total forage yield (MTon/ha) of the five tested Egyptian and two local clover varieties as a percentage of the total accumulated yield obtained from three cuts at the MAIL Shishem Bagh Research Farm, Nangarhar Province during the growing season of 2010-2011……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………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Figure 4. Average of alfalfa fresh forage yield (MTon/ha) obtained from three cuts at MAIL Shishem Bagh Research Farm, Nangarhar Province during the growing season of 2010-2011.

Figure 5. Average yield performance (MTon/ha) of the first Synthetic cycle of five Egyptian clover varieties obtained from three cuts at the MAIL Shishem Bagh Research Farm, Nangarhar Province during the growing season of 2010-2011.

Table 3. Fresh forage yield of fodder beet obtained at MAIL Shishem Bagh Research Farm and Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL), and at demonstration plots in three districts: Behsood, Kama, and Khewa in Nangarhar province during the growing season of 2010-2011.

Figure 6. Fresh forage yield of fodder beet obtained at MAIL Shishem Bagh Research Farm and Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL), and at demonstration plots in three districts: Behsood, Kama, and Khewa in Nangarhar province during the growing season of 2010-2011.

Figure 7. Average fresh forage yield (MTon/ha) of Egyptian clover intercropped with fodder beet obtained at MAIL Shishem Bagh Research Farm during the growing season of 2010-2011.

Table 4. Total fresh forage yield (MTon/ha) of fodder beet intercropped with Egyptian clover obtained at MAIL Shishem Bagh Research Farm in 2010-2011 growing season.

Table 5. Total monthly weight gain (Kg) of goats and lambs obtained at the Shishem Bagh DAIL/Animal Husbandry Department facility in Jalalabad, Nangarhar province in May-June 2011.

Figure 8. Total monthly weight gain (Kg) of six lambs obtained Shishem Bagh DAIL/Animal Husbandry Department facility in Jalalabad, Nangarhar province in May-June 2011.

Figure 9. Total monthly weight gain (Kg) of four goats obtained Shishem Bagh DAIL/Animal Husbandry Department facility in Jalalabad, Nangarhar province in May-June 2011.

Table 6. Total forage yield (MTon/ha) of the six tested Egyptian and local clover varieties as a percentage of the total accumulated yield obtained from three cuts at the Nangarhar University Agronomic Research Farm, Nangarhar Province during the growing season of 2010-2011.

Figure 10. Forage yield (MTon/ha) distribution per cut of the six tested Egyptian and local clover varieties obtained from three cuts at the Nangarhar University Agronomic Research Farm, Nangarhar Province during the growing season of 2010-2011.

Figure 11. Total forage yield (MTon/ha) distribution of the six tested Egyptian and local clover varieties obtained from three cuts at the Nangarhar University Agronomic Research Farm, Nangarhar Province during the growing season of 2010-2011.
**ABBREVIATIONS AND TERMS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AWATT</td>
<td>Afghanistan Water, Agriculture and Technology Transfer</td>
</tr>
<tr>
<td>Canal</td>
<td>In this and all AWATT documents, the word “canal” refers to either a secondary or tertiary canal. ¹</td>
</tr>
<tr>
<td>CSU</td>
<td>Colorado State University</td>
</tr>
<tr>
<td>jerib</td>
<td>Unit of land area approx. 0.2 hectare</td>
</tr>
<tr>
<td>karez</td>
<td>Usually unlined sloping tunnels in the hills that access aquifers</td>
</tr>
<tr>
<td>MAIL</td>
<td>Ministry of Agriculture, Irrigation and Livestock</td>
</tr>
<tr>
<td>MEW</td>
<td>Ministry of Energy and Water</td>
</tr>
<tr>
<td>NMSU</td>
<td>New Mexico State University</td>
</tr>
<tr>
<td>NVDA</td>
<td>Nangarhar Valley Development Authority</td>
</tr>
<tr>
<td>SIUC</td>
<td>Southern Illinois University Carbondale</td>
</tr>
<tr>
<td>UIUC</td>
<td>University of Illinois at Urbana-Champaign</td>
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<tr>
<td>US</td>
<td>United States</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
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</table>

¹This distinction is important because the new Afghan Water Law passed this year (2010) gives responsibility for primary canals (diverted directly from the rivers) to the Ministry of Energy and Water (MEW), and for secondary canals (diverted from the primary canals to villages) and tertiary canals (diverted from the secondary canals for distribution to the farms) to be the responsibility of MAIL, specifically the newly established MAIL Department of Irrigation (DI). Similarly, the term “watercourse” is used interchangeably with the word “canal” in AWATT documents.
EXECUTIVE SUMMARY

Continued use of traditional short-term wheat-rice crop rotations may not be a sustainable agricultural practice in Afghanistan. Although the rice/wheat crop rotations may have been profitable in the past, they have had negative consequences such as reducing organic matter in the soil and increasing soil erosion, increasing the need for more external inputs like fertilizer and pesticide, lower productivity, weeds, insects and disease. As a consequence, farmers need viable production alternatives. In addition, basic challenges face farmers who do not know the relationship between nitrogen fixing crops and soil health. They plant the same crops season after season without putting nutrients back in soil, thus depleting the soil and further reducing productivity. Nangarhar Province is characterized as an overly-reliant on “the cereal wheat/rice cycle in Afghanistan that has resulted in soil degradation, lower productivity, lower organic matter, weeds, insects and disease.

However, before farmers can make objective decisions about alternative, sustainable agricultural practices, they need sound information from replicated, long-term research and demonstrations conducted at a realistic sized farm in different districts in Nangarhar Province in Afghanistan. Integrated crop rotation using Egyptian clover may be a good alternative for farmers. Using extended pasture rotations with livestock also diversifies the farming system and reduces reliance on fertilizer and pesticide.

The farmers' building capacity is a challenge to correct and improve the Afghan agricultural system. Farmers also have low knowledge about the basic principles of agricultural production which include crop rotation, livestock nutritional health, irrigation practices and natural fertilizers. Farmers do not understand the relationship between protein rich forage legume and the productivity of their livestock.

The FRM program addresses the various factors that inhibit plentiful harvests and keep farm incomes low, in ways that can be handed off to the provincial Department of Agriculture, Irrigation and Livestock extension agents and be replicated in other areas of the country.

The USAID/DAIL/AWATT Farm Resource Management Program has been established since June of 2010. FRM is a lower watershed rehabilitation program designed to improve on-farm animal husbandry practices, water management practices, irrigation practices, and soil conditions through scientifically accepted forage and fodder crop rotation practices. The main objective of the FRM program is to break the cereal wheat/rice cycle in Afghanistan that resulted in soil degradation, lower productivity, lower organic matter, weed, insects and disease problems. The FRM program is based on the introduction and the incorporation of the Egyptian clover varieties into the current wheat/rice crop rotation in order to correct it.
**INTRODUCTION**

In June 2010, the AWATT Forage and Rangeland Management Specialist, Dr. Hamdy Oushy, proposed to the USAID/Nangarhar, the On-Farm Resource Management Strategy, the integrating crop and livestock uses of land and water resources in the lower Afghan watersheds. This Proposal has been approved by the USAID starting with the establishment of the FRM program through the DAIL extension and research system in three districts: Chaparhar, Kama and Behsood in Nangarhar Province and the establishment of a FRM demonstration plot at the Shishem Bagh Research Farm.

The FRM Program is a long term program (2-3 years) and will be expanded to the other 19 districts in Nangarhar and other provinces in Afghanistan in 2011. For instance, in October 2011, the Farm Resource Management (FRM) program will start up in the lower watershed farming area of Kashmond Kala village at Dare Noor District in Nangarhar Province, which is connected to the pilot upper rangeland watershed rehabilitation area managed by the Rangeland Watershed Management (RWM) Program.

**AWATT FARM RESOURCE MANAGEMENT PROGRAM**

**Program Description**

The Farm Resources Management (FRM) is a program of the Nangarhar DAIL that is designed by AWATT to improve on-farm animal husbandry and water management and irrigation practices, and improve soil conditions through scientifically accepted forage and fodder crop rotation practices, and begin rehabilitation of the lower watershed. FRM program is also a part of the Integrated Watershed Management collaborative efforts that the USAID, ADT, and USDA initiated through the MAIL for the Eastern Region Pilot project.

- In the lower watershed, AWATT’s Farm Resource Management program was introduced to establish sustainable agricultural practices that included the rehabilitation of farmland and discouraged unfettered grazing of the upper watershed catchment areas.
- The main focus of the FRM program is to break the cereal wheat/rice cycle in Afghanistan that resulted in soil degradation, lower productivity, lower organic matter, weeds, insects and disease problems.
- The FRM program is based on the introduction and the incorporation of the Egyptian clover varieties as the main legume forage crop in the current wheat/rice crop rotation in order to correct it and introduce the practice of crop rotation for healthier soil.
- The FRM program deals with 7 components, soil, water irrigation, crop rotation, forage legume, livestock, local farmers and community participation, and farm economic incentive.
- The Farm Resource Management (FRM) program applies lessons learned through tested AWATT interventions in forage, irrigation and upper watershed restoration to increase
agricultural productivity and sustainability in the lower watersheds. The FRM is an adaptation of the “whole farm management” concept under local environmental conditions.

- As a pilot project, FRM is essentially a research enterprise. The goal is to determine the best mix of traditional and modified farming and animal husbandry practices, incorporating the appropriate combination of crops to produce optimal results for the population.

- The major crop-related element of the FRM pilot is the introduction of suitable nitrogen-fixing forage crops to the farmers’ inventory. Therefore, six high-yield varieties of Egyptian clover were introduced by the AWATT/FRM program from Egypt and were being tested as a winter forage crop under Nangarhar environmental conditions. The rotation of the nitrogen-rich Egyptian clover with the traditional winter wheat will result in higher yields of the wheat and the summer crops, as well as improved soil conditions.

- The AWATT on-farm water irrigation management will be part of the FRM model, including laser land-leveling, water turnouts and irrigation scheduling. The crop yield per unit of water and land will be determined by DAIL researchers in Nangarhar. In addition to farm economic analysis, farm return and impact of the FRM program will be determined by DAIL/Nangarhar.

- The FRM Program for integrating crop and livestock uses of land and water resources in the lower Afghan watersheds has been developed as a model project based on the DAIL extension and research facilities in Chaparhar, Kama, Behsood, Kuz Kunar (Khewa) districts in Nangarhar province, a demonstration plot at the MAIL Shishem Bagh Research Farm, Jalalabad, and a demonstration plot selected with MAIL under the Nangarhar Valley Development Authority (NVDA) at Hada Farm #1.
Alternate livelihood support and training are provided to farmers in the selected villages in Chaparhar, Kama, Behsood, Kuz Kunar (Khewa) districts to diversify the economic base for the pilot project area and to incentivize farmers and villagers to participate in and maintain the FRM program. The participating farmers are learning new ways to farm sustainably, such as rotating their crops, recycling animal manures in the soil and integrating livestock into the cropping system to improve the quality of their soil. They can compare the results alongside their traditional fields.

The FRM program is highly collaborative, involving Afghan agricultural officials, research and extension personnel from national, provincial and district levels; the U.S. National Guard Agriculture Development Team (ADT-Missouri in Nangarhar), local political leaders, faculty and students from the provincial university, and a group of 13 farmers from four districts.

