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

Farm Resource Management (FRM)

Training Course
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FARM RESOURCE MANAGEMENT (FRM)

PROGRAM FOCUS AND BENEFITS - FRM CONCEPT

A sustainable cropping system is an essential part of a complete farming system of soil, water, air, plant, animal, and human resources. Considering how the farm fits into broader watershed management (e.g. off-site effects and resource opportunities) is also fundamental to problem-posing and problem-solving, resource management success, and development of sustainable communities.

We should focus on understanding and improving soil quality, water quantity/quality, air quality, nutrient and salinity management, crop yield and quality, irrigation/water management, and integrated pest management. In addition, we should concentrate on reducing overall on-farm energy use, inputs, production costs, pest incidences, pumping costs, and soil and water losses.

The key approach to achieving integrated sustainable management is to think system (ecosystem, whole farm, and watershed), think critically (connect the dots), actively seek resource opportunities, emphasize technology “exchange” vs. “transfer” with other producers and partners, plan creatively and flexibly, and focus on keeping energy flow through the integrated system. A reemphasis on biological factors is also necessary since recent agriculture has essentially forgotten biological processes, but rather focused on chemical and physical factors. Improving soil quality is a key to improving soil, water, air, plant, and animal resources. Case studies, field trials, and demonstrations are all important approaches for technology exchange. Interdisciplinary teams including producers and partners are necessary to develop integrated sustainable farming systems.

We must utilize holistic approaches to management of soil and water resources. Integration of needed conservation practices and management schemes assures critical resource concerns are addressed and water quality, soil quality, and overall ecosystem health is maintained or improved. Considering how the farm fits into broader watershed management is also essential to ‘problem-posing and solving’ to ensure resource management success.

Now is a critical time to implement management schemes to protect long-term soil sustainability. Global reduction in agricultural productivity due to soil erosion and degradation, depletion of irrigation water supplies, and competing land uses is putting a squeeze on capacity to meet increasing world-wide demand for food and fiber. Couple this with the economic challenges posed by the high cost of fossil fuels and derived products, such as fertilizers, and struggling farm economies, and it becomes clear that the continued success of agricultural systems is dependent upon our ability to maintain soil health and manage water resources through holistic approaches in conservation planning.

In order to benefit the poor more directly, a Farm Resource Management (FRM) approach must be applicable under the highly heterogeneous and diverse conditions in which smallholders live; it must be environmentally sustainable and based on the use of local and indigenous resources. The emphasis must be on improving whole farming systems at the field or watershed level rather than specific commodities. Technological generation must be demand-driven, which
means that research priorities must be based on the socio-economic and environmental needs and circumstances of resource-poor farmers (Blauert and Zadek, 1998).

The study ”An Agroecological Basis for Natural Resource Management Among Poor Farmers in Fragile Lands” prepared by Miguel A. Altieri (2005), indicated that food security in the developing world will clearly need to be increased, especially in the marginal areas where the majority of the poor people are concentrated. In order to benefit the poor more directly, a new Farm Resource Management (FRM) approach must be developed to directly and simultaneously tackle the following objectives:

- Poverty alleviation;
- Food security and self reliance;
- Ecological management of productive farming system;
- Empowerment of rural communities.

**INTRODUCTION**

We will explore the problem of crop rotation in Afghanistan, and discuss possible remedies and solutions using the FRM approach.

New approaches to enhance productivity must depart from the intensive inputs of the Green Revolution and use resource-conservation technologies. The use of such technologies, for example, the incorporation of legumes in rotation schemes, can enhance the sustainability of agroecosystems in many rural areas (Lappe et al., 1998).

A sustainable agricultural development strategy that enhances the environment must be based on agroecological principles. Attention focused on the linkages between agriculture and natural resource management will be of great help in solving the problems of poverty, food insecurity and environmental degradation (Altieri et al., 1998).

The On-Farm Resource Management (FRM) approach that USAID/DAIL/AWATT have launched in Nangarhar province, Afghanistan, will demonstrate the best model to tackle the problems of soil degradation, low organic matter, low water holding capacity, low productivity, weeds, disease, and insects. We need to break the cycle of wheat/rice to solve these problems. In Afghanistan, the main problems with the wheat/rice intensive crop rotation system are:

- both crops are grasses, so they do not add any organic matter to the soil;
- both crops only use the top 30 cm of the soil, where they have shallow root systems, so the top 30 cm of the soil has been depleted and degraded;
- Afghan farmers do not to return animal manure to the soil; instead, the majority use the manure for fuel purposes.
Wheat/ Rice Intensive Crop Rotation

Rice/wheat intensive crop rotation in Baghlan Province on May 25, 2009; above, the wheat field was close to maturity and harvest; below, the rice nursery contained seedlings to replace the wheat after harvest in June.

Wheat/rice intensive crop rotation in Baghlan Province on November 18, 2009; right, rice fields had been harvested and were ready to be plowed for the planting of winter wheat; left, a germinated wheat field had already replaced rice.
Problems of Wheat/Rice Crop Rotation in Afghanistan

**Soil Problems:**
Salinity accumulation on soil due to lack of proper crop rotation and proper farm management.

**Weed Problems (Wild Oats):**
Wild oats have invaded a wheat field due to lack of crop rotation with Egyptian clover.

**Weed Problems (Dodder Weeds):**
Dodder weed has invaded farms due to lack of proper crop rotation and farm management.

**Intensive wheat/rice crop rotation.**
The Green Revolution with its intensive inputs may not work in a small farming system.

**Wheat field:** no animals, no farmers and no diversity of production.
Rationale for Project

Continued use of short-term wheat-rice crop rotations in Afghanistan may not be sustainable. As a consequence, farmers need viable production alternatives. If there are more options for farmers, there is a better probability that agricultural and community systems can remain viable and sustainable.

However, before farmers can make objective decisions about alternative, sustainable agricultural practices, they need sound information from replicated, long-term research and demonstration conducted at a realistic farm-size in different districts in Nangarhar Province in Afghanistan.

The Farm Resource Management (FRM) project's principal investigator is Dr. Hamdy Soliman Ousy, Associate Professor at the New Mexico State University and the Forage & Rangeland Management Specialist at the USAID-Funded AWATT Program in Afghanistan. It is his contention that although the rice/wheat crop rotations may have been profitable in the past, they have had negative consequences like reducing organic matter in the soil and increasing soil erosion, increasing the need for more external inputs like fertilizer and pesticide.

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, pesticide and fossil fuels.

Description of Project

A selected section of farmland at Nangarhar Province in Afghanistan will be used in a unique multi-disciplinary applied study involving USDA/ADT/DAIL/AWATT research scientists, DAIL extension agents and Nangarhar stakeholders.

A farming system consisting of Egyptian clover rotations with livestock integrated into conservation-based row crop production will be established. Teams will measure and compare various agroecological attributes associated with this system. Costs and revenues will be analyzed as well as how this type of agricultural system would affect soil fertility, weed and disease control, and the local farming communities within and around Nangarhar Province.

The FRM field experiment will be similar to a small demonstration project at the Behsood, Kama, Chaparhar, Shishem Bagh, and Khewa Districts' farms involving Egyptian clover integrated into a wheat/rice cropping system. The system is being attempted because it has already shown great potential in Egypt, Pakistan and India.

