ROMANIA
AGRICULTURAL POLLUTION CONTROL PROJECT

Design of Testing and Demonstration Program
for
Environment-friendly Agricultural Practices

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Introduction

A team of technical personnel conducted a study to determine the environment-friendly conservation practices that would be appropriate for the project area. The team also prepared a list of practices to be tested and demonstrated on farms in both the terrace (upland) and the Polder (bottomland) of the project area. The team consisted of:

- Ion Toncea, Research Institute for Cereals and Industrial Crops, Fundulea, Romania
- Constantin Rotaru, National Forestry Organization (Regia Nationala a Padurilor)
- Gabriel Vulpe, Administrative Assistant, PPU
- Arnold King, U.S. Department of Agriculture

Land treatment alternatives discussed in this report are cost-effective and reduce the risk of water pollution from non-point sources. Practices were selected that can be applied by farmers using inexpensive material and labor. The environmental effects for all recommended practices are beneficial, but quantifying the effects will require long-term monitoring of the ground and surface water within the project area.

The Polder area will have reforestation practices that will require the use of native plant species which may/or may not be readily available through the National Forestry Organization (Constantin Rotaru). The polder area has salinity problems aggravated by sub-irrigation activities that may continue to worsen under current farming practices. Irrigation or land conversion to permanent vegetation are two options to correct this insidious problem.

The overriding natural resource concern that prompted development of this project is pollution of the Danube river and Black Sea from water leaving Romania through groundwater lateral flow, and runoff into tributaries. Addressing this primary concern will provide spin-off effects that will benefit other natural resources and social concerns identified by stakeholders during our field review.

Those expressed concerns are:

- Pollution of water caused by leakage of pollutants into the water system
- Unsuitable drinking water and associated diseases throughout much of the project area
- Lack of fish and wildlife food and cover
- Lack of recreational opportunities for citizens and tourists
- Lack of community pride and economic stability
- Uninformed citizens concerning waste disposal technology
- Wind and water erosion in a few areas
- Deforestation and subsequent effects
- Moisture conservation on cropland
- Declining soil tilth
- Inadequate forage for current and planned increases in livestock production

In meetings with the citizens (stakeholders) within the comunas, it was notable that they expressed full support and gave first priority to waste management systems at the village level. The citizenry also expressed interest in planting windbreaks, and using other buffer technology to improve the environment in the project area. There was an expressed concern about the need for soil improvement and sustainability of the natural resource base within the project area. Intensive tillage over a long time period has depleted much of the organic matter in these tremendously productive soils.

Landscape Setting

The project area is situated in the Southeastern part of Romania in Calarasi County. There are 78,876 ha, of which 69,011 are agricultural land and 44,722 ha are on the terrace area above the Danube river. The remaining 24,289 ha are in the Boianu-Sticleanu polder (flood plain). There are 7 comunas scattered throughout this geographical area, housing about 26,657 people most of which are directly involved in agriculture. Agriculture is intensive, and farming is about the only source of income.

The soils on the terrace area are gently sloping, fine textured, deep brown chernozem soils with approximately 2 meters of soil over a layer of calcium carbonate. These soils have a very high production potential with moisture being the limiting factor for crop production. There are some sloping soils going into major drainage areas that still have sufficient unleached calcium carbonate to effervesce when acid is applied. This characteristic would pose a fertility problem, but only a small percentage of soils have this characteristic. Inherent fertility is high, but continuous deep tillage is obviously depleting the organic matter. Moisture conservation is a major concern and is the limiting factor in crop yields. Managing moisture from rain as well as snow is a very important management consideration. According to farm records on the Maria Dragomir farm (Cuza Voda comuna), significant increases in crop yields have been associated with established windbreaks on farmland she operates. Practices installed for snow management should be considered a very important component of this project. The other component of moisture management is conservation tillage which will conserve moisture lost from tillage and improve farm fuel efficiency.