Program Focus

The main focus of the FRM program is to break the cereal wheat/rice cycle in Afghanistan that resulted in soil degradation, lower productivity, lower organic matter, weed, insects and disease problems by the introduction of Egyptian clover as the best alternative forage legume that can be rotated with wheat in winter and with rice in summer in the same unite of land.

The FRM program will deal with 7 components:

- Soil
- Water irrigation
- Crop rotation
- Forage legume (Egyptian clover)
- Livestock
- Local farmers and community participation
- Farm economic and incentive component
The Seven Components of Farm Resource Management:

1. Soil:
   - Team will analyze the soil at start to determine chemical and physical properties and reanalyze after every crop rotation.
   - Plays a vital role in the cropping system.
   - Suffers currently under existing management systems.
   - Benefits from new soils lab in Chaparhar district

2. Water irrigation:
   - Team will determine yield per unit of water and land and perform the following tasks appropriately:
     - Direct laser leveling.
     - Raised beds
     - Advanced canal systems
     - Scheduled irrigation crop water requirements
     - Calculate amount of water irrigation delivered to each crop on the farm.

3. Crop rotation:
   - Team will implement a new two-year rotation system where
     - Wheat and Egyptian clover are planted in the winter
     - Rice, corn, and forage (cow pea, soya bean, pearl millet, and Sudan grass) are planted in the summer.

4. Forage legume:
   - Team will introduce Egyptian clover, which:
     - Has high nitrogen fixing
     - Offers high yields (up to five cuts per winter season)
     - Has deep root system
     - Gives high nutritional value for livestock
     - Increases soil fertility
     - Improves soil properties

5. Animals:
   - Team will provide fencing, shading, and structures made from local materials.
   - Advisors will
     - Suggest purchase of compatible breeds.
     - Provide temporary grain sources, and
     - Establish a livestock marketing system.

6. Farmer & community participation:
   - Local communities, village leaders, district governors, DAIL, extension workers, USAID, and ADT will participate and contribute during the transition to the new system.

7. Farm economic incentive:
   - Team will monitor and evaluate the lower watershed models in terms of:
     - Soil fertility and properties.
     - Yield performance.
     - Water irrigation and consumption.
     - Forage production and livestock feeding system.
     - Manure production and recycling.
     - Crop budget and returns, and
     - Socioeconomic analysis.
Program Objectives

In general, the objectives of the AWATT Farm Resource Management Program in Nangarhar Province are:

- To introduce the Farm Resource Management (FRM) system by incorporating the Egyptian clover as a highly nutritional value as well as a high Nitrogen-fixing ability in the cereal Wheat/Rice cropping system in Afghanistan;
- To assist the local government, MAIL and DAIL extension workers, and farmers in improving agricultural production through initiating and monitoring the crop and forage production activities, providing the supervision and the necessary technical assistance;
- To demonstrate farm resource management procedures for the different farming systems and traditional approaches in selected districts in Nangarhar Province;
- To improve soil fertility, provide higher high quality protein forage and increase cereal yields;
- To improve the farmer’s livelihood through more efficient and sustainable agriculture and crop-forage-Livestock production systems;
- To develop and introduce low-cost crop and forage production technologies beneficial to farmers and their families in terms of increasing their income, efficiency in use of time or labor through on-farm demonstrations, workshops, and field days;
- To provide on-farm demonstration training to farmers, extension workers, researchers, faculty members, teachers and students in selected districts in crop and forage technology transfer including: crop, forage and seed production, as well as practical agronomic training in land preparation, fertilizer application, irrigation, plantation, harvesting fresh crop and forage, and seed production.

Expected Outcomes

Based on the expected positive results from the establishment of pilot demonstration plots and farmers’ response in selected districts of Nangarhar Province, the USAID/DAIL/AWATT FRM Program anticipates increasing farm production and economic benefits for all farmers participating in the program.

The anticipated benefits from the FRM Program development for farmers are:

- Improved soil productivity due to increased organic matter and nutrients;
- Opportunity for upper watershed to heal, creating a more productive resource for grazing, tree products and decreased flooding and siltation of the lower watershed irrigation systems;
- Increased quality of livestock marketed and yields of wheat, rice and fruit/nut crops - all leading to higher per-capita income;
- Increased household incomes from selling their Egyptian clover as fresh forage to dairy farms in Nangarhar province in winter.
Model Program Site

The pilot FRM Program involves 13 farms (13 demonstration plots and 26.4 jerebs or 5.3 hectare) selected in four districts: Chaparhar, Kama, Behsood, Kuz Kunar (Khewa) and 2 demonstration plots at the MAIL Shishem Bagh Research Station in Jalalabad (2 jerebs or 0.4 hectare) and at the MAIL Hada Farm under Nangarhar Valley Development Authority (NVDA/MAIL) in Jalalabad (15 jerebs or 3 hectare) for a total land area of 43.4 jerebs or 8.7 hectares.

Program Partners

- Ministry of Agricultural, Irrigation and Livestock (MAIL),
- Nangarhar Directory of Agriculture, Irrigation and Livestock (DAIL),
- US Military Nangarhar Agri-Business Development Team (ADT IV Missouri),
- USAID/Nangarhar,
- USDA/Nangarhar,
- US-PRT/Nangarhar,
- Farmers,
- District Shura Councils,
- Afghanistan Water, Agriculture, and Technology Transfer (AWATT) program.

Roles and Responsibilities

The DAIL is the FRM project owner and participates with their extension and research system during the implementing and evaluation phases;

- Monitors and evaluates the effectiveness of the FRM program relating to socioeconomic benefits, soil improvement, water use and crop yields;
- Has primary responsibility for community integration as well as follows up with the community in all matters;
- Implements and maintains an extension training material development program that utilizes and incorporates the resources of Nangarhar University and international organizations to increase the ability of the DIAL to provide direct training to farmers;
- Provides technical and professional training and advice to extension officers in all areas of agriculture production relating to forage and fodder crops, on-farm animal husbandry practices, watershed rehabilitation techniques, leadership, government management, animal husbandry practices, cooperative association management and market development;
• Keeps and maintains the animal sheltering facility at the facility of the DAIL Animal Husbandry Department in Jalalabad in order to provide an on-farm animal husbandry demonstration program that utilizes improved forage and fodder production techniques.
• Keeps and maintains improved forage and fodder plot at Shisambaugh Agricultural Research Station or another readily accessible government facility in Jalalabad to permit continued research in improved forage and fodder growing and as a demonstration plot for farmers.

The USAID-OAG provides organizational leadership of the FRM Program through a team oriented approach that includes DAIL, AWATT and ADT.

The ADT is primarily interested in increasing the capacity of the DAIL to provide constituent agriculture services through the DAIL’s extension officers through technical, management and leadership training. The ADT extension centers will be the meeting points for training and soil lab testing.

ADT provides:
• Fencing, shading areas, and feeding facilities;
• High quality Egyptian clover, wheat and rice seeds;
• A training facility to disseminate knowledge about the FRM Model in Nangarhar including, improving irrigation and agronomic practices;
• Seed processing facility for sustainability;
• Extension materials and training;

The USDA provides technical support to the ADT and USAID and works with the DAIL to help them implement the best practices.

AWATT is the lead Implementing Partner and subject matter expert:
• Leads the project and provides technical and scientific expertise for the implementation and expansion of the FRM program;
• Provides mentoring and on-job training to DAIL employees, including extension officers, cooperative associations and farmers on programs and techniques relating to the FRM program.
• Seeks funding to hire two master trainers to be placed within the DAIL Home Economics department to provide training and resources to females in support of the FRM program. These master trainers may also provide additional training and resources to women on non-FRM projects and programs, at no additional cost to AWATT.
• Assists the 13 farmers previously selected to perform proof-of-concept for the FRM program in forming a cooperative association.
• Develops a master animal sheltering plan that utilizes readily available local resources and which are easily constructed and maintained by individual farmers for hay storage, on-farm feeding and sheltering of livestock.
• Develops a plan to extend the FRM program beyond the original key 13 farmers participating in the FRM program.

**Beneficiaries**

The success of the FRM program depends upon the local community being fully invested in the program. The anticipated improved agricultural productivity and economic benefits will increase the possibility of sustained behavioral change by the local villagers.

Farm resource management activities and efforts such as soil fertility, on-farm water management, efficient and sustainable crop rotation, introduction of Egyptian clover forage legume, integrated crop/livestock systems, farm economic incentives, and community participation will benefit the farmers and local communities and provides the foundation to encourage community participation in the FRM pilot project efforts. Watershed rehabilitation activities in both the upper and lower watersheds under the FRM and RWM programs will significantly contribute to the overall watershed reclamation.

The FRM program will increase the output of the forage crops and farmers' incomes from improved livestock health and productivity in the eastern region of Afghanistan that will allow farmers also to grow forage crops as an alternative source of income.

**FRM Program Activities**

The first FRM Program meeting and workshop had been held in Jalalabad, Nangarhar at Shishem Bagh Research Center in August 2, 2010, where over 60 participants were at the meeting, including the national Afghanistan Press.

In addition, the Nangarhar and Kunar DAIL directors, Nangarhar DAIL Line Managers of Extension, Irrigation, Livestock, National Resources Management and Planning and Policy Manager participated in this event. The USAID-OAG, Missouri ADT (Nangarhar), Kansas ADT (Laghman), USDA representatives and the USAID implementing partners ASAP, CHAMP, SWSS and IDEA-NEW Nangarhar University Agriculture Faculty also attended.
Since the first FRM Program meeting and workshop held in Jalalabad, Nangarhar in August 2, 2010, the AWATT Farm Resource Management Program expanded and developed its activities in Nangarhar Province under the supervision of Mr. Robert Smith, the ownership of Eng. Safi, DAIL-DG and the technical leadership of Dr. Hamdy Oushy, the AWATT FRM and Forage Programs Leader.

The FRM pilot project activities and agricultural inputs provided to farmers who participated in the program are as following:

In August 2010, several meetings were held with the District Governor, extension officer and farmers’ community of both Kama and Behsood districts to finalize the demo plot site selection and to inform about the FRM activities of AWATT in Nangarhar province.

- Four FRM Demonstration Plot sites in each of the three districts; Behsood, Kama and Kuz Kunar (Khewa) and one demo plot in Chaparhar district were selected after a full consultation with DAIL Nangarhar, and local government authorities. In addition, one
demo plot has been selected at the MAIL Shishem Bagh Research Farm, Jalalabad, and one demo plot has been selected at the MAIL Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA).

- The selected plots have been laser leveled.

In September 2010, laser land leveling had been completed at the FRM Demonstration plot sites in Kama and Behsood districts in preparation for planting Egyptian clover.

- The areas of the selected demo plots have been measured by GPS and coordinates noted.
- The soil analysis for fertility has been carried out at each of the selected demonstration plots (farms) before planting and after each crop rotation at the newly established soils lab in Shishem Bagh Research Farm.

Recommendations from the soil analysis report for the type and quantity of fertilizers required to be applied have been provided;

Broadcasting Egyptian clover in October, 2010; and the growing clover in January, 2011 in Behsood district, Nangarhar Province.