This new project will encompass a much larger area than the demonstration project and consist of three types of land management:

- Extended rotations of wheat/Egyptian clover;
- Extended rotations of corn, cotton, pearl millet, Sudan grass/Egyptian clover;
- Permanent forage of alfalfa in extended rotations;
ANALYSIS OF PROJECT

The project will be broken into three separate, yet integrated, components, including:

Agroecology attributes comparison

- Soil fertility
- Soil structure
- Water quality
- Livestock performance
- Pest abundance

Economic analysis

It is intended to compare and contrast the economic value of a conventional wheat/rice crop rotation and a wheat/Egyptian clover/rice cropland-forage system that involves extended rotations.

Community perspectives analysis

The project will evaluate how an alternative agricultural system like FRM will affect local and nearby communities in Nangarhar Province.
**FRM Focus**

The main focus of the Farm Resource Management (FRM) program is to break the cereal wheat/rice cycle in Afghanistan that has resulted in soil degradation, lower productivity, lower organic matter, weed invasion, insects and disease problems.

Rain-fed wheat areas have negatively affected the upper watershed, Samangan Province May, 2009

Rain-fed wheat areas invaded by weeds (wild oats) have negatively affected the upper watershed, Samangan Province May, 2009

The FRM program is based on the introduction and the incorporation of Egyptian clover into the current wheat/rice crop rotation as the best winter forage legume to correct the problems.

The FRM program will deal with seven components: soil, water irrigation, crop rotation, forage legume, livestock, local farmers and community participation, farm economics, and monitoring and evaluation. The FRM Program is a long-term program (2-3 years) and will be expanded to the other districts in Nangarhar and other provinces in Afghanistan next year.
STRATEGIES TO RESTORE AGRICULTURAL FARM DIVERSITY

- Crop Rotations
- Animal Integration

FRM OBJECTIVES

In general, the objectives of the Farm Resource Management Program in Afghanistan are:

- To introduce the Farm Resource Management (FRM) system by incorporating Egyptian clover into the wheat/rice cropping system in Afghanistan;
- To assist local government, MAIL and DAIL extension workers, and farmers to improve agricultural production through initiating and monitoring crop and forage production activities and providing supervision and the necessary technical assistance;
- To demonstrate farm resource management procedures for 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 break the cycle of the weed, insect and diseases problems;
- To improve on-farm water use efficiency through implementing land laser leveling, water turnout and water scheduling;
- To provide high quality legume forage for livestock;
- To release the pressure of overgrazing on the upper watershed by encouraging farmers to keep their small ruminant animals on their farms at the lower watershed;
- To improve farmers’ livelihoods through more efficient and sustainable agriculture and crop-forage-livestock production systems;
- To develop and introduce low-cost crop and forage production technologies, through the crop/livestock system, beneficial to farmers and their families through increased incomes and improved efficiency in use of time or labor. Technologies will be introduced through on-farm demonstrations, workshops, and field days;
- To provide on-farm resource management demonstration training to farmers in selected districts in water, crop and forage technology transfer including: water turnout, laser land leveling, irrigation schedule, crop, forage and seed production, as well as practical agronomic training on land preparation, fertilizer application and plantation.

**FRM Benefits for Farmers**

The FRM Program expects positive results from the pilot demonstration plots in selected districts of Nangarhar Province, and there have already been encouraging responses from farmers in the area. Based on these factors, the program expects to improve farm production, including increased livestock and crop production, more efficient water use, and general economic benefits for all farmers participating in the program.

Specific anticipated benefits from 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 growth, and decreased flooding and siltation of the lower watershed irrigation systems;
- Increased quality of livestock marketed and increased yields of wheat, rice and fruit/nut crops; and more efficient water use—all leading to higher per-capita income.
CHAPTER 1:

AGROECOLOGY AS THE FUNDAMENTAL SCIENTIFIC BASIS FOR FRM

To be of benefit to the rural poor, agricultural research and development should operate on the basis of a "bottom-up" approach, using and building upon the resources already available: local people, their knowledge, and their natural resources.

It must also seriously take into consideration, through participatory approaches, the needs, aspirations, and circumstances of smallholders. A relevant FRM strategy requires the use of general agroecological principles and customizing agricultural technologies to local needs and circumstances. Agroecological principles have universal applicability but the technological forms to be used depend on the prevailing environmental and socio-economic conditions of the target farmer group.

BUILDING ON TRADITIONAL KNOWLEDGE

A logical starting point in the development of new pro-poor agricultural development approaches are the very systems that traditional farmers have developed and/or inherited throughout centuries. Such complex farming systems, adapted to local conditions, have helped small farmers to sustainably manage harsh environments, and to meet their subsistence needs without depending on mechanization, chemical fertilizers, pesticides or other technologies of modern agricultural science.

The traditional crop management practices used by many resource-poor farmers represent a rich resource for modern workers seeking to create novel agroecosystems well adapted to local agroecological and socioeconomic circumstances. Farmers use a diversity of techniques, many of which fit well to local conditions and can lead to the conservation and regeneration of the natural resource base as in the case of indigenous soil and water management practices in Africa. The techniques tend to be knowledge-intensive rather than input-intensive, but clearly not all are effective or applicable, therefore modifications and adaptations may be necessary. The challenge is to maintain the foundations of such modifications grounded on farmers' rationales and knowledge.

THE SCIENCE OF AGROECOLOGY

Agroecology is a science that provides guidelines to understanding the nature of agroecosystems and the principles by which they function. It provides the basic ecological principles for how to study, design, and manage agroecosystems that are both productive and natural resource-conserving, and that are culturally sensitive, socially just and economically viable—offering several advantages for the development of farmer-friendly technologies. Instead of focusing on one particular component of the agroecosystem, agroecology emphasizes the interrelatedness of all agroecosystem components and the complex dynamics of ecological processes, including all environmental and human elements.
Agroecology takes greater advantage of natural processes and beneficial on-farm interactions in order to reduce off-farm input use and to improve the efficiency of farming systems. Technologies enhance the functional biodiversity of agroecosystems as well as the conservation of existing on-farm resources. Promoted technologies such as cover crops, green manures, intercropping, agroforestry and crop-livestock mixtures are multi-functional, as their adoption usually means favorable changes in other components of the farming systems at the same time.

First, agroecology relies on indigenous farming knowledge and selected modern technologies to manage diversity, incorporate biological principles and resources into farming systems, and intensify agricultural production. Second, it offers a practical way to restore agricultural lands that have been degraded by conventional agronomic practices. Third, it provides an environmentally sound and affordable way for smallholders to intensify production in marginal areas.

Ecological concepts are used to favor natural processes and biological interactions that optimize synergies so that diversified farms are able to sponsor their own soil fertility, crop protection and productivity. By assembling crops, animals, trees, soils and other factors in spatial/temporal diversified schemes, several processes are optimized. Such processes are crucial in determining the sustainability of agricultural systems (Altieri, 1995).

**Agroecosystem Processes Optimized through the Use of Agroecological Technologies**

Agroecology takes greater advantage of natural processes and beneficial on-farm interactions in order to reduce off-farm input use and to improve the efficiency of farming systems. Technologies enhance the functional biodiversity of agroecosystems as well as the conservation of existing on-farm resources.

- Organic matter accumulation and nutrient cycling;
- Soil biological activity;
- Natural control mechanisms (disease suppression, biocontrol of insects, weed interference);
- Resource conservation and regeneration (soil, water, germplasm, etc.);
- General enhancement of agrobiodiversity and synergism between components.