Most of the fields were plowed and visible erosion may have been hidden. But sheet and rill erosion appears to be insignificant, and very few signs of gully erosion were observed on the production agriculture sites. However, serious erosion from runoff water is occurring on the cultivated sloping land (mostly garden size areas) adjacent to major drainage areas. In addition, slope failure is apparent in several areas along the bench terraced slopes installed during the late 1980's. The bankslopes on many of the canals and lakes are almost vertical and the soil is sloughing off into the water course at most sites visited. Sediment is not considered a serious pollutant, but chemicals attached to soil particles may contribute to the pollution problem. Wind erosion was expressed as a problem or at least a consideration in some areas due to destruction of trees and shrubs removed for fuel purposes. Some accumulations of windblown material was noticed in the established windbreaks. This is probably not indicative of a high wind erosion hazard but indicates a few severe and extraordinary storms have occurred during the past few decades. The polder area is an artificially drained area that was originally developed for irrigation. The soils are lighter in color and range from silt loam to sandy loam in texture. The limitations for crop production in the polder area include salinity, acidity, and moisture management. Irrigation and drainage systems in the polder and terrace area are potential sources of nitrate and sewage pollution of the water draining into the Danube river. The polder area is well suited for irrigation and much of the infrastructure is in place when irrigation is restored to

the area. Comunas are set up on administrative boundaries and serve as a convenient way to administer the demonstrations.
The comunas of the project area are:

1. Alexandru Odobescu
2. Ciocanesti
3. Cuza Voda
4. Gradistea
5. Independenta
6. Vâlcelele
7. Vlad Tepes

The project area has three broad-basic problems that need immediate attention to begin reducing pollution of the water system. They are:

- **Pollution from livestock waste** - Is a priority point source throughout the project area. It will involve installing platforms for depositing, handling and distributing manure supplies back to the land for soil improvement and fertilization. Platforms and waste containers for recyclable waste will also be installed at home sites where manure can be deposited and transferred to the comuna platforms for later distribution. Full length corn stalks, with leaves removed, is a major source of difficult to manage waste material. Provisions for chopping the long corn stalks, and other waste material will be a component to this project. It is also common for people to dump garbage in drainage and irrigation canals.
- **Non-point sources of pollution** - Environmentally-Friendly practices will be demonstrated for possible adoption in the project area and other areas of Romania. The recommended practices are agronomic in nature and can be widespread in a relatively short time period if proven beneficial, economically advantageous, and acceptable to the area farmers. The practices were selected based on comments, resource concerns, and recommendations made by the farmers interviewed during the field visits. Non-point source pollution is vague, and difficult to quantify. The practices selected for these demonstrations will provide the latest technology, and the best defense against non-point sources of pollution from cropland. The reforestation projects in the polder area will have dramatic impacts on water quality, and more land conversion and wetland enhancement work is recommended for future projects. The impacts of these practices will be more difficult to quantify than the comuna manure management component. However, the impacts will occur and they will be beneficial to the environment, the farmers, and the public.
- **Pollution from human waste** - Not addressed by this project, but obviously an important issue related to water pollution in the comunas.

Ecological Site Description

Climate - The Calarasi area climate is classified as typical continental climate characterized by hot dry summers and cold winters with frequent blizzards alternating with short defrosted intervals. Soil productivity is limited by insufficient growing season moisture. A micro-climate exists along the Danube river floodplain characterized by even hotter summers, and warmer winter months than expected on the plains area above the river.

Atmospheric Circulation - The air mass is characterized by frequent incoming ocean tempered air from the West and Northwest during the summer months and some temperate-continental air from the Northeast and East during the winter months. Some rare occurrences of very cold air from the arctic regions do take place, and maritime tropical air from the Southwest and South is present at times.

Air Temperature - The air temperature generally decreases from the Southeast to the Northwest, as a consequence of the decrease in mean global sun radiation values. Mean annual temperature values are 11.3 C in Calarasi, and 10.4 C in Fundulea (to the NW of the area). The coldest month is January ranging from averages of -2 C to 3.2 C depending on location. The warmest month is July ranging from averages of 22.4C to 23.1C again depending on location. The absolute minimum temperature was recorded in Calarasi on January 9, 1938. The average number of frost free days ranges from 257.5 in Fundulea to 269.4 in Calarasi.