- 200 Kg of the best Egyptian clover six varieties (Hellaly, Sakh-4, Gemiza-1, Serw-1, Giza-6, and Fahl) were brought to Nangarhar from Egypt by Dr. Hamdy Oushy for the FRM
implementation program in addition to 20 Kg seeds of improved alfalfa from Australia and 9 Kg of improved fodder beet seeds from Hungarian to be used in the FRM program in Nangarhar province. Below is the list of the introduced forage varieties:

- Egyptian clover (Hellaly variety) 100 kg
- Egyptian clover (Sakha-4 variety) 20 kg
- Egyptian clover (Gemiza-I variety) 20 kg
- Egyptian clover (Giza-6 variety) 20 kg
- Egyptian clover (Serw-I variety) 20 kg
- Egyptian clover (Fahl variety) 20 kg
- Alfalfa (Server variety) from Australia 20 kg
- Fodder beet (Hungarian Variety) 9 kg

- Farmers in Chaparhar, Kama, Behsood, Kuz Kunar (Khewa) districts and demonstration plots at Hada Farm #1 NVDA/MAIL and at the MAIL Shishem Bagh Research Farm, Jalalabad have been provided with 1,350 kg of DAP and 1,350 kg of UREA fertilizers:
  - Chaparhar: 100 kg of each fertilizer
  - Kama: 350 kg of each fertilizer
  - Behsood: 350 kg of each fertilizer
  - Kuz Kunar (Khewa): 300 kg of each fertilizer
  - Hada Farm #1 NVDA/MAIL 150 kg of each fertilizer
  - MAIL Shishem Bagh Research Farm 100 kg of each fertilizer

- The participating farmers have been provided with the improved Egyptian clover and fodder beet seeds, and fertilizer only at 25% of the actual cost.
- Egyptian clover was planted on the plots, where wheat and other crops had been grown in the past;
- Clover growth, number of cuts, health of animals and milk production have been monitored for assessing the benefits in comparing to traditional forages;
- Irrigation of the plots has been carefully monitored throughout the growing season.

**On Farm Demonstration**

The main objectives of the AWATT/ FRM On-Farm Demonstration activities are to 1) Incorporate and demonstrate the Egyptian clover into the wheat/rice rotation at the farmers’ levels; 2) Educate farmers and build their capacity in FRM principles via demo plots; 3) Educate and train the DAILs’ extension workers and researchers in FRM principles and concepts through hands-on training in applied research and extension activities.
In July 2010, the AWATT FRM Program had initiated its activities on Egyptian clover forage and seed production technological demonstration and testing in four districts of the Nangarhar province. Thirteen farmers in four districts: Kama (4), Behsood (4), Chaparhar (1) and Khewa (4) were selected to participate in the FRM Egyptian clover on-farm demonstration and testing program.

During the 2010 growing season, Dr. Hamdy Oushy, the AWATT Forage & Rangeland Specialist, and the AWATT FRM Program Team Leader worked on the development and supervision of 13 Egyptian clover forage demonstration plots (6 jeribs – 26.4 jeribs or 5.3 hectare) that have been established and planted in four districts in Nangarhar province for the purpose of Egyptian clover forage and seed production testing and demonstration to local farmers:

- The AWATT FRM Program Team and DAIL worked closely with the farmers in each of districts to monitor their progress and provide guidance and necessary technical assistance. The AWATT FRM team worked closely with the DAIL extension workers to guide them and improve their capacity to perform their work effectively;
- All the demonstration plots were regularly visited by the AWATT FRM team and the DAIL extension workers;
Egyptian clover Forage Yield Performance Results

In October of 2010, the AWATT FRM Program team prepared layouts of 13 Egyptian clover forage demonstration plots in Kama, Behsood, Chaparhar and Khewa districts in Nangarhar province. Forage data from four cuts at the farmers’ demo plots were collected by the MAIL extension workers and the AWATT Forage team and analyzed for a future evaluation of yield performance on farmer-owned land.

The Egyptian clover forage yield results obtained in 2010-2011 growing season at 13 demo plots (farms) in Nangarhar province are displayed below in Table (1) and Figure (1).
Table 1. Average fresh forage yield (MTon/ha) of Egyptian clover obtained in 4 Districts in Nangarhar Province at 13 demonstration plots (farms) during the growing season of 2010-2011

<table>
<thead>
<tr>
<th>NN</th>
<th>District Name</th>
<th>Number of Farmers</th>
<th>Average Fresh Egyptian Clover Forage Yield per Cut (MTon/ha)</th>
<th>Total Fresh Forage Yield (MTon/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Behsood</td>
<td>4</td>
<td>Cut - 1: 19.17, Cut - 2: 26.67, Cut - 3: 32.60, Cut - 4: 36.28</td>
<td>114.72</td>
</tr>
<tr>
<td>2</td>
<td>Kama</td>
<td>4</td>
<td>Cut - 1: 28.98, Cut - 2: 34.33, Cut - 3: 32.04, Cut - 4: 36.38</td>
<td>131.73</td>
</tr>
<tr>
<td>3</td>
<td>Khewa</td>
<td>4</td>
<td>Cut - 1: 20.38, Cut - 2: 30.33, Cut - 3: 40.33, Cut - 4: 35.38</td>
<td>126.42</td>
</tr>
<tr>
<td>4</td>
<td>Chaparhar</td>
<td>1</td>
<td>Cut - 1: 19.67, Cut - 2: 41.83, Cut - 3: 42.83, Cut - 4: 40.83</td>
<td>145.16</td>
</tr>
</tbody>
</table>

Average of Fresh Egyptian Clover Forage Yield (MTon/ha)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>Average Fresh Egyptian Clover Forage Yield (MTon/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cut - 1: 22.05, Cut - 2: 33.29, Cut - 3: 36.95, Cut - 4: 37.22</td>
</tr>
</tbody>
</table>

Figure 1. Average fresh forage yield (MTon/ha) of Egyptian clover obtained in 4 Districts in Nangarhar Province at 13 demonstration plots (farms) during the growing season of 2010-2011

![Bar chart showing average Egyptian Clover Fresh Forage Yield Per Cut in 4 Districts in Nangarhar Province, 2010-2011](chart)
A farmer in Behsood district is happy with his improved Egyptian clover variety; and data collection was carried out at other Egyptian clover demonstration plot in Kama District, Nangarhar province, in March 2011

Summary of results

- During the growing season of 2010-2011, the obtained number of cuts was four cuts.
- The Egyptian clover fresh forage yield per growing season from four cuts ranged from 114.7 MTon/ha in Behsood, 126.4 MTon/ha in Khewa, 131.7 MTon/ha in Kama, and 145.2 MTon/ha in Chaparhar districts.
- The overall average fresh forage yield of Egyptian clover per growing season of 2010 in four districts per cut 1, 2, 3 and 4 were 22.1, 33.3, 37.0, and 37.2 MTon/ha respectively.
- The participating 13 farmers reported that they will replace the local inferior clover variety by the AWATT introduced and improved variety of Egyptian clover after they planted at their farms, tested, fed to their livestock, increased milk production and their livestock’s weight gain.
- The participating 13 farmers requested that MAIL and DAILs have to produce the certified seeds of the improved Egyptian clover for all Afghan farmers, and make it available in their local seed markets.

Recommendations

- Based on the results and findings documented above, we recommend that this adapted, promising, high yielding, highly nutritional and long growing season forage legume Egyptian clover crop be registered and certified at MAIL Seed System as a new forage crop for the benefits of the Afghan farmers, herders, dairy productions and for the agricultural production enhancement in Afghanistan.
- National Afghan seed enterprises should include the Egyptian clover as one of the top forage legume crop to be produced according to the new seed law of Afghanistan.
Applied Research and Observation Trials

The main objectives of these AWATT/FRM activities are to 1) Test and evaluate the yield performance of the introduced improved Egyptian clover, fodder beet and alfalfa crops under Nangarhar environmental conditions; 2) Improve the MAIL FRM research base and researchers' capacity building; 3) Improve the FRM research base of the College of Agriculture at Nangarhar University as well as their research capacity building; 4) Produce a fact sheet and training extension materials of all the agricultural practices for Egyptian clover for farmers, MAIL extension workers, researchers, faculty members and students.

Ten trials in animal feeding, the Egyptian clover varietal comparison, the breeding program, fodder beet and alfalfa yield performance, and seed production were applied in October 2010 at 1) MAIL Shishem Bagh Agricultural Research Farm, 2) Agronomic Research Farm at Nangarhar University; 3) MAIL Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL).

MAIL Shishem Bagh Research Farm, 2010-2011

The following AWATT FRM Program applied research and demonstration activities have taken place at the MAIL Shishem Bagh Research Farm (2 jeribs or 0.4 hectare), Jalalabad in Nangarhar province during the 2010-2011 growing season:

Applied Research Experiment:
- Yield Performance of 5 Egyptian Clover and 2 Local Clover Varieties under Shishem Bagh, Nangarhar Environmental Conditions;

Yield Performance Observation Trials (Demonstration Plots) for Forage and Seed Production:
- Yield Performance of Alfalfa;
- Yield Performance of Egyptian Clover Synthetic Variety under Breeding Program;
- Yield Performance of Fodder Beet;
- Yield Performance of Egyptian Clover (Hellaly Variety) and Fodder Beet Intercropping;

Lambs and Goats Feeding Observation Trial
- Animals Feeding Observation Trial at Shishem Bagh DAIL/Animal Husbandry Department, Jalalabad.
Egyptian Clover Yield Performance Trial

Experimental title: Varietal Comparison Trial of five Egyptian clover varieties: Hellaly, Gemiza-1, Serw-1, Sakha-4, and Giza-1 and two Afghan local varieties: Local Afghan and Peshawri under Shishem Bagh Research Farm, Nangarhar Province Environmental Condition in Afghanistan.

Dr. Oushy delivers a training program in FRM research and principles for the MAIL Shishem Bagh Researchers at AWATT Compound in Jalalabad, Nangarhar province, in February 2011

Dr. Oushy delivers a practical training in Egyptian clover research trials; and data collection for the DAIL-Researchers at the MAIL Shishem Bagh Research Station in Jalalabad, Nangarhar province, in February 2011

Experimental objectives

- To evaluate the fresh yield of the seven Egyptian and local Clover Varieties under Shishem Bagh Research Farm, Nangarhar province conditions;
- To recommend the best performing clover variety for Shishem Bagh Research Farm type conditions in Nangarhar Province;
- To demonstrate the forage best practices and train MAIL-Researchers, Nangarhar University faculty and students in forage varietal research;
To produce a fact sheet and farmers’ field guide for farmers and extension agents about Egyptian clovers best agricultural practices.