**Enhancing Productivity through Multi-Species Agroecosystems**

Many agricultural studies have shown that complex, multi-species agricultural systems are more dependable in production and more sustainable in terms of resource conservation than simplified agroecosystems. Significant yield increases have been reported in diverse cropping systems compared to monocultures. Enhanced yields in diverse cropping systems may result from a variety of mechanisms, such as more efficient use of resources (light, water, nutrients) or reduced pest damage.
HEALTHY SOILS – HEALTHY PLANTS

The ability of a crop plant to resist or tolerate pests is tied to optimal physical, chemical and biological properties of soils; a diverse and active community of soil organisms contributes to plant health. Organic-rich soils generally exhibit complex food webs and beneficial organisms that prevent infection by disease-causing organisms.

EXAMPLES OF MULTIFUNCTIONAL AGROECOLOGICAL TECHNOLOGIES

- Cover crops, green manures and mulching;
- Intercropping;
- Rotations;
- Organic soil fertilization;
- Agroforestry;
- Crop-livestock integrated system (including aquaculture).

For example, cover crops function as an “ecological turntable” which activates and influences key processes and components of the agroecosystem: the complex of beneficial fauna, soil biology, weed suppression, nutrient cycling, etc. Similarly the incorporation of green manures not only provides nutrients, but also increases soil organic matter and hence water retentive capacity, further reducing susceptibility to erosion.

Many of these proven and promising agroecological technologies can be integrated to enhance the sustainability of farming systems. Farmer groups throughout the developing world are implementing local agroecological initiatives in collaboration with NGOs. Many of their experiences demonstrate the feasibility of stabilizing yields, regenerating and conserving soils and water, preserving agrobiodiversity and enhancing food security, all based on agroecological technologies and locally available resources (Pretty, 1995).

Agroecological field projects show that traditional crop and animal combinations can often be adapted to increase productivity when the biological structuring of the farm is improved and labor and local resources are efficiently used (Altieri, 1995). In fact, most agroecological technologies promoted by NGOs can improve traditional agricultural yields, increasing output per area of marginal land from some 400-600 kg/ha to 2000-2500 kg/ha. Integrating these technologies also enhances the general agrobiodiversity and has associated positive effects on food security and environmental integrity.

In general, data show that agroecological systems exhibit more stable levels of total production per unit area over time than high-input systems; produce economically favorable rates of return; provide a return to labor and other inputs sufficient for a livelihood acceptable to small farmers and their families; and ensure soil protection and conservation as well as enhance biodiversity (Pretty, 1997).
SELF-SUFFICIENCY

Before the rural poor in marginal areas can be expected to be a part of and compete with regional markets, they must build up a minimum level of local self-sufficiency. This prevents them from sinking to levels at which their food security is threatened. The kinds of technologies developed should therefore emphasize as a prerequisite food self-sufficiency and independence from outside resources (Reinjtes et al., 1992).

ELEMENTS OF AN APPROPRIATE FRM STRATEGY

- Contribute to greater environmental preservation;
- Enhance production and household food security;
- Provide on and off-farm employment;
- Provision of local inputs and marketing opportunities;
- Promotion of resource-conserving multifunctional technologies;
- Participatory approaches for community involvement and empowerment;
- Institutional partnerships;
- Effective and supportive policies.

REQUIREMENTS OF A PRO-POOR FRM STRATEGY

- Use of agroecological technologies that optimize biological processes;
- Minimize use of external inputs;
- Minimize tradeoffs between productivity, sustainability and equity;
- Farmer participation and partnerships.

INTEGRATION OF SOIL AND PEST MANAGEMENT PRACTICES

Integration of soil and pest management practices used by farmers may result in synergism leading to healthy and productive crop:

A. Enhanced soil fertility:
- Fertilizer
- Crop cover, Egyptian clover
- Green manure
- Mulching
- Compost
- Rotations, etc.

B. Enhanced pest regulation:
- Crop diversity
- Cultural practices
- Pesticides
- Habitat modification
CHAPTER 2: 

Soil

Soil plays a vital role in a cropping system. Currently, soil in Afghanistan is suffering under the existing management system. The soil will be analyzed for fertility before planting, and reanalyzed after each crop rotation at the newly established AWATT Program soils lab in Chaparhar district to determine chemical and physical properties.

Salt-contaminated soil in Balkh Province.

Salt-contaminated soil in Balkh Province.

Compacted soil with low infiltration rate as a result of salt accumulation on soil surfaces.

The study “Building Soil Fertility and Tilth with Cover Crops” by Marianne Sarrantonio, SARE, 2010, describes soil as an incredibly complex substance. It has physical and chemical properties that allow it to sustain living organisms—not just plant roots and earthworms, but hundreds of thousands of different insects, wormlike creatures and microorganisms. When these organisms are in balance, soil cycles nutrients efficiently, stores water and drains the excess, and maintains an environment in which plants can thrive.

To recognize that a soil can be healthy or unhealthy, one has only to think of the soil as a living entity. It breathes, it transports and transforms nutrients, it interacts with its environment, and it can even purify itself and grow over time. If one views soil as a dynamic part of any farming system, unsustainable crop management practices amount to soil neglect, which sickens the soil and causes it to lose life functions one by one.
Compacted soil with low infiltration rate after rice is farmed in Baglan Province, November, 2009.

Regardless of how healthy or alive the soil is right now, Egyptian clover as a cover crop can play a vital role in ensuring that the soil provides a strong foundation for a farming system. While the most common reasons for including Egyptian clover crop in a farming system may relate to the immediate short-term need, the continued practice of planting Egyptian clover becomes an investment in building healthy soil over the long term.

Egyptian clover improves soil in a number of ways. Protection against soil loss from erosion is perhaps the most obvious soil benefit of cover crops, but providing organic matter is a more long-term and equally important goal. Cover crops contribute indirectly to overall soil health by catching nutrients before they can leach out of the soil profile or, in the case of legumes, by adding nitrogen to the soil. Their roots can even help unlock some nutrients, converting them to more available forms. Cover crops provide habitat or a food source for some important soil organisms, break up compacted layers in the soil and help dry out wet soils.

**Addition of Organic Matter**

The benefits of organic matter include improved soil structure, increased infiltration and water-holding capacity, increased cation exchange capacity (the ability of the soil to act as a short-term storage bank for positively charged plant nutrients) and more efficient long-term storage of nutrients. Without organic matter, there is no soil to speak of, only a dead mixture of ground-up and weathered rocks.

Organic matter includes thousands of different substances derived from decayed leaves, roots, microorganisms, manure and even groundhogs that died in their burrows. These substances function in different ways to build healthy soil. Different plants leave behind different kinds of organic matter as they decompose, so the choice of cover crop will largely determine which soil benefits will develop.

There is a portion in soil that can be called the “active” portion and one that might be called the “stable” portion, which is roughly equivalent to humus. The active fraction represents the most easily decomposed parts of soil organic matter. It tends to be rich in simple sugars and proteins and consists largely of recently added fresh residues, microbial cells and the simpler waste products from microbial decay.
In general, annual legumes are succulent. They release nitrogen and other nutrients quickly through the active fraction, and long-term use of annual legumes (Egyptian clover) can increase soil humus. Perennial legumes such as alfalfa may fall in both categories—its leaves will break down quickly, but their stems and root systems may become tough and fibrous and can contribute to humus accumulation.

Organic matter builds up very slowly in the soil. A soil with 3% organic matter might only increase to 4% after a decade or more of soil building. The benefits of increased organic matter, however, are likely to be apparent long before increased quantities are detectable. Some, such as enhanced aggregation and increased water infiltration rates and nutrient release will be apparent the first season; others may take several years to become noticeable.

**Animal Manure**

*Animal manure is important for soil fertility, water holding capacity and productivity.*

*Animal Manure at Kefayt Dairy Farm in Mazar on May 10, 2010.*

**Cover Crops Can Stabilize Soil**

The more you use cover crops (Egyptian clover), the better your soil health will be, research continues to show. One reason is that cover crops, especially legumes, encourage populations of beneficial fungi and other microorganisms that help bind soil aggregates.
Cover crops (Egyptian clover) help bring other nutrients back into the upper soil profile from deep soil layers. Calcium and potassium are two macronutrients with a tendency to travel with water, though not generally on the express route with N. These nutrients can be brought up from deeper soil layers by any deep-rooted cover crop. The nutrients are then released back into the active organic matter when the cover crop dies and decomposes.

Leguminous Cover Crops Can Add Nitrogen through Nodulation

One of nature’s most gracious gifts to plants and soil is the way that legumes, with the help of rhizobial bacteria, can add nitrogen to enrich soil.

With the help of nitrogen-fixing bacteria, legume cover crops can supply some or all of the nitrogen needed by succeeding crops. This nitrogen-producing team can’t do the job right unless the correct bacterial inoculant is matched with your legume cover crop species. Only particular strains of rhizobia provide optimum nitrogen production for each group of legumes. If legume roots don’t encounter their ideal bacterial match, they work with the best strains they can find, but they do not work as efficiently together and they produce less nitrogen.

Like other plants, legumes need nitrogen to grow. They can take it from the soil if enough is present in forms they can use. Legume roots also seek out specific strains of soil-dwelling bacteria that can “fix” nitrogen gas from the air for use by the plant. While many kinds of bacteria compete for space on legume roots, the root tissues will only begin this symbiotic nitrogen-fixing process when they encounter a specific species of rhizobium bacteria. Only particular strains of rhizobia provide optimum nitrogen production for each group of legumes.

Egyptian clover is a heavy nitrogen producer and the least winter-hardy of all true annual clovers. This makes it an ideal legume cover before corn or other nitrogen-demanding crops in Afghanistan. Egyptian clover draws down soil nitrogen early in its cycle. Once soil reserves are used up, it can fix 100 to 200 lb N/acre or more.
CHAPTER 3: IRRIGATION

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

The study “Integrated Water Management” by ASA-CSSA-SSSA (November 4, 2009 – Pittsburgh, PA) reported that irrigation water management is an integral part of a complete farm management program of soil, water, air, plant, and animal resources. The assessment will enable the increased understanding needed to evaluate and implement alternative best management practices for irrigation water management. Considering how the farm fits into broader watershed management is also essential to problem-posing and solving for resource management success.

The AWATT project provides technical assistance for producers in:

- Cropland conservation;
- Irrigation water management (e.g. installation of irrigation water management practices, water measuring, irrigation scheduling, irrigation system design, reduced cultivation);
- Nutrient management (e.g. soil, water, and plant nutrient analysis, developing basic nutrient budgets, and determining appropriate fertilizer and manure applications);
- Agronomic-related practices and management such as reduced tillage, crop rotations, green manure crops, salinity and pest management, and wildlife conservation.

Irrigation water management is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner. The primary purpose of this assessment is to evaluate and implement alternative best management practices for irrigation water management within an integrated system, with the end result being a more economical, sustainable, and producer-acceptable farming enterprise.

We hope that the water users will be able to reduce water quantities used, energy use and costs for crop production, and the opportunity for ground and surface water contamination. The greater the understanding we have of our soil, water, and plant resources, the better will be our ability to manage all of our natural resources.

POTENTIAL BENEFITS OF IRRIGATION WATER MANAGEMENT

Water resources:

- Conserves surface and ground water supplies;
- Protects surface and ground water quality;
- Substantial reduction in irrigation labor costs;
- Significant increase in irrigation application efficiencies (higher yields);
- Reduced pumping costs;
• Potential detrimental effects of water quality (pH, salinity & sodium) on plants and soils are properly assessed and managed;
• Irrigation water losses through evaporation, runoff and deep percolation are minimized.

**Soil resources:**
• Improved soil quality is possible because of increased biomass production (more crop residues are produced);
• Reduced soil erosion from both water and wind;
• Proper assessment, management and prevention of saline, saline-sodic and sodic soils is attained;
• Reduced use of soil amendments;
• Reduction in water-logged soils;
• Reduced leaching resulting in higher nitrogen-use efficiency.

![Land laser leveling and water turnouts in Nangarhar Province; they are important for proper farm water management.](image)

**Plant resources:**
• Cost for crop production is reduced due to integration of IWM with nutrient management practices;
• Significant increases in yield and crop quality;
• Reduced incidences of diseases and pests;
• Available water quantity and quality meet the specific requirements of the crop (consumptive use, leaching) (Rudy Garcia, 2008).
CHAPTER 4: 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 cowpea, soybean, pearl millet, and Sudan grass are planted in the summer.

The study "Crop Rotations for Increased Productivity” by Michael D. Peel (January 1998) defined crop rotation as a planned order of specific crops planted on the same field. Crop rotation also means that succeeding crops are of a different genus, species, subspecies, or variety than the previous crop.

The planned rotation sequence may be for a two- or three-year period, or longer. The general purposes of rotations are to improve or maintain soil fertility, reduce erosion, reduce the build-up of pests, spread the workload, reduce risk of weather damage, reduce reliance on agricultural chemicals, and increase net profits.

CONSERVATION CROP ROTATION

This practice involves growing various crops on the same piece of land in a planned sequence. This sequence may involve growing high residue producing crops such as corn or wheat in rotation with low residue producing crops such as vegetables or soybeans. The rotation may also involve growing forage crops in rotation with various field crops.

PRACTICAL FUNCTIONALITY

The effect crop rotations have on the land varies with the soil type, crops produced, farming operations, and how the crop residue is managed. The most effective crops for soil improvement are fibrous rooted high residue producing crops such as grass and small grain. Perennial plants used for forage are very effective in crop rotations due to increases in organic matter and reduced soil erosion. In addition, crop rotations help break insect, disease and weed cycles.

Rotations add diversity to farm operations and often reduce economic and environmental risks. Crop rotation is a low-cost practice that often forms the basis for other conservation practices. Practices such as residue management, contouring, strip-cropping, diversions, terraces, and waterways may not function properly without planned crop rotation.

Crop rotations have fallen out of favor because they require additional planning and management skills, increasing the complexity of farming. Solid-seeded crops such as small grains and flax have predominated in the past, but row crops such as sunflower, pinto bean, corn, and soybean provide additional planting options and good reasons for crop rotations.

Rotating to a different crop such as barley in place of wheat usually results in higher grain yields when compared to continuous cropping of wheat. Even greater benefits are usually obtained by rotating two distinctly unrelated crops, such as a small grain seeded into land where the previous crop was a legume such as Egyptian clover or other herbaceous dicot such as flax or sunflower.
Some of the more important beneficial effects that can be obtained from a well-planned crop rotation are:

- Reduced insect and disease problems;
- Beneficial residual herbicide carryover;
- Improved soil fertility;
- Improvements in soil tilth and aggregate stability;
- Soil water management;
- Reduction of runoff and soil erosion;
- Reduction of allelopathic or autotoxic effects;
- Reduced reliance on chemicals;
- Better moisture efficiency;
- Higher yields;
- Improved aesthetics and wildlife habitats.