Eng. Mohamed Hussein Safi, DAIL/Nangarhar General Director, with Dr. Oushy in visit to the FRM research and demonstration plots of Egyptian clover and fodder beet at Shishem Bagh Research Farm in Jalalabad, Nangarhar province, in February 2011

10 DAIL-Researchers carried out all the FRM demonstrations and research trials of Egyptian clover, fodder beet and alfalfa at the MAIL Shishem Bagh Research Station in Jalalabad, Nangarhar province, from October 2011 to June 2011

Egyptian and local clover forage varietal comparison trial results

Yield results of the Egyptian and local clover forage varietal comparison trial obtained at the Shishem Bagh Research Farm, in Jalalabad obtained during the growing season of 2010-2011 are displayed below in Table (2) and Figure (2 and 3).
Table 2. Total forage yield (MTon/ha) of the five tested Egyptian and two local clover varieties as a percentage of the total accumulated yield obtained from three cuts at the MAIL Shishem Bagh Research Farm, Nangarhar Province during the growing season of 2010-2011

<table>
<thead>
<tr>
<th>Clover Forage Variety</th>
<th>First Cut</th>
<th>Second Cut</th>
<th>Third Cut</th>
<th>Total of three cuts (MTon/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield</td>
<td>% of the total</td>
<td>Yield</td>
<td>% of the total</td>
</tr>
<tr>
<td>Hellaly</td>
<td>19.97 A</td>
<td>22.74</td>
<td>27.12 A,B</td>
<td>30.88</td>
</tr>
<tr>
<td>Local Afghan</td>
<td>20.59 A</td>
<td>22.16</td>
<td>32.53 A</td>
<td>35.00</td>
</tr>
<tr>
<td>Gemiza-1</td>
<td>19.94 A</td>
<td>21.98</td>
<td>30.31 A,B</td>
<td>33.42</td>
</tr>
<tr>
<td>Serw-1</td>
<td>22.50 A</td>
<td>26.53</td>
<td>26.37 B</td>
<td>31.09</td>
</tr>
<tr>
<td>Sakha-4</td>
<td>24.02 A</td>
<td>27.94</td>
<td>27.69 A,B</td>
<td>32.20</td>
</tr>
<tr>
<td>Peshawri</td>
<td>19.06 A</td>
<td>24.65</td>
<td>25.69 B</td>
<td>33.22</td>
</tr>
<tr>
<td>Giza-1</td>
<td>22.44 A</td>
<td>25.28</td>
<td>25.12 B</td>
<td>28.30</td>
</tr>
<tr>
<td>CV (%)</td>
<td>15.95</td>
<td>14.72</td>
<td>19.44</td>
<td>10.33</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>5.03</td>
<td>6.09</td>
<td>10.93</td>
<td>13.34</td>
</tr>
</tbody>
</table>

LSD (0.05) Hellaly 6.83
LSD (0.05) Local Afghan 13.65
LSD (0.05) Gemiza-1 4.52
LSD (0.05) Serw-1 8.80
LSD (0.05) Sakha-4 6.49
LSD (0.05) Peshawri 7.58
LSD (0.05) Giza-1 6.12

Figure 2. Forage yield (MTon/ha) distribution per cut of the five tested Egyptian and two local clover varieties obtained from three cuts at the MAIL Shishem Bagh Research Farm, Nangarhar Province during the growing season of 2010-2011

![Diagram showing forage yield distribution per cut](attachment:Graph.png)
Summary of results

This experiment should be replicated in the next growing season for two more successive years. An experimental (seeding rates) error had been discovered that negatively affected the outcome results. The seeding rate was calculated based on the actual clover seeding rate in Nangarhar province; when we were told by farmers that they have been using 5 kg seed per Jerib (2000 m²). However, after the first cut we have discovered that the number of seeds per gram for local Afghan clover (Local Afghan and Peshawri) is twice as much as the Egyptian clover.

Therefore, the plant density, number of plants per m², for both Egyptian and local clover became significantly different. As a result, the yield was not reflected the phenotypic performance of the Egyptian clover varieties.

Dr. Hamdy Oushy, the AWATT Forage & Rangeland Specialist, and the AWATT FRM Program Team Leader has decided to keep these results and display it in the present report with explanation as a lesson learned that local researchers, scientists and students or anyone who will do research in Afghanistan would pay attention to this fact.

The results shown that the lowest significant yield was recorded by Peshawri with 77.3 MTon/hectare; whereas, there are no significant differences in yield among Serw-1, Sakh-4, Local Afghan, Hellaly, and Gemiza-1.
Recommendations

- This experiment should be replicated in the next growing season for two more successive years.
- The optimal seeding rates that should be used is 10 kg/Jerib for the Egyptian clover Varieties and 5 kg/Jerib for the Local Afghan varieties.

Forage Alfalfa Observation Trial

An observation trial of alfalfa (Medicago sativa), Server variety from Australia was implemented at DAIL-Shishem Bagh Research Farm in Jalalabad in Nangarhar province on October 24, 2011. AWATT Farm Resource Management Program introduced alfalfa as a perennial major forage legume that highly adapted to Afghanistan, highly nutritional for livestock and good alternative legume crop in three year crop rotation for healthy productive soil in Afghanistan.

The results for the fresh forage yield of alfalfa obtained at the MAIL Shishem Bagh Research Farm during the growing season of 2010-2011 are displayed in Figure (4).

*Figure 4. Average of alfalfa fresh forage yield (MTon/ha) obtained from three cuts at MAIL Shishem Bagh Research Farm, Nangarhar Province during the growing season of 2010-2011*

Summary of results

- The obtained number of cuts was three cuts, in the first half of the establishment year, through the period from October 2010 to June 2011.
- The total fresh forage alfalfa yield from the first three cuts, in the first establishment year, was 105.06 MTon/ha.
The fresh forage yields recorded per cut 1, 2 and 3 were 32.9, 37.4 and 34.8 MTon/ha respectively.

**Recommendations**

- The alfalfa demo plot should be continued up to three years in order to make a conclusion.
- The alfalfa demo plot should be rotated after three years with wheat/Egyptian clover and rice/wheat crop rotations.

**Breeding Program: Synthetic Variety of Egyptian Clover**

Five equal weights of five Egyptian clover varieties: Hellaly, Sakh-4, Gemeza-1, Serw-1, and Giza-1 were mixed and planted with seeding rate of 7.5 kg per Jerib to produce the first Synthetic cycle of the offspring seeds at Shishem Bagh Research Farm in Jalalabad at Nangarhar Province in October 2010. This cycle should be repeated for 4-5 years with selection to produce the new synthetic variety for Nangarhar of the mixture Egyptian clover varieties. The DAIL-Researchers at Shishem Bagh Research Farm received a specialized training in Egyptian clover breeding program to produce synthetic variety adapted and highly productive in Nangarhar Province.

**Objectives:**

- To produce high yielding and high quality new synthetic varieties of Egyptian clover under Nangarhar environmental condition;
- To improve the capacity of MAIL-researchers on forage breeding;
- To sustain the breeding program and maintain the breeding materials for years to come.

The results for the fresh forage yield of mixed five Egyptian clover varieties: Hellaly, Sakh-4, Gemeza-1, Serw-1, and Giza-1 obtained from three cuts under the Breeding Program at the MAIL Shishem Bagh Research Farm during the growing season of 2010-2011 are displayed in Figure (5).
Summary of results

- The obtained number of Egyptian clover cuts was three cuts per 2010-2011 growing season. The total fresh forage yield per growing season from three cuts was 74.4 MTON/ha.
- The fresh forage yields recorded per cut 1, 2 and 3 were 20.3, 24.7 and 29.5 MTON/ha respectively.

Recommendations

- This synthetic cycle should be repeated for 4-5 years with selection to produce the new synthetic variety for Nangarhar of the mixture Egyptian clover varieties.
Forage Fodder Beet Observation Trial

AWATT FRM program introduced fodder beet to Afghanistan/Nangarhar as the second winter forage crop after Egyptian clover. Fodder beet is a mono cut, highly nutritional and very rich forage crop in carbohydrates. Results shown that fodder beet is significantly increased milk production.

An observation trial of fodder beet (Beta vulgaris) Beta Vrochenger variety from Hungarian variety from Australia was implemented at DAIL-Shishem Bagh Research Farm in Jalalabad in Nangarhar province on October 24, 2011. AWATT Farm Resource Management Program introduced fodder beet as an annual winter forage crop adapted to Nangarhar province.

Objectives:

- To be planted with Egyptian clover in intercropping or as a mono crop.
- It is harvested in May; where there no available fresh forage crops for livestock.
- It will fell the shortage of forage between the last winter forage cut and the first summer forage cut.
- It is introduced for the household milk production cows to help farmers to increase their livestock’s milk production as well as their incomes and their nutritional diets.
A farmer feeds his milking cow fodder beet produced from his farm in Behsood district, Nangarhar Province in May 2011

The results for the fresh forage yield of fodder beet obtained at the MAIL Shishem Bagh Research Farm and Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL), and at demonstration plots in three districts: Behsood, Kama, and Khewa in Nangarhar province, during the growing season of 2010-2011 are displayed in Table (3) and Figure (6).

**Table 3. Fresh forage yield of fodder beet obtained at MAIL Shishem Bagh Research Farm and Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL), and at demonstration plots in three districts: Behsood, Kama, and Khewa in Nangarhar province during the growing season of 2010-2011**

<table>
<thead>
<tr>
<th>No</th>
<th>District</th>
<th>Farmer or Farm’s Name</th>
<th>Village</th>
<th>Plots Size (m²)</th>
<th>Tuber Unit Weight (Kg)</th>
<th>Weight (MTon/m²)</th>
<th>Weight (MTon/Ha)</th>
<th>Weight (MTon/Jerib)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Behsood</td>
<td>Morad Khan</td>
<td>Qalay Peer Sahib</td>
<td>1,000</td>
<td>8</td>
<td>0.04</td>
<td>400</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>Khewa (Farm 1)</td>
<td>Nadir Khan</td>
<td>Malikzay</td>
<td>500</td>
<td>10</td>
<td>0.05</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Khewa (Farm 2)</td>
<td>Noor Ul Haq</td>
<td>Shad Khan</td>
<td>500</td>
<td>13</td>
<td>0.06</td>
<td>600</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>Kama</td>
<td>Pach</td>
<td>Khanjar Khile</td>
<td>500</td>
<td>8</td>
<td>0.04</td>
<td>400</td>
<td>80</td>
</tr>
<tr>
<td>5</td>
<td>Hada Farm #1</td>
<td>MAIL/NVDA</td>
<td></td>
<td>8,000</td>
<td>8</td>
<td>0.04</td>
<td>400</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>MAIL Shishem Bagh Research Farm</td>
<td></td>
<td></td>
<td>100</td>
<td>11</td>
<td>0.05</td>
<td>500</td>
<td>100</td>
</tr>
</tbody>
</table>
Figure 6. Fresh forage yield of fodder beet obtained at the MAIL Shishem Bagh Research Farm and Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL), and at demonstration plots in three districts: Behsood, Kama, and Khewa in Nangarhar province during the growing season of 2010-2011.

Summary of results

- The obtained yield of fodder beet ranged between 400 to 600 MTon/ha per 2010-2011 growing season.
- The average total fresh forage yield per growing season was 500 MTon/ha per season in late May.
- The highest fodder beet yield was recorded in Khewa district with 600 MTon/ha.
- The yield was converted to MTon/ha; however, farmers planted in small demo plots.
- The yield performance is very promising and highly productive; it indicated that the crop is very adapted to Nangarhar Province environmental condition.
Recommendations

- Fodder beet should be intercropped with Egyptian clover in the small farming system.
- It should be feed after cutting in relatively small pieces for cows.
- It should be also intercropped around the border of the vegetable fields.
- It should be feed daily with mixtures of Egyptian clover hay and wheat straw for milking cows to obtain the highest milk production.