**PEST CONTROL**

Pest control is often an important reason for crop rotation. Rotations can be used to prevent or partially control several pests and reduce the reliance on chemical and mechanical control. A combination of crop rotation and pesticides is often more effective in reducing pest populations to economic levels than pesticides alone.

**DISEASE CONTROL**

Crop rotation has tremendous potential for reducing and often preventing the transmission of disease. Disease pressures change with changing environmental conditions. Crop rotation, in combination with mechanical or biological control practices and fungicides, is the most desirable method of disease control.

**INSECT CONTROL**

Insect populations may increase in a region where only one or two crops are continuously grown in contrast to a region where several crops are grown in rotation. Insects such as corn borer, sunflower seed, and stem weevil and many others readily migrate to nearby or distant fields. Therefore, only partial control can be obtained by rotation. Increasing field isolation from fields seeded to the same crop the previous year will often increase the effectiveness of crop rotation as an insect control method.
**Weed Control**

Rotations can be used to cause shifts in weed populations. Populations of certain weed species can be suppressed by competition from the crop raised or by the selective use of herbicides. Wild mustard populations can be reduced by selective treatment of small grain grown in rotation with row crops. Grass weed populations, often a problem in small grains, can be reduced by the rotation with Egyptian clover.

Herbicides can have both beneficial and harmful residual effects on the next crop. Therefore, planning the correct sequence of herbicide use together with crop selection has become a necessary part of rotation management.

![Aggressive weeds in wheat field in Baghlan Province, May 25, 2010.](image)

**Soil Nitrogen**

Legumes in the rotation can be used to increase the available soil nitrogen. Symbiotic nitrogen-fixing bacteria called rhizobia form nodules on the roots of legume plants and convert or fix atmospheric nitrogen to organic nitrogen. The amount of nitrogen fixed varies with species, available soil nitrogen, and many other factors. Fixed nitrogen not removed from the land by harvest becomes available to succeeding crops as the legume tissues undergo microbial decomposition. When the legume crop is seeded, rhizobia inoculum should always be applied to the seed to ensure the most productive commercial strains are available to form nodules and that inoculating bacteria are always present. Even though indigenous bacteria may be present in the soil, research shows improved commercial strains of rhizobia have more capacity to fix nitrogen.

**Soil Tilth and Structure**

Many farmers who rotate crops comment on the improvement in tilth or friability of soil following soybean or other row crops. In a study involving corn, sugar beet, and barley planted in succeeding years, soil aggregate stability was increased from 67 to 76 % when three years of alfalfa were added to the rotation. Increased aggregate stability reduces the tendency of the soil
to puddle or crust, increases the rate of water infiltration under certain conditions, and may also reduce wind erosion.

**SOIL MOISTURE**

Crop rotation can lead to greater overall efficiency in soil water utilization. Spring-seeded small grains usually deplete soil water 3 to 4 feet deep. In contrast, sunflower, safflower, corn, and sugar beet are deep-rooted crops, which can deplete soil water to depths of 5 to 6 feet. Therefore, deep-rooted crops such as sunflower following small grains can take advantage of the extra reserve of deep moisture and any nitrogen that was positionally unavailable to a shallow-rooted crop.

Alfalfa and sweet clover, also deep-rooted crops, can be used to dry up saline seeps and other wet areas. Depletion of soil water in saline areas prevents the accumulation of salts on the surface, permits movement of the salts downward by leaching, and allows re-cropping to a cash crop such as wheat.

**REDUCTION OF SOIL EROSION**

Crop rotations combined with recommended tillage practices can play an important role in reducing wind and water erosion. Solid seeded crops such as small grains provide more protection against water erosion than row crops. Permanent crops such as hay or pasture provide even more protection against erosion. Management of crops to provide sufficient residue throughout the year is essential for satisfactory control of both wind and water erosion. No-till or minimum till farming is highly desirable as a conservation practice, but crop rotation must be used to reduce the build-up of insects, disease and weed pests.

**ALLELOPATHY**

The reasons for improved yields from crop rotations are not completely understood. Research has attempted to reveal some of the unknown factors. Allelopathy refers to plant material or chemicals derived from these materials which inhibit the germination, growth or development of another species. Autotoxicity refers to plant material that inhibits the germination, growth and development of the same species. Legumes such as alfalfa, while often beneficial to non-related species, exhibit autotoxic effects to alfalfa seedlings. Research in Illinois indicated older stands caused greater inhibition of new seedlings. This study indicated that one year without alfalfa was sufficient to nullify the detrimental effects of the alfalfa.

**MONITORING AND POSSIBLE REDESIGN OF ROTATION**

The implementation phase will likely reveal the need for additional adjustments to the plan. The effectiveness of the rotation must be monitored against the goals of the plan, changes in the needs of the overall farm management and marketing strategy, and the rotation guidelines suggested earlier.
CHAPTER 5: FORAGE LEGUME

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

Egyptian clover is a crop of ancient cultivation in Egypt (landrace) where it is a major winter crop; from there it was introduced to Sindh-Pakistan in the early years of the twentieth century. It was well-adapted to the conditions and farming systems of the irrigated subcontinent and spread rapidly throughout northern India (Roberts & Singh, 1951). It is now the major cultivated fodder crop on millions of hectares; it has been the most rapid spread of a fodder in recent times and is all the more notable for being mainly under smallholder conditions. It is also grown in the USA, and in parts of southern Europe as both a winter and summer crop.

Egyptian clover and/or Berseem clover (Trifolium alexandrinum) is a summer annual or winter annual legume. It is the most important forage legume in Egypt; it is cultivated as a major crop in all rural areas of the country. In Egypt, it is a winter forage legume crop and considered the major feed for livestock during the winter and spring seasons. It plays an important role in the suppression of weeds and erosion prevention, provides high nutritional values for livestock, produces green manure, improves soil fertility, and provides chopped forage and grazing.

It is a fast-growing summer annual; Egyptian clover can produce up to 18 tons per jerib of fresh green forage from five cuts under irrigation in Afghanistan. It is a heavy producer of nitrogen and the least winter-hardy of all true annual clovers. It draws down soil nitrogen early in its cycle. Once soil reserves are used up, it can fix 23 to 45 kilograms of nitrogen per jerib or more. It becomes well established quickly, making it an excellent cover for crop rotation in Afghanistan with wheat or barley in winter or with corn, pearl millet, vegetables, and Sudan grass in summer.

Egyptian clover is the fertility foundation of agriculture in the Nile Delta of Egypt, and has nourished soils in the Mediterranean region as a green manure for thousands of years. At 16 °C, Egyptian clover will be ready to cut approximately 60 days after planting, and produces up to 200 Kg seed/Jerib if it is left to mature.

Forage legumes are very important

Egyptian clover is the major winter forage legume in Egypt. This highly nutritional and nitrogen-fixing crop has been introduced to Afghanistan by AWATT to break the cycle of wheat/rice crop rotation and to provide high-quality feed for livestock.
**Chapter 6: Integrated Crop-Livestock Farming System**

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.

Large livestock (cows) looking for feed.

Small ruminants graze in upper watershed areas in Samangan Province, May 2009. Such overgrazing will destroy the upper watershed habitats.

A study published by IFAD in January 2009 indicated that integrated crop-livestock systems within the FRM system are a method of diversifying a farm for improved long-term sustainability. Such a system has been shown to be beneficial to soil parameters that improve soil quality.

Animals are important components of any healthy agricultural production systems.

The increasing pressure on land and the growing demand for livestock products makes it more and more important to ensure the effective use of feed resources, including crop residues. An integrated farming system consists of a range of resource-saving practices. It will aim to achieve acceptable profits and high and sustained production levels, while minimizing the negative effects of intensive farming and preserving the environment.

Based on the principle of enhancing natural biological processes above and below the ground, the integrated system represents a winning combination that:

- Reduces erosion;
- Increases crop yields, biological soil activity and nutrient recycling;
- Intensifies land use, improving profits;
- Can therefore help reduce poverty and malnutrition and strengthen Environmental sustainability (IFAD, January 2009).

**DIVERSIFIED VS. INTEGRATED SYSTEMS**

Diversified systems consist of components such as crops and livestock that coexist independently from each other (FAO, 2001). In a diversified system, integrating crops and livestock serves primarily to minimize risk and not to recycle resources. In an integrated system, crops and livestock interact to create a synergy, with recycling allowing the maximum use of available resources. Crop residues can be used for animal feed, while livestock and livestock by-product production and processing can enhance agricultural productivity by intensifying nutrients that improve soil fertility, reducing the use of chemical fertilizers.
A high integration of crops and livestock is often considered a step forward, but small farmers need to have sufficient access to knowledge, assets, and inputs to manage this system in a way that is economically and environmentally sustainable over the long term.

**Advantages and Constraints of the System**

**Advantages**

In an integrated system, livestock and crops are produced within a coordinated framework. The waste products of one component serve as a resource for the other. For example, manure is used to enhance crop production; crop residues and by-products feed the animals, supplementing often inadequate feed supplies and contributing to improved animal nutrition and productivity.

The result of this cyclical combination is the mixed farming system, which exists in many forms and represents the largest category of livestock system in the world in terms of animal numbers, productivity, and the number of people it serves.

Animals play key and multiple roles in the functioning of the farm, and not only because they provide livestock products (meat, milk, eggs, wool, and hides) or can be converted into prompt cash in times of need. Animals transform plant energy into useful work: animal power is used for plowing, transport and in activities such as milling, logging, road construction, marketing, and water lifting for irrigation.

Animals also provide manure and other types of animal waste. Excreta has two crucial roles in the overall sustainability of the system:

**Improving nutrient cycling:**

Excreta contains several nutrients (including nitrogen, phosphorus, and potassium) and organic matter, all important for maintaining soil structure and fertility. Through its use, production is increased while the risk of soil degradation is reduced.

**Providing energy:**

Excreta is the basis for the production of biogas and energy for household use (e.g. cooking, lighting) or for rural industries (e.g. powering mills and water pumps). Fuel in the form of biogas or dung cakes can replace charcoal and wood.

Crop residues represent the other pillar on which the equilibrium of this system rests. They are fibrous by-products that result from the cultivation of cereals, pulses, oil plants, roots and tubers. They are a valuable, low-cost feed resource for animal production, and are consequently the major source of nutrients for livestock in developing countries.

The overall benefits of crop-livestock integration can be summarized as follows:

- **Agronomic:** Through the retrieval and maintenance of the soil’s productive capacity;
- **Economic:** Through product diversification and higher yields and quality at less cost;
- **Ecological:** Through the reduction of crop pests (less pesticide use and better soil erosion control);
• **Social:** Through the reduction of rural-urban migration and the creation of new job opportunities in rural areas;

The system has other specific advantages:

• It helps improve and conserve the productive capacities of soils, with physical, chemical and biological soil recuperation. Animals play an important role in harvesting and relocating nutrients, significantly improving soil fertility and crop yields;

• It is quick, efficient and economically viable because grain crops can be produced in four to six months, and forage formation after cropping is rapid and inexpensive;

• It helps increase profits by reducing production costs. Poor farmers can use fertilizer from livestock operations, especially when rising petroleum prices make chemical fertilizers unaffordable;

• It results in greater soil water storage capacity, mainly because of biological aeration and the increase in the level of organic matter;

• It provides diversified income sources, guaranteeing a buffer against trade, price and climate fluctuations.

**Constraints:**

• Nutritional values of crop residues are generally low in digestibility and protein content. Improving intake and digestibility of crop residues by physical and chemical treatments is technically possible but not feasible for poor small farmers because they require machinery and chemicals that are expensive or not readily available.

• Crop residues are primarily soil regenerators, but too often they are either disregarded or misapplied.

• Intensive recycling can cause nutrient losses.

• If manure nutrient use efficiencies are not improved or properly applied, the import of nutrients in feeds and fertilizers will remain high, as will the costs and energy needs for production and transportation, and the surpluses will be lost in the environment.

• Farmers prefer to use chemical fertilizer instead of manure because it acts faster and is easier to use.

• Resource investments are required to improve intake and digestibility of crop residues.

Mixed farms are prone to using more manure than crop farms do. Manure transportation is an important factor affecting manure use.

**Challenges:**

1. To develop strategies and promote crop-livestock synergies and interactions that aim to:

   • Integrate crops and livestock effectively with careful land use;
   
   • Raise the productivity of specific mixed crop-livestock systems;
   
   • Facilitate expansion of food production; and
Simultaneously safeguard the environment with prudent and efficient use of natural resources.

2. To devise measures (for instance, facilitating large-scale dissemination of biodigesters) to implement a more efficient use of biomass, reducing pressures on natural resources; and develop a sustainable livestock manure management system to control environmental losses and contaminant spreading.

**KEY PRINCIPLES**

**Cyclic**
The farming system is essentially cyclic (organic resources – livestock – land – crops). Therefore, management decisions related to one component may affect the others.

**Rational**
Using crop residues more rationally is an important route out of poverty. For resource-poor farmers, the correct management of crop residues, together with an optimal allocation of scarce resources, leads to sustainable production.

**Ecologically Sustainable**
Combining ecological sustainability and economic viability, the integrated livestock-farming system maintains and improves agricultural productivity while also reducing negative environmental impacts.

**Lessons Learned and Recommendations**

- The maintenance of an integrated crop-livestock system is dependent on the availability of adequate nutrients to sustain animals and plants and maintain soil fertility. Animal manure alone cannot meet crop requirements, even if it does contain the kind of nutrients needed because of its relatively low nutrient density and the limited quantity available to small-scale farmers. Alternative sources for the nutrients need to be found.

- Growing fodder legumes and using them as a supplement to crop residue is the most practical and cost-effective method for improving the nutritional value of crop residues. This combination is also effective in reducing weight loss in animals, particularly during dry periods;

- Given their traditional knowledge and experience, local farmers are perfectly capable of applying an integrated system. In practice, however, relatively few adopt this system, mainly because they have limited access to credit, technology and knowledge. The crop-pasture rotation system is complex and requires a substantial capital outlay for machinery and implements. Associations of grain and livestock producers are useful for filling these gaps and can promote the adoption of a crop-livestock system;

- Veterinary services are generally unable to reach poor small farmers in remote areas. Therefore, for livestock production to be improved, more attention needs to be paid to making veterinary care accessible, particularly in terms of prevention;
• Better livestock management is needed to safeguard water. Livestock water demand includes water for drinking and for feed production and processing. Livestock also have an impact on water, contaminating it with manure and urine. All of these aspects need to be given due consideration.

• Intensification of agriculture through appropriate incorporation of small livestock has the potential to decrease the land needed for agricultural production and relieve the pressure on upper watershed areas, forests and rangelands.