Intercropping of Egyptian Clover and Fodder Beet

AWATT established a demonstration plot for intercropping fodder beet in the border of the Egyptian clover (Hellaly variety) plots at MAIL-Shishem Bagh Research Farm in Jalalabad at Nangarhar Province in October 2010.

Objectives:

- To maximize and diversify the forage production per unit area.
- To produce high quality balanced forage mixture for milking cows at small farms.
- To increase the household farm incomes from selling fresh milk.
- To improve livestock production.

The results for the fresh forage yield of Egyptian clover, Hellaly variety, and fodder beet obtained at the MAIL Shishem Bagh Research Farm during the growing season of 2010-2011 are displayed in Figure (7) and Table (4) respectively.
Figure 7. Average fresh forage yield (MTon/ha) of Egyptian clover intercropped with fodder beet obtained at MAIL Shishem Bagh Research Farm during the growing season of 2010-2011

Table 4. Total fresh forage yield (MTon/ha) of fodder beet intercropped with Egyptian clover obtained at the MAIL Shishem Bagh Research Farm during the 2010-2011 growing season

<table>
<thead>
<tr>
<th>No</th>
<th>Demo Plot Size</th>
<th>Crops</th>
<th>Quantity of Fodder Beet Tubers per Plot Size</th>
<th>Tuber Unit Weight (Kg)</th>
<th>Total Yield per Plot Size (MTon)</th>
<th>Total Yield (MTon/ Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 m² (10*10)</td>
<td>Fodder Beet Intercropping with Egyptian Clover (Hellaly variety)</td>
<td>180</td>
<td>8</td>
<td>1.44</td>
<td>144</td>
</tr>
</tbody>
</table>

Summary of results

- The obtained number of Egyptian clover cuts was four cuts per 2010-2011 growing season. The total fresh forage yield per growing season from four cuts was 130.0 MTon/ha.
- The fresh forage yields recorded per cut 1, 2, 3 and 4 were 24.2, 32.1, 41.6 and 32.1 MTon/ha respectively.
- 180 fodder beet tubers or 1.44 MTon of fodder beet were produced from 100 m² of intercropped land with Egyptian clover.
Therefore, for every Jerib (2000 m²) of planted Egyptian clover, 28.8 MTon of intercropped fodder beet could be produced from the same unit of land with no additional water irrigation and or chemical fertilizers.

**Recommendations**

- Intercropping of fodder beet with Egyptian clover should be implemented in Nangarhar province as normal agricultural practices to maximize forage quality, quantity and household incomes.
- Fodder beet should be cut in pieces right before feeding the milking cows.
- Fodder beet should be fed in mixture with Egyptian clover hay and wheat or rice straw.

**Animals Feeding Observation Trial**

AWATT FRM Program in collaboration with the US Military Agribusiness Development Team (ADT IV Missouri – Nangarhar) and DAIL/Nangarhar Animal Husbandry Department at Shishem Bagh Research Farm in Jalalabad, rehabilitated fencing, shading areas, and feeding facilities for demonstration, research and training.

This feeding facility was used to carry out a feeding observation trial to investigate the best alternative rations based on the available forage resources in summer. In addition to be used as a training site for the DAIL Animal Husbandry Department (DAHD) staff in animal nutrition.

The Lambs and Goats Feeding Observation Trial was carried out by AWATT FRM Team at Shishem Bagh DAHD facility in Jalalabad, Nangarhar province in May 2011. This observation trial was conducted on five groups of feeding rations with five groups of animals including 6 lambs and 4 goats of three month ages for 30 days from May 20th to June 20th of 2011. Six different daily rations have been used for the trial.

**Objectives:**

- To investigate the best alternative feeding ration based on the available forage resources in summer.
- To be used as a training and research site for the DAIL Animal Husbandry Department (DAHD).
- To train DAIL/Nangarhar researchers, extension workers, staff, and students in animal nutrition.
- To enhance the research and extension bases of MAIL in animal nutrition.
Dr. Oushy and Dr. Roger, AWATT COP, discuss the FRM collaborative works with the ADT/Nangarhar Commander Col Fortune and his team: the rehabilitation of the Animal fencing, shading area, and feeding facilities of MAIL at Shishem Bagh Animal Husbandry Department, Jalalabad, Nangarhar province in February 2011

Dr. Oushy discusses the pre-rehabilitation process of the animal nutrition facility with the DAIL/Nangarhar DG and his staff and shows to the AWATT COP, Dr. Roger the actual rehabilitation of the Animal fencing, shading areas, and feeding facilities of MAIL at Shishem Bagh Animal Husbandry Department, Jalalabad, Nangarhar province in February 2011

Animals Nutrition Observation Trial carried out at Shishem Bagh DAIL/Animal Husbandry Department facility, Jalalabad, Nangarhar province through May-June 2011
The results of the lambs and goats feeding observation trial obtained at the MAIL Shishem Bagh Research Farm in May-June 2011 are displayed in Table (5) and Figure (8 and 9).

**Table 5. Total monthly weight gain (Kg) of goats and lambs obtained from the Shishem Bagh DAIL/Animal Husbandry Department facility in Jalalabad, Nangarhar province in May-June 2011**

<table>
<thead>
<tr>
<th>No</th>
<th>Group</th>
<th>Livestock</th>
<th>Daily Ration</th>
<th>Lambs and Goats Feeding Observation Trial: May 20 - June 20, 2011</th>
<th>Total Monthly Weight Gain (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Egyptian Clover Hay</td>
<td>Wheat Straw</td>
<td>Barley</td>
</tr>
<tr>
<td>1</td>
<td>A</td>
<td>Lamb</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Lamb</td>
<td>28.0</td>
<td>28.8</td>
<td>30.8</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>Lamb</td>
<td>23.0</td>
<td>23.1</td>
<td>24.0</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Lamb</td>
<td>28.0</td>
<td>29.8</td>
<td>31.0</td>
</tr>
<tr>
<td>5</td>
<td>C</td>
<td>Lamb</td>
<td>28.0</td>
<td>28.4</td>
<td>29.4</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Lamb</td>
<td>26.0</td>
<td>26.8</td>
<td>28.8</td>
</tr>
<tr>
<td>7</td>
<td>D</td>
<td>Goat</td>
<td>16.8</td>
<td>16.9</td>
<td>17.3</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Goat</td>
<td>15.5</td>
<td>15.9</td>
<td>16.7</td>
</tr>
<tr>
<td>9</td>
<td>E</td>
<td>Goat</td>
<td>16.0</td>
<td>16.3</td>
<td>16.8</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Goat</td>
<td>10.0</td>
<td>10.4</td>
<td>11.3</td>
</tr>
</tbody>
</table>

**Figure 8. Total monthly weight gain (Kg) of six lambs obtained from the Shishem Bagh DAIL/Animal Husbandry Department facility in Jalalabad, Nangarhar province in May-June 2011**

![Graph showing weight gain of lambs from Group A, B, and C over 30 days]
Summary of results

- The obtained result in table (5) indicated that group B ration for lambs resulted in the highest monthly gain weights with average of 7.2 Kg/month.
- The lowest monthly gain weight for lambs was recorded in group C ration with average of 6.0 Kg/month gain weight.
- The highest monthly gain weight for goats was recorded in group D ration with average of 4.5 Kg/month.
- The lowest monthly gain weight for goats was recorded in group E ration with average of 3.6 Kg/month.

Recommendations

- The feeding ration of daily: 3.0 Kg of Egyptian clover hay, 1.0 Kg of barley grain, and 1.0 Kg of wheat straw should be used in fattening lambs to have the highest gain weights.
- The feeding ration of daily: 4.0 Kg of Egyptian clover hay and 1.0 Kg of barley grain should be used in fattening goats to have the highest gain weights.
**FRM Demonstration and Research Activities at MAIL/NVDA in 2010-2011**

The following AWATT FRM program activates were applied observation research and demonstration activities which have been taken place at the MAIL Hada Farm #1 under the Nangarhar Valley Development Authority (NVDA/MAIL), in Jalalabad (15 jeribs or 3 hectare) in Nangarhar province during the growing season of 2010/2011.

**FRM Research and Demonstration Activities**

- Yield Performance of Alfalfa;
- Breeding Program of Egyptian Clover: Synthetic Variety under Nangarhar condition;
- Yield Performance of Fodder Beet;

**Objectives**

- To develop and establish sound feeding system for the milking cows at the NVDA farm;
- To produce a synthetic new adapted high yielding variety of Egyptian clover under Nangarhar environmental condition;
- To introduce and diversify the fresh forage crops at NVDA dairy farms for their milking cows;
- To establish sound forage based legume crop rotation at NVDA Farm in order to provide a flow of fresh forage resources for the milking cows all the year around.

**Activities**

The following activities have been underway at the Farm-e-Hada (NVDA):

- 2.9 jeribs were used for seed production of Egyptian clover (Fahl variety);
- 1.6 jeribs were used for alfalfa forage and seed production;
- 3.6 jeribs were used for developing a new adapted synthetic variety of Egyptian clover under Jalalabad environmental conditions. The following Egyptian clover improved varieties and quantity were used to produce the first cycle of synthetic variety breeding program:
  - Serw-1 - 7.7 kg,
  - Sakh-4 - 7 kg,
  - Hellaly - 6 kg,
  - Gemiza-1 - 3 kg
- 3.9 jeribs - for forage fodder beet production for milking cows at the NVDA

These above activities have been ongoing activities for years to come. The FRM program has provided the necessary training for the NVDA local staff to follow up and sustain these activities after the end of AWATT project.
FRM Demonstration and Research Activities at the Agronomic Research Farm at Nangarhar University in 2010-2011

AWATT FRM program established a research, training, and demonstration program in forage and FRM technology based on Egyptian clover at the Agronomic Research Farm, College of Agriculture, at Nangarhar University in Jalalabad, Nangarhar Province in the winter growing season of 2010-2011.

FRM Research and Demonstration Activities

- Yield Performance of six Egyptian Clover varietal Comparison under Nangarhar condition;
- Egyptian clover hay house making;
- Egyptian clover hay bale making.

Objectives

- To develop and establish sound feeding system for the small ruminant at the College Farm;
- To strengthen the forage research agronomic base at the Nangarhar University;
- To test and evaluate the six introduced high yielding varieties of Egyptian clover at the College of Agriculture in Nangarhar University;
- To establish sound forage based legume crop rotation at NVDA Farm in order to provide a flow of fresh forage resources all the year around for the milking cows;
- To demonstrate a simple technology for Egyptian clover hay and bale making at the College of Agriculture;
To improve the capacity in research and extension of FRM and forage technology for the faculty members and students.

Egyptian clover Varietal Comparison Trial

Experimental Title:
Yield Performance Comparison of Six Egyptian clover varieties from Egypt: Hellaly, Sakha-4, Gemiza-1, Serw-1, Fahl, and Giza-6 under Nangarhar Environmental Condition.

Experimental objectives

- To evaluate the fresh yield of six Egyptian clover varieties under the Agronomic Research Farm, at Nangarhar University;
- To recommend the best performing clover variety under Nangarhar conditions to be used in Nangarhar Province;
- To demonstrate the forage best practices and train faculty members, Researchers, and students at Nangarhar University in forage replicated applied research;
- To produce a farmers' field guide for farmers and extension agents for Egyptian clover best agricultural practices.