Horses graze pearl millet (Shandawel-1 variety) at Kefayt Dairy Farm in Mazar-e-Sharif, November 1, 2010.

**Key Issues/Questions for Project Design**

The increase in demand for livestock products presents opportunities for small farmers who can increase livestock production and benefit from related income. However, in terms of environmental impact, the growing number of livestock and the increase in livestock processing can have a negative impact on natural resources unless actions are taken to identify farming practices that are economically and ecologically sustainable. Thanks to the dynamic interaction of its various components, the highly improved integrated crop-livestock system can guarantee more sustainable production and therefore constitutes a valid new approach.
Camels and dairy cattle graze pearl millet (Shandawel-I variety) at Kefayt Dairy Farm in Mazar-e-Sharif, November 1, 2010.

Experience in the use of this system has shown that:

- Adopting sustainable management practices can improve production while preserving the environment;
- Residues, wastes and by-products of each component serve as resources for the others;
- Poor farmers have the traditional knowledge needed to integrate livestock and crop production, but because of their limited access to knowledge, assets and inputs, relatively few adopt an integrated system.

The challenge for development practitioners is to ensure that poor small farmers can increase the productivity of traditional farming systems, adopting an effective integrated system that produces usable biomass while conserving natural resources, and can therefore be sustainable in the long term.
CHAPTER 7: RURAL 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.

DEFINITIONS

The FAO Informal Working Group on Participatory Approaches and Methods (IWG) provides some useful definitions in a web site dedicated to participatory project formulation.

With regard to rural development … participation includes people’s involvement in decision-making processes, in implementing programs, their sharing in the benefits of development programs and their involvement in efforts to evaluate such programs (Cohen and Uphof, 1977).

Participation is concerned with . . . the organized efforts to increase control over resources and regulative institutions in given social situations on the part of groups and movements of those hitherto excluded from such control (Pearse and Stifel, 1979).

Participation can be seen as a process of empowerment of the deprived and the excluded. This view is based on the recognition of differences in political and economic power among different social groups and classes. Participation in this sense necessitates the creation of organizations of the poor which are democratic, independent and self-reliant (Ghai, 1990).

Participatory development stands for partnership which is built upon the basis of dialogue among the various actors, during which the agenda is jointly set, and local views and indigenous knowledge are deliberately sought and respected. This implies negotiation rather than the dominance of an externally set project agenda. Thus people become actors instead of being beneficiaries (OECD, 1994).

Participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them (World Bank, 1994).

The IWG uses elements of these descriptions to provide its own definition as:

… A process of equitable and active involvement of all stakeholders in the formulation of development policies and strategies and in the analysis, planning and implementation, and monitoring and evaluation of development activities. To allow for a more equitable development process, disadvantaged stakeholders need to be empowered to increase their level of knowledge, influence and control over their own livelihoods, including development initiatives affecting them.
CHAPTER 8: MONITORING AND EVALUATION OF THE FRM

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;
- Economic returns; and
- Socioeconomic analysis.

FRM MODEL IN THE LOWER WATERSHED AREAS OF NANGARHAR

Work Plan

1. The USG team and DAIL are in the planning stages to roll out Farm Resource Management (FRM) in Nangarhar.

2. Once successful results are realized, this can be replicated in other provinces and regions.

Site selection

1. Pilot villages will be selected in the following districts: Chaparhar, Kama and Behsood of Nangarhar.

2. A number of farmers will be selected to participate in the program.

Basic criteria for farmers’ selection

1. Willingness to follow the advice of AWATT/DAIL extension staff on different practices;

2. Ownership of livestock;

3. Willingness to sign an agreement with DAIL to continue with the program based on established criteria;

4. Ability and willingness to invest their own money for 25% of the project as an indication of commitment and ownership of the program.

Soil analysis of the selected plots

1. Soil analysis of the selected plots will be carried out in the DAIL Shisham Bagh soil lab;

2. Efforts would be made to restore any soil deficiencies before planting.

Agricultural inputs

1. The selected plots would be laser leveled;

2. An improved and certified variety of wheat would be planted using seed drill;

3. Recommendations from the soil analysis report would be followed for the type and quantity of fertilizers required;
4. Egyptian clover would be planted on plots where wheat and other crops had been grown in the past;
5. Growth, number of cuts, health of animals and milk production would be monitored to assess benefits as compared to traditional forages;
6. Irrigation of the plots would be carefully monitored throughout the season.

**Roles and responsibilities:**

1. The project owner is DAIL and as such they will participate with their extension and research system during the implementation and evaluation phases;
2. DAIL will monitor and evaluate the socioeconomic, soil, water, and crop yields;
3. DAIL will have the final say on where the farms will be established;
4. DAIL will have primary responsibility for community integration as well as follow-up with the community in all matters;
5. Program organizational leadership will be provided by USAID-OAG, although all activities are team-oriented.
6. The ADT will provide the following:
   - 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 improvement of irrigation and agronomic practices.
7. USDA will provide technical support to:
   - ADT and USAID; and
   - Will work with the DAIL to help them achieve best practices.
8. AWATT is the lead implementing partner and subject matter expert. They will:
   - Lead the project from a technical and implementation standpoint;
   - Interact with all parties to include the farmers;
   - Provide on-the-job training of DAIL staff and selected farmers in the field, an integral part of the plan.
CHAPTER 9: FARM ENTERPRISE

INTRODUCTION

In 2010, the FAO reported that farmers are intensifying existing patterns of production and diversifying their farm enterprises in an attempt to improve their livelihoods. Technical know-how is not enough. In order to be competitive and take advantage of the new opportunities that are arising, farmers increasingly have to adapt their farm business to market changes and improve efficiency, profitability and income.

The desire to increase income by taking advantage of market opportunities requires farmers to become better decision makers and better at competing in a new environment. The emphasis on the competitive market calls for better farm management skills. Marketing and farm management have rapidly gained predominance globally over the last two decades. Farm business management skills and knowledge is recognized as important for farmers to effectively respond to present day farming challenges. Farm management advice helps farmers to make the right choice between crop enterprises according to individual levels of financial, labor and land endowments and at their level of risk aversity. As farmers become more market-oriented, extension needs are changing and extension workers and farmers face new challenges in providing appropriate advice.

As a response to these changes, the service has been involved in providing strategic guidance to policy makers and program managers in farm management extension, developing training approaches and materials for improving farm management skills of extension workers and farmers and provide guidance to policy makers and extension workers on farm data collection, analysis and dissemination. Close internal partnership is also maintained with other services in the Rural Infrastructure and Agro Industries Division, as well as with other divisions and services in FAO.

DIVERSIFICATION OF FARM ENTERPRISES AND THE INCREASED NEED TO PRODUCE FOR THE MARKET

The farming population in Afghanistan is largely made up of small-scale farmers who cultivate most of the agricultural land. These farmers cultivate small plots and have a limited supply of family labor and access to credit. As a result of these structural difficulties, farm incomes are low.

The decrease in farm income among rice/wheat producers in Afghanistan due to the declining productivity has triggered a change toward farm diversification. Afghan farmers need to diversify their farming system into mixed crop-livestock systems and shift production from staple crops to higher value commodities. In order to improve farm income, farmers require knowledge of market trends and opportunities as well as the skills necessary to manage their farm in an increasingly competitive environment.
Grain Production (Rice)

Afghan Farmers processing their rice grain in Baglan Province, November, 2009.

Extension services provided by MAIL agencies in Afghanistan have traditionally focused on technology transfer. They have consisted mainly of technical messages, such as agronomic practices, pest and disease control, and water management. Farm management and agribusiness need to be improved in Afghanistan.