Yield results of Egyptian clover varietal comparison trial obtained at the Agronomic Research Farm at Nangarhar University during the growing season of 2010-2011 are displayed below in Table (6) and Figure (10 and 11).

Table 6. Total forage yield (MTon/ha) of the six tested Egyptian clover varieties as a percentage of the total accumulated yield obtained from three cuts at the Nangarhar University Agronomic Research Farm, Nangarhar Province during the growing season of 2010-2011

<table>
<thead>
<tr>
<th>Egyptian Clover Forage Variety</th>
<th>First Cut</th>
<th>Second Cut</th>
<th>Third Cut</th>
<th>Total of three cuts (MTon/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield (MTon/ha)</td>
<td>% of the total</td>
<td>Yield (MTon/ha)</td>
<td>% of the total</td>
</tr>
<tr>
<td>Hellaly</td>
<td>29.38 A</td>
<td>45.76</td>
<td>34.81 B</td>
<td>54.24</td>
</tr>
<tr>
<td>Sakha-4</td>
<td>31.88 B</td>
<td>38.93</td>
<td>50.00 A</td>
<td>61.07</td>
</tr>
<tr>
<td>Gemiza-1</td>
<td>26.31 B</td>
<td>41.93</td>
<td>36.44 B</td>
<td>58.07</td>
</tr>
<tr>
<td>Serw-1</td>
<td>28.00 C</td>
<td>40.88</td>
<td>40.50 A,B</td>
<td>59.12</td>
</tr>
<tr>
<td>Giza-6</td>
<td>24.06 B</td>
<td>35.78</td>
<td>43.19 A,B</td>
<td>64.22</td>
</tr>
<tr>
<td>Fahl</td>
<td>46.31 C</td>
<td>100.00</td>
<td>0.00 C</td>
<td>0.00</td>
</tr>
<tr>
<td>CV (%)</td>
<td>18.13</td>
<td>18.55</td>
<td>7.46</td>
<td>8.66</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>8.47</td>
<td>9.55</td>
<td>3.66</td>
<td>12.75</td>
</tr>
<tr>
<td>LSD (0.05) Hellaly</td>
<td></td>
<td></td>
<td></td>
<td>11.58</td>
</tr>
<tr>
<td>LSD (0.05) Sakha-4</td>
<td></td>
<td></td>
<td></td>
<td>10.63</td>
</tr>
<tr>
<td>LSD (0.05) Gemiza-1</td>
<td></td>
<td></td>
<td></td>
<td>5.42</td>
</tr>
<tr>
<td>LSD (0.05) Serw-1</td>
<td></td>
<td></td>
<td></td>
<td>8.59</td>
</tr>
<tr>
<td>LSD (0.05) Giza-6</td>
<td></td>
<td></td>
<td></td>
<td>6.69</td>
</tr>
</tbody>
</table>
Figure 10. Forage yield (MT/ha) distribution per cut of the six tested Egyptian and local clover varieties obtained from three cuts at the Nangarhar University Agronomic Research Farm, Nangarhar Province during the growing season of 2010-2011

![Bar chart showing fresh clover forage yield per cut for six varieties from three cuts.](chart10.png)

Figure 11. Total forage yield (MT/ha) distribution of the six tested Egyptian and local clover varieties obtained from three cuts at the Nangarhar University Agronomic Research Farm, Nangarhar Province during the growing season of 2010-2011

![Bar chart showing total fresh clover forage yield at Nangarhar University Agricultural Research Farm demonstration plots, Nangarhar Province, 2010-2011.](chart11.png)
Faculty members, students and AWATT FRM Team are collecting data from the Egyptian clover varietal comparison experiment at the Agronomic Research Farm in the College of Agricultural at Nangarhar University in March 2011

Summary of results

- During the growing season of 2010-2011, the obtained number of cuts was three cuts, due to the late plantation in late November, 2010.
- The highest total Egyptian clover fresh forage yield from three cuts were recorded for Sakh-4 variety with 124.5 MTon/ha, followed by Serw-1 with 105.5 MTon/ha and then by Gimeza-1 with 96.9 MTon/ha.
- The range between the highest and lowest yield performances was 27.6 MTon/ha.
- The productivity of the Fahl variety was obtained from just one cut, since this variety is mono cut type of forage. This variety was included in the experiment to introduce it and demonstrate it to the students. Therefore, it will not actually part of the comparison trial.

Recommendations

- Sakh-4 variety of Egyptian clover should be multiplied and certified with MAIL Seed System and be release as a new Egyptian clover variety under Nangarhar environmental conditions.
- This adapted research trial should be replicated for the second year at the same location to verify the results.
- National Afghan seed enterprises should include the Egyptian clover, Sakh-4 variety as one of the top forage legume crop to be produced according to the new seed law of Afghanistan.
Forage Preservation Program

*Egyptian clover hay house making*

A simple hay-house technology to produce high quality hay was introduced and demonstrated for Egyptian clover by the AWATT FRM team to the College of Agriculture at Nangarhar University in January, 2011. Below is the step-by-step demonstration procedure to establish the hay-house and make the Egyptian clover hay.

**Step (1)**

**Step (2)**

**Step (3)**

**Step (4)**
**Egyptian clover hay bale making**

A simple Hand-Empowered Hay bale making technology was transferred from Texas A&M Extension Cooperative Service and introduced and demonstrated to Afghanistan for Egyptian clover by the AWATT FRM team to the College of Agriculture at Nangarhar University in January, 2011. Below is some photos for the Hand-Empowered Hay bale making technology that was demonstrated at the College of Agriculture at Nangarhar University and at the MAIL Shishem Bagh Farm in Jalalabad in Nangarhar province in 2011. Below is the step-by-step procedure of producing high quality hay of alfalfa and Egyptian clover at the DaIL Animal Husbandry Department at Shishem Bagh Agricultural Research Station in Jalalabad in Nangarhar Province.

**Step-1:** Hay production in forage hay house

**Step-2:** Feed & Compress the Hand-Empowered Hay by hay
Step 3: Placing the Bale String

Step 4: Remove the hay bale

High quality alfalfa hay bales were produced by DAIL staff through the introduced Hand-Powered Hay Bale by AWATT-FRM program at Shishem Bagh Animal Husbandry Depart in Jalalabad, in March 2011.

The introduced simple technology of the Hay-House and Hand-Powered Hay Bale by AWATT-FRM program was displayed at the Farmer Day Exhibit at the Nangarhar Governor House in Jalalabad, Nangarhar Province, in April 2011.
Capacity Building

The main objectives of these AWATT/FRM activities are to provide technical assistance and training to MAIL and DAILs researchers and extension workers to improve their skills and ability to plan, manage and implement the provincial FRM program activates at the district and farm levels.

AWATT FRM program held several training workshops, field days, field visits at MAIL Shishem Bagh Research Farm, Nangarhar University, AWATT compound and US-ADT VI Missouri in Jalalabad in Nangarhar Province. The objectives of these capacity building and public awareness activities were to:

- Building the FRM capacity of the Mail staff, University faculties and students.
- Public awareness among farmers about the important principles of FRM in improving agricultural production.
- Demonstrate the agricultural practices to improve soil fertility, integrate crop/livestock, and incorporate forage legume and implement a proper crop rotation.

Below are some photos of the FRM Capacity building and training workshop activities in Nangarhar through 2010/ June-2011.

**FRM Training Workshops**

- On October 3, 2010, AWATT FRM Program held a training workshop at the AWATT compound in Jalalabad:
  - 20 farmers, who participated in the FRM Program attended this workshop;

FRM training workshop took place at the AWATT compound in Jalalabad on October 3, 2010

- During this workshop, farmers learned about the FRM Program and its objectives and were trained in:
  - The best agronomic agricultural practices to maximize crop and forage production and sustain resources;
  - The establishment of Egyptian clover and fodder beet fields at their farms.

On October 4, 2010, the AWATT FRM Program held a training workshop in Behsood District:

- Farmers, extension workers, the USAID Deputy Representative in Nangarhar Province, Mr. Safi the DG of MAIL-Nangarhar, and the AWATT Forage and Water Program teams attended this workshop;

During this workshop, the first FRM demonstration plot at Morad Khan Farm in Behsood district has been established, where Egyptian clover and fodder beet have been planted;
The first FRM demonstration plot at Morad Khan Farm in Behsood district, Nangarhar province in October 2010

FRM Program Sessions

On October 23-24, 2010, the FRM Research, Demo Plots Establishment and Planning Sessions with ADT/USAID/ DAIL/NVDA/ /AWATT held in Jalalabad, Nangarhar province were focused on the establishment of the FRM research and demonstration plots at the MAIL Shishem Bagh Research Station and the MAIL Farm-e- Hada at Nangarhar Valley Development Authority (NVDA/MAIL).

FRM demo plots establishment and training session for DAIL researchers at MAIL Shishem Bagh Research Farm in Jalalabad, Nangarhar province on October 24, 2010
FRM demo plots establishment and training session for DAIL researchers at MAIL Shishem Bagh Research Farm in Jalalabad, Nangarhar province on October 24, 2010

Dr. Hamdy Oushy explains nutritional value of forage crops for dairy cows and FRM demonstration plots, water turnouts establishment and training for DAIL researchers at the MAIL Shishem Bagh Research Farm in Jalalabad, Nangarhar province on October 24, 2010

**FRM Program Field Days**

On March 9th, 2011, a Field Day was held by the AWATT FRM Program Team at the College of Agriculture, Nangarhar University to demonstrate the Egyptian and Local Clover Forage Varietal Comparison Trial to 100 students and faculty members. Special training was delivered at this Field Day in data collection and the hay making process for students and faculty members by using “Hand-Powered Hay Baler” and Hay Houses.
A Field Day was held at the College of Agriculture, Nangarhar University on March 9th, 2011 for students and faculty members.

Two hay houses and a “Hand-Powered Hay Baler” were provided to the College of Agriculture at Nangarhar University by the AWATT FRM Program Team in order to demonstrate the Egyptian clover hay making process to students and teachers.

Two hay houses and a “Hand-Powered Hay Baler” were provided to the College of Agriculture at Nangarhar University by the AWATT FRM Program Team, March 2011.
The National Guard’s Agribusiness Development Teams (ADTs) Training Program

In February, March and April 2011, as part of the education process, a continuity training program was prepared and provided by the AWATT FRM Program Team for the National Guard’s ADTs in Nangarhar province. The scope of the training included the following topics:

- The Afghan agriculture system;
- Afghan water resources and availability, including irrigation schemes and practices;
- The Afghan watershed, including the upper and lower watershed, and how it functions;
- Current constraints on Afghan agricultural practices and development;
- Potential agri-business opportunities in the Afghan agricultural system;
- Introduction to the FRM system as one potential solution for Afghan agriculture Problems;
- MAIL & DAIL structure and effective strategies to deal and cooperate with them at the Provincial and District level;
- Introduction to upper watershed rehabilitation in Afghanistan;
- Impact of Afghan culture on agriculture practices and development.

Dr. Oushy gives a presentation to the commanders of the Iowa National Guard’s 734th Agribusiness Development Team, the Illinois National Guard’s 1-14th Agribusiness Team, Missouri ADT IV and Missouri ADT V at the Shishem Bagh Research Station on January 28, 2011.
Lessons Learned and Recommendations

FRM is a program of the Nangarhar DAIL that is designed by AWATT to break the cycle of rice/wheat, improve soil fertility, control weeds and diseases, improve on-farm animal husbandry practices, improve on-farm water management practices, improve soil conditions through scientifically accepted forage legume and fodder crop rotation practices, and begin the rehabilitation of the lower watershed.

All activities initiated by the AWATT FRM Program in Nangarhar province during the 2010 growing season and presented in this report have been focused on achieving these goals, developing the sustainability of the crop-forage and seed production system in Afghanistan and providing the broad long-term assistance to Afghanistan national and local government, MAIL and DAIL extension workers, farmers to succeed in this process.

During the FRM Program development in Nangarhar province in 2010-2011, the AWATT FRM Program Team learned important lessons that can be valuable for future international aid activities in Afghanistan.

These lessons include the following:

- Farmers and MAIL extension workers and researchers need the basic agricultural knowledge to understand and properly manage their farm resources and increase productivity;
- Applying basic agricultural principles with low cost intervention as FRM principles, we can set up the foundation for stronger agricultural production in Afghanistan;
- MAIL Extension and Research System is very weak and inefficient;
- There is a lack of communicating, monitoring and evaluating between MAIL and DAILs;
- The crop rotation has to be corrected and it also has to be connected to the market needs.
- Every province in Afghanistan should identify its own competitive agricultural advantages and agricultural production objectives based on the best crop rotations to meet these objectives; future internal and/or external agro business investments will be based on these facts.
- With limited farm water resources in Afghanistan, soils become the most critical factor to maximize the productivity per unit of water.

As a result of the AWATT/FRM Program activities in Afghanistan in 2010-2011, there are a few important recommendations for future activities that have been identified as the following:

- The FRM project was designed for three successive years; therefore, it has to be continued by the DAIL research and extension system and ADT team in Nangarhar in order to obtain relatively long term viable results.
- Farm Resource Management should be continued, expanded and implemented to all of the Afghanistan provinces.
• The Egyptian clover foundation seeds produced by the FRM project have to be used on plantation developed in 2010 to achieve two main objectives: first, half of the produced seeds have to be multiplied as foundation seeds for further usage and; second, the other half has to be used to roll out the FRM program to cover all the districts in Nangarhar province and pilot demos in Laghman and Kunar provinces.
• The introduced improved variety of Egyptian clover should be registered and certified by the MAIL seed system and turned over to local private seed enterprises to produce for Afghan farmers.
• Egyptian clover is the first cash crop for the Egyptian farmers and it should be the same for the Afghan farmers, based on AWATT FRM Program team experience in Nangarhar.

Conclusion

The FRM program relies on community support and involvement to be successful. Community involvement and support can only be achieved with programs that are fully owned and supported by the Provincial DAIL and the District government. Involvement of the Provincial DAIL and District government will increase the legitimacy of the government of Afghanistan with local villagers and demonstrate the government’s ability to provide development programs that are successful and meet the needs of the people.

The USAID, AWATT and coalition forces must provide support to the Provincial DAIL until the government of Afghanistan is capable of assuming full support for the program. However, the program must be seen as government-led with support from the USAID, AWATT and the coalition forces, and not the other way around. This ensures that the government is seen as providing basic services to its people which will help to counter the insurgency.
ANNEX I

AWATT Farm Resource Management Program Activities in Figures
Kama District

<table>
<thead>
<tr>
<th>Plot No</th>
<th>Farmer Name</th>
<th>Village Name</th>
<th>Plot Area Size (Jerib)</th>
<th>Egyptian Clover Seeds (Kg)</th>
<th>Chemical Fertilizer</th>
<th>Soil Sample</th>
<th>Laser Land Leveling</th>
<th>Water Turnouts</th>
<th>GPS Coordinates</th>
<th>Progress of Sowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ajmal</td>
<td>Detahir</td>
<td>2.5</td>
<td>12.6</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>N:34<em>24.365, E:70</em>36.996, EL: 532m</td>
<td>completed</td>
</tr>
<tr>
<td>2</td>
<td>Fazlullah</td>
<td>Kama khas</td>
<td>2.0</td>
<td>10.0</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>E: 70<em>39.425, N: 34</em>24.717, EL: 506m</td>
<td>completed</td>
</tr>
<tr>
<td>3</td>
<td>Pacha Saheb</td>
<td>Sanger Sari</td>
<td>2.0</td>
<td>10.2</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>E: 70<em>37.702, N: 34</em>24.24.347, EL: 520m</td>
<td>completed</td>
</tr>
<tr>
<td>4</td>
<td>Fiaq Shah</td>
<td>Kama Khas</td>
<td>1.6</td>
<td>7.8</td>
<td>50 Kg of DAP + 50 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>N 34<em>24.208, E 070</em>38.529, EL 515 M</td>
<td>completed</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
<td><strong>8.1 Jeribs</strong></td>
<td><strong>40.6</strong></td>
<td>350 Kg of DAP + 350 Kg of Urea</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Behsood District

<table>
<thead>
<tr>
<th>FRM-Plot No</th>
<th>Farmer Name</th>
<th>Village Name</th>
<th>Plot Area Size (Jerib)</th>
<th>Egyptian Clover Seeds (Kg)</th>
<th>Chemical Fertilizer Requirements</th>
<th>Soil Sample</th>
<th>Laser Land Leveling</th>
<th>Water Turnouts</th>
<th>GPS Coordinates</th>
<th>Progress of Sowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Morad Khan</td>
<td>Qalay Peer Saheb</td>
<td>2.2</td>
<td>10.7</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>N: 34<em>27.424, E: 70</em>28.992, EL: 537m</td>
<td>completed</td>
</tr>
<tr>
<td>2</td>
<td>Abdul Ghani</td>
<td>Canal # 14</td>
<td>2.4</td>
<td>11.9</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>E:70<em>31.572, N: 34</em>21.119, EL: 585m</td>
<td>completed</td>
</tr>
<tr>
<td>3</td>
<td>Niamat ullah</td>
<td>Qalay Khiali</td>
<td>2.3</td>
<td>11.3</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>N:34<em>26.627, E:70</em>30.265, EL: 549 m</td>
<td>completed</td>
</tr>
<tr>
<td>4</td>
<td>Lal Mohammad</td>
<td>Canal # 14</td>
<td>1.6</td>
<td>7.7</td>
<td>50 Kg of DAP + 50 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td>N 34<em>21.148, E 070</em>31.805, EL 580 M</td>
<td>completed</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
<td><strong>8.5</strong> Jeribs</td>
<td><strong>41.6</strong></td>
<td><strong>350 Kg of DAP + 350 Kg of Urea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Kuz Kunar (Khewa) District

<table>
<thead>
<tr>
<th>FRM-Plot No</th>
<th>Farmer Name</th>
<th>Village Name</th>
<th>Plot Area Size (Jerib)</th>
<th>Egyptian Clover Seeds (Kg)</th>
<th>Chemical Fertilizer Requirements</th>
<th>Soil Sample</th>
<th>Laser Land Leveling</th>
<th>Water Turnouts</th>
<th>GPS Coordinates</th>
<th>Progress of Sowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Meer Ahamd</td>
<td>Sar Jal, Khewa</td>
<td>1.9</td>
<td>9.3</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td></td>
<td>Completed</td>
</tr>
<tr>
<td>2</td>
<td>Shappor Daman Kalee</td>
<td>1.9</td>
<td>9.3</td>
<td></td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td></td>
<td>Completed</td>
</tr>
<tr>
<td>3</td>
<td>Noor Ul Haq Shad Khan</td>
<td>2.0</td>
<td>10.0</td>
<td></td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td></td>
<td>completed</td>
</tr>
<tr>
<td>4</td>
<td>Nadir Khewa Markaz</td>
<td>2</td>
<td>10.0</td>
<td></td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
<td></td>
<td>completed</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>7.8 Jeribs</td>
<td>38.6</td>
<td>400 Kg of DAP + 400 Kg of Urea</td>
<td></td>
<td></td>
<td></td>
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</table>

## Charparhar District

<table>
<thead>
<tr>
<th>FRM-Plot No</th>
<th>Farmer Name</th>
<th>Village Name</th>
<th>Plot Area Size (Jerib)</th>
<th>Egyptian Clover Seeds (Kg)</th>
<th>Chemical Fertilizer Requirements</th>
<th>Soil Sample</th>
<th>Laser Land Leveling</th>
<th>Water Turnouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Matiullah Khan</td>
<td>Sara Qela</td>
<td>2.0</td>
<td>10.0</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>completed</td>
<td>completed</td>
</tr>
</tbody>
</table>

## Nangarhar Valley Development Authority/ MAIL (NVDA/MAIL)

<table>
<thead>
<tr>
<th>FRM-Plot No</th>
<th>Farmer Name</th>
<th>Village Name</th>
<th>Plot Area Size (Jerib)</th>
<th>Egyptian Clover Seeds (Kg)</th>
<th>Chemical Fertilizer Requirements</th>
<th>Soil Sample</th>
<th>Laser Land Leveling</th>
<th>Water Turnouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NVDA/MAIL</td>
<td>Hada Farm # 1</td>
<td>15.0</td>
<td>20.0</td>
<td>150 Kg of DAP + 150 Kg of Urea</td>
<td>Collected</td>
<td>completed</td>
<td>completed</td>
</tr>
</tbody>
</table>
## Shishem Bagh Research Farm / MAIL

<table>
<thead>
<tr>
<th>FRM-Plot No</th>
<th>Farmer Name</th>
<th>Village Name</th>
<th>Plot Area Size (Jerib)</th>
<th>Egyptian Clover Seeds (Kg)</th>
<th>Chemical Fertilizer Requirements</th>
<th>Soil Sample</th>
<th>Laser Land Leveling</th>
<th>Water Turnouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MAIL/SBRF</td>
<td>Shesham Bagh</td>
<td>2.0</td>
<td>10.0</td>
<td>100 Kg of DAP + 100 Kg of Urea</td>
<td>Collected</td>
<td>Leveled</td>
<td>completed</td>
</tr>
</tbody>
</table>

### Total quantity of chemical fertilizers:

<table>
<thead>
<tr>
<th>No</th>
<th>District</th>
<th>No of Demo Plots</th>
<th>DAP</th>
<th>UREA</th>
<th>Plot Area Size (Jerib)</th>
<th>Plot Area Size (Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kama</td>
<td>4</td>
<td>350 Kg</td>
<td>350 Kg</td>
<td>8.1</td>
<td>1.62</td>
</tr>
<tr>
<td>2</td>
<td>Behsood (Khewa)</td>
<td>4</td>
<td>350 Kg</td>
<td>350 Kg</td>
<td>8.5</td>
<td>1.7</td>
</tr>
<tr>
<td>3</td>
<td>Kuz Kunar (Khewa)</td>
<td>3</td>
<td>300 Kg</td>
<td>300 Kg</td>
<td>7.8</td>
<td>1.56</td>
</tr>
<tr>
<td>4</td>
<td>Chaparhar</td>
<td>1</td>
<td>100 Kg</td>
<td>100 Kg</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>5</td>
<td>NVDA/MAIL</td>
<td>1</td>
<td>150 Kg</td>
<td>150 Kg</td>
<td>15.0</td>
<td>3.0</td>
</tr>
<tr>
<td>6</td>
<td>Shishem Bagh/MAIL</td>
<td>1</td>
<td>100 Kg</td>
<td>100 Kg</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>14</strong></td>
<td><strong>1,350 Kg</strong></td>
<td><strong>1,350 Kg</strong></td>
<td></td>
<td><strong>43.4 Jeribs</strong></td>
<td><strong>8.7 Hectares</strong></td>
</tr>
</tbody>
</table>

### Fertilizer Rate and Application:

**First: DAP**

1. **DAP Rate:** 30 Kg per Jerib;
2. **DAP Application:** DAP must be applied after land laser leveled and be mixed with soil by using light plowing;

**Second UREA:**

1. **Use 20 Kg per Jerib after broadcasting the seeds and before irrigation;**
2. **UREA:** Use 10 Kg per Jerib after two weeks from plantation.
ANNEX 2

Note to Colleagues on “Farm Resource Management (FRM)” Workshop held in Jalalabad on August 1, 2010 by Mr. Robert J. Smith and Mr. Alam, Allah Mohammad
Dear USAID-OAG and USDA Colleagues,

Yesterday in Jalalabad, Nagarhar we held a major Agriculture meeting and workshop. This event is a direct connection to the work you are doing in Kabul and clearly demonstrates how your efforts translate to the field with MAIL and USG partners.