**Need for Improved Management and Business Skills to Increase Profits and Farm Income**

Farmers who possess the skills to manage their farms both efficiently and profitably and respond to market changes will be in a better position to take advantage of existing opportunities to increase income.

As producers, farmers require improved technologies and practices that lead to intensification of agricultural production. But farmers must also have the capacity to respond to market opportunities through diversification of farm enterprises (cropping activities, as well as livestock, aquacultural and other non-crop activities).

Efforts must then be directed toward strengthening the capabilities of small farmers. They must move from being simple producers to becoming efficient farm planners and managers involved in commercial farming. The need to increase income by taking advantage of market opportunities means farmers must be able to compete in this new environment. This is what is meant by market-oriented farming.

**Definition of a Farm**

A farm consists of resources and enterprises; resources or factors of production are limited. A farm is a piece of land on which a farm household undertakes agricultural activities as part of its livelihood. In addition to the land itself, a farm may include structures erected on the land, such as wells, irrigation channels, fences to control livestock, buildings to house livestock or to store farm produce, and a house in which the farm family lives. The farm also includes the crops, livestock and other enterprises that support the livelihood of the farm family. Some of the
operations conducted on the farm include the cultivation of fields, the tending of orchards and vegetable gardens, the raising of livestock, as well as combinations of these activities.

In order to grow a crop or raise livestock, farmers need land and water, labor and capital. These are called resources and sometimes “factors of production.” Resources are limited and farmers face problems of choice as to how to combine the resources they have in the best way and at the lowest cost in order to increase their income.

**Natural resources**

These can be likened to “gifts of nature.” They include land, water, soil and rainfall. These are resources that do not come from “human effort.” Land: a typical farm family may own or rent some land for cultivation. Water: Farmers will have some access to water. These might be springs, dams, wells and rivers or water collected from rainfall. This water may be on the land used by the farmer or it may be from a communal source.

**Labor resources**

This is human effort. It is needed on all farms. Farmers may have three different sources of labor:

- Farm family (family labor),
- Hired labor, or
- Labor provided through cooperation between members of the community where the farmer lives.

**Capital resources**

These are simply resources that are produced as a result of “human effort.” Cash is used by farmers both small and large. However, small-scale farmers often use very little cash capital in farming. Most of the capital on their farms is found in kind. These include livestock, tools, equipment, buildings, land improvement measures, as well as stocks of seed, fertilizer and animal feed. Capital is an important resource for all farmers.

**Resources have alternative uses**

Farm resources have two characteristics:

- They are scarce
- They have alternative uses.

The quality and quantity of the resource, the techniques employed and the skills used in obtaining the best possible combination all help to determine the quality and quantity of the final product. They all contribute to production by acting together.

**Understanding farm enterprises**

Farm enterprises are the crop and livestock production activities associated with the farm. These activities include the production of rice, wheat, clover, yams, corn, vegetables and livestock.
Generally a farm is made up of several enterprises. Each farm enterprise has its own inputs and outputs. Inputs are the scarce resources used in the production process: the use of the land, the labor of farmers and their families and any workers who may be hired, the mental effort put into planning and managing, the seed for the crops and feed for animals, fertilizers, insecticides and other supplies, tools and implements, and draught livestock or tractors. All the things that go into agricultural production are inputs. The outputs are the crop and livestock products the farm produces.
**Chapter 10: Farm Management**

**Definition of Farm Management**

The farmer is both producer and manager. The role of the farmer is twofold. The farmer is at the same time producer and manager. The first role of the farmer is to take care of plants and livestock in order to produce useful products. For crops, this includes the preparation of the seedbed, the sowing of the crop, the elimination of weeds, the management of soil moisture and measures for the control of pests and diseases. For livestock this includes herding and feeding, protection from disease, and where necessary provision of housing.

**The Farmer as Manager Needs New Skills**

Another of the farmer’s roles is that of manager and decision-maker. Where the skills of production are mostly physical, the skills of management are largely mental backed by will. They involve making decisions or choices between alternatives. The decisions that farmers must make as managers include choosing between different crops that might be planted in each field, choosing the livestock to be kept on the farm, and deciding how to distribute available labor time among different tasks, especially at times of the year when several tasks need to be carried out concurrently. They also involve choices as to what and how many draught animals need to be kept for work in the field.

As agriculture becomes more market-driven and commercial in nature, the farmer must develop skills in buying and selling. Farmers must decide whether to purchase improved seeds, fertilizers, pesticides and new implements. They must decide whether or not to employ additional labor in farming. They must decide how much of each crop to be kept for home consumption and how much to be sold. They must decide when to sell the produce and to whom to sell.

Some common definitions of management include “making decisions to increase profit,” “making efficient use of available resources,” “using, managing and allocating resources.” Farm management is about producing with limited available resources (e.g. land, labor and capital). Farmers need to know how to combine these resources in the best possible way in order to assure the best outcome. They require improved management skills to become more competitive as farming becomes more market-driven. Farmers need to develop managerial skills so that they are better equipped to take advantage of opportunities and to make their farms as productive as possible while increasing profits.

Farm management takes time and work, and this is just as critical to success as the planting, growing, harvesting and marketing of a crop or a livestock product. Good farmers need to learn from their day-to-day experience and recognize their mistakes, become accountable for their actions and be willing to change their thinking based on new information.

The common functions of management that help farmers deal with changes are shown in the diagram and described below.
FUNCTIONS OF FARM MANAGEMENT

Diagnose  Plan  Evaluate  Implement  Monitor

Figure 2 Phases of Farm Management

1. Diagnosis
2. Planning
3. Implementing
4. Monitoring
5. Evaluation

Diagnosis involves analysis of the current situation of the farm and its enterprises and identifying the constraints and opportunities to increase profitability and sustainability. It entails analyzing the causes of problems and identifying ways of overcoming them. Diagnosis is conducted for a single farm enterprise or alternatively for the whole farming operation.

Planning is considered the most fundamental and important principle. It entails deciding on a course of action, formulating policy and procedure, and assessing the future physical and financial performance for each enterprise and for the farm as a whole. Plans are prepared based on resources available and on personal objectives.

Implementation includes the purchase of the inputs and materials necessary to put the plan into effect and overseeing the process. This is a very important function within the farming context because in dealing with crops and livestock, the farmer is faced with a large number of daily decisions.

Monitoring and evaluation involves checking on the actions and progress achieved. Monitoring implies not just scrutiny of the progress of some change in the farming pattern but also checking on the whole system over time. Monitoring is a tool for evaluating the physical and financial performance of the farm business. The results of monitoring are used as inputs in making decisions about the day-to-day activities of the farm.
Evaluation is used to assess the outcomes and impact of the farm business. Evaluation involves making comparisons of the farm business performance over time and between farms. The results are used to identify strengths and weaknesses. The process is a cycle.

**FURTHER READING**

*Green Manures for Organic Soil Improvement - Garden Organic Guide Booklet*

*Beds: Labor-Saving, Space-Saving, More Productive Gardening* - Pauline Pears, HDRA/Search Press 1992

*Soil Care and Management* - Jo Readman, HDRA/Search Press 1991

*The Vegetable Garden Displayed* - Joy Larkcom, RHS 1992

*Planning the Organic Vegetable Garden* - Dick Kitto (Thorsons 1986)
SOURCES OF INFORMATION AND EXAMPLES OF BEST PRACTICE