This conference and workshop featured “Farm Resource Management (FRM)” and was held at the Shisham Bagh Research Center in Jalalabad. The event has been in the planning stages for several months in coordination with our USAID OAG Implementing Partner AWATT. Assembled was an impressive cast of participants to include: The Nangarhar and Kunar DAIL directors. Nangarhar DAIL Line Managers of Extension, Irrigation, Livestock, National Resources Management and Planning and Policy Manager. In addition USAID implementing partners ASAP, CHAMP, SWSS and IDEA-NEW were present. Nangarhar University Agriculture Faculty also attended.

Representing the USG team were USAID-OAG, Missouri ADT (Nangarhar), Kansas ADT (Laghman) and USDA. In all over 60 participants were at the meeting and also included the national Afghanistan Press. The coverage of the event was aired the same evening with positive words of support for this government effort.

The workshop was broken down into a presentation portion where the information about FRM was presented to the larger audience. A working lunch was conducted where participants viewed the documentary on the China Watershed Management Project. In the afternoon the DAIL project stakeholders meet to work out the details on the project to include site and farmer selection criteria. A plan was also developed regarding the roles and responsibilities of the DAIL, particularly the extension managers.
USAID-OAG Implementing Partner AWATT is the facilitator and driver of this effort from both a technical and implementation standpoint. Both Dr. Roger Beck and Dr. Hamdy Oushy were present at the workshop with DR. Hamdy delivering the message on FRM and also leading the afternoon breakout session for key stakeholders.

The most critical aspect of success for this important program is ownership by the key Afghan Government stakeholders both at the Provincial and District level. We encouraged DAIL Director Engineer Safi to own the meeting and his leadership and enthusiasm contributed to the success of the workshop as will be the case with the project on the whole.

This important project covers many key areas of OAG strategy to include:

- GIRoA Capacity Building
- Increased Agricultural Productivity
- Watershed and Irrigation Management
- Extension

For specific project information please see attached program review.

Again thank you for your hard work and support in Kabul. Without your efforts we in the field would not be able to initiate these programs and projects.

Kind regards Robert J. Smith and Alam, Allah Mohammad
ANNEX 3

Farm Resource Management (FRM) Program Overview
East Region Final by Mr. Robert J. Smith and Mr. Alam, Allah Mohammad
**Farm Resource Management**

**Integrated approach to water-land-livestock management**

USAID-OAG, Missouri ADT, USAID, USDA Implementing Partner, AWATT and the Directorate Agriculture, Irrigation and DAIL in Nangarhar have been working together for increasing the productivity of the two vital resources—land and water—in Nangarhar through different interventions that are adaptable and acceptable locally. Measurement based management of canals in Chaparhar, Kama and Behsood districts of Nangarhar has shown the impact of improper water distribution along the canal on cropping pattern and farmers’ economy. Similarly, the impact of water conservation technologies like laser land leveling has shown about 50 percent increase in crop yields as compared to the provincial average of wheat yield in Nangarhar.

Based on the positive results from demos and farmers’ response to these programs, DAIL will increase the number of beneficiaries (demos) in the area for the forthcoming wheat season. Simultaneously, the USG team is introducing its forage program in Nangarhar as an agent of soil fertility improvement by breaking the decade’s old wheat-rice and wheat-corn cropping pattern, and for providing more nutritious feed to the livestock of the area.

**The Plan**

The USG team and DAIL are in the planning stages to roll-out Farm Resource Management (FRM) in Nangarhar. Once successful results are realized this can be replicated in other provinces and regions.

After the kick off work shop at Shesham Bagh Research Farm on August 2\textsuperscript{nd} pilot villages will be selected in the, Chaparhar, Kama and Behsood districts of Nangarhar. Basic criteria for farmers’ selection would be their willingness to follow advice of AWATT/DAIL extension staff on different practices, own
livestock, would sign an agreement to continue with the program based on established criteria and to invest 25 percent of their own money as an indication of commitment and ownership of the program. Soil analysis of the selected plots would be carried out in the DAIL Shesham Bagh soil lab and efforts would be made to fulfill the deficiencies therein before planting. The selected plots would be laser leveled, improved and certified variety of wheat would be planted using seed drill. Recommendations from soil analysis report would be followed for the type and quantity of fertilizers required to be applied. Alongside, forage crops would be planted on plots where wheat and other crops had been grown in the past. The growth, number of cuts, health of animals and milk production would be monitored for assessing its benefits as compared to traditional forages. Irrigation of the plots would be carefully monitored throughout the season.

**Roles and Responsibilities:**

- The project owner is DAIL and as such they will participate with their extension and research system during the implementing and evaluation phases. DAIL will monitor and evaluate the socioeconomic, soil, water, and crop yields. The DAIL will have the final say on where the farms will be established. They will have primary responsibility for community integration as well as follow up with the community in all matters.

- Program organizational leadership will be provided by USAID-OAG, although all activities are team oriented.

- The ADT will provide fencing, shading areas, and feeding facilities. The ADT will also provide high quality wheat and rice seeds. And, it will provide a training facility to improve irrigation and agronomic practices.

- USDA will provide technical support to the ADT and USAID and work with the DAIL to help them achieve best practices.
• AWATT is the lead Implementing Partner and subject matter expert. They will lead the project from a technical and implementation standpoint. They will interact with all parties to include the farmers. On-the-job training of DAIL staff and selected farmers in the field. Would be an integral part of the plan.

The 7 components of Farm Resource Management:

1. Soil: Plays a vital role in cropping system. Currently suffering under existing management system. New soil lab in Chaparhar district. We will analyze the soil at the beginning to determine chemical and physical properties. We will reanalyze after every crop rotation.

2. Water irrigation: We will determine the yield per unit of water and land. This will include laser leveling, raised bed and advanced canal system, scheduled irrigation, crop water requirements, and calculating amount of water irrigation delivered to each crop on the farm.

3. Crop rotation: We will implement a new two year rotation system in which wheat and Egyptian clover are planted in the winter, while rice, corn, forage cow pea, soya bean, pearl millet, and Sudan grass are planted in the summer.

4. Forage legume: We will introduce Egyptian clover which has high nitrogen fixing, high yield capacity of up to 5 cuts per winter season, high nutritional value for livestock, a deep root system, increases soil fertility, and improves soil properties.

5. Animals: We will provide fencing, shading, and structures made from local materials. We will suggest purchasing compatible breeds, provide temporary grain sources, and establish a livestock marketing system.
7. Local farmers and community participation: The local communities, village leaders, district governors, DAIL, extension workers, USAID, and ADT will participate and contribute during the transition to the new system.

8. Farm economic incentive: We will monitor and evaluate the lower watershed models in terms of soil fertility and properties, yield performance, water irrigation and consumption, forage production and livestock feeding system, manure production and recycling, crop budget and returns, and the socioeconomic analysis.
ANNEX 4

Farmers’ Comments on Farm Resource Management FRM Program

Mr. Abdul Ghani Khan: “I am very happy from FRM program because I have own Dairy farm and I was in need for good forage and finally I got it in the form of Egyptian clover for the livestock as winter fresh forage and Perl Millet as summer”.

Mr. Shapoor: “He said about Egyptian clover that it’s also called Green Gold: I am 100 % agree with this quote because I saw and observed”.

Mr. Nematullah: “I want to say that is perfect feed, it’s our need, since we have cultivated the Egyptian clover and we are satisfied from our farm feed”.

Mr. Pacha: “Many people are visiting me for seed, because they came to know about the quality and nutritional value of the clover as compared to the traditional one”.

Mr. Noor Ul Haq: “About fodder beet, it is unique crop, feeding with Egyptian clover to our livestock they are becoming healthy and have also increased their milk”.

Engr. Mohammad Hussain Safi: “We changed the life of a whole village by implementing a small watershed project in Dara- e-Noor”.

Engr. Safi: “FRM component of AWATT project was a unique, we learn much more about farming, crop rotation, even though, being a director I was unaware about these techniques”.

Engr. Safi: “I will recommend all the farmers of the Province, to use half of their land for Clover because its Cash crop and also a great alternative”.

Mr. Bahadur Khan: “Thanks to AWATT for providing us an opportunity to perform some practical experiments- After 15 years of Graduation from University, if I learnt something, it was from FRM – AWATT Program”.

Mr. Abdul Fatah: “We had a facility for Livestock, but nothing there since long, but now we have lambs and goats and performing the feeding trials. Being a veterinary doctor, it’s more important for us to inform the farmer about the proper feeding patterns of their livestock”.

Haji Mohammad: “FRM Program provided job opportunity, but it also saved our land from degradation by making check dams”.

ACKNOWLEDGEMENTS

I would like to acknowledge the contributions, collaboration, and support of the following groups and individuals in the development of this Farm Resource Management (FRM) report; USAID/Afghanistan, AWATT in country team, MAIL, DAILs, US Military ADT/Nangarhar.

Moreover, I would like to acknowledge the great support of New Mexico State University, for its sincere support to establish this Farm Resource Management Program and provide the model and tools for MAIL to improve farm resources and agricultural production in Afghanistan.

Special thanks should be given to Col. Michael D. Fortune, Nangarhar ADT IV Commanding and his team for his sincere cooperation, through the signed MOU in collaborative FRM, and support for all our efforts to help Afghan people to improve their agricultural system and production.

In addition, I would like express my appreciation for Robert Smith, the USAID Field Officer, Agriculture Office, in Nangarhar for his tireless efforts to establish the FRM Program in Nangarhar Province and to be rolled out all over Afghanistan.

Thanks should be extended to Tanya McDonald, Assistant Scientist, and Rosanne Norris, Administrative Assistant, at Ag Econ Ag Business Department at NMSU for formatting and editing this report.

Also, I would like to acknowledge the contribution and support of my FRM and forage teams in Nangarhar province for their tireless efforts and support for the FRM program implementation.

Finally, I would like to acknowledge the contribution and support of Eng. Mohamed Hussein Safi, Director General of DAIL/Nangarhar and his team for his sincere support for the FRM technology transfer program in Nangarhar Province.

- Hamdy Oushy