Rainfall - Average annual rainfall ranges from 510.2 mm in the Oltenita area to 504.0 mm in Calarasi. The highest rainfall month on the average is June adding an average of 75.9 mm in Oltenita and 72.2 mm in Calarasi. The average minimum rainfall month is February which adds only 30.1 mm in Calarasi and 30.8 mm in Oltenita. Most of the rainfall occurs during the summer months, and thunderstorms are frequent.

Snow - The average duration of snow cover ranges from 36.3 days in Calarasi to 40.0 days in Fundulea. The average thickness of the snow layer has a peak value during January, of 8 - l0 cm at county level and 9.10 cm in Calarasi.

Winds - Average annual frequency values indicate predominant winds from the West 16.4%; Southwest 12.4 %; North 16.8%; and Northeast 13.3%. There is a slightly higher predominance from the North, and the North winds have been recorded as significantly higher in velocity than winds occurring from other directions.

Vegetation - Ecological conditions are somewhat uniform and this is reflected in the wildlife and vegetation. Flora of the area is basically steppe, silvosteppe, and deciduous trees. The steppe vegetative types cover most of the area. Islands of light colored oaks (Quercus pedunculiflora) and tatars maple (Acer tataricum) occur between croplands and pasturelands. The silvo-steppe type vegetation on the western portion of the area includes light colored oaks (Quercus pedunculiflora), tatars maple (Acer tataricum), Quercus pubescens, Quercus cerris, and Quercus frainetto. There are also areas of Quercus robur, Frazinus excelsior, various willows, elms and poplars. Floodplain herbaceous vegetation includes plants such as Agrostis stolonifera, Alopecuris pratensis, and Agropyron repens. Other herbaceous vegetation includes Festuca valesiaca, Botreochloa, Andropogon, and Stipa capillata.

Soils - The soils on the terrace above the Danube river are carbon based chernozems, cambic chernozems, and clayed chernozems all of which are dark brown to reddish in color. These soils were formed on a loess base, with their texture being fine to medium. Alluvial soils with various textures and stages of siltation are found within the floodplain (polder) areas of the project.

Evaluation of existing practices and constraints to adoption of improved practices.

The review team visited each of the comunas, and discussed existing conservation practices and cultural techniques. It was agreed that the sample of sites visited would adequately represent the project situation in regard to practices currently applied, practices needed, and constraints that might affect adoption of new technology.

The overall objective of the project is to increase the use of environment-friendly conservation practices. Existing practices are almost exclusively crop production oriented with very little consideration for higher technology related to public benefits. However, there was interest expressed in environment-friendly practices during all field visits. The field review indicated

several additional conservation practices can be recommended and field tested to address the expressed resource concerns.

Practices currently being applied are cultural practices characteristic of farmers who keep themselves informed concerning agronomic principles, but lack financial resources to invest in environment-friendly practices that have mutual public benefits. Practices currently being applied include:

1. **Crop Rotations** - consisting of wheat, soybeans, corn, and sunflower are crops traditionally produced in the local area. They are grown in various rotations to break disease cycles, and for other cultural reasons. Very few farmers manage a grass based rotation. Research at the RICIC research center located at Fundulea report a favorable yield response from grass based crop rotations, and with fewer inputs. This would be a very beneficial practice. In many areas the fields are so small that converting part of the small area to grass might be impractical. However, in most areas of the project no particular objections to high level crop rotations was expressed and due to current interest in increasing livestock there appears to be potential for increasing forage crops including grasses for inclusion in crop rotations. Ion Toncea, team member with RICIC, has a lot of experience with this practice and has an ongoing project to research the concept.
2. **Rough Tillage** - is applied with the traditional moldboard plow during the fall to create a cloddy surface. The large clods help reduce erosion, and capture winter moisture. The soils apparently receive intensive tillage for weed control and seedbed preparation. Higher level tillage systems are needed to increase organic matter in the surface area of the soil. On the upland areas there was no evidence of damage from erosion, and it can be assumed, with some confidence, that erosion rates are within the range of 5 to 10 tons per acre. This is generally considered sustainable for deep soils. However, there is clear evidence that soil tilth needs improvement. Clods and crusts are troublesome at planting time. The only way to significantly increase soil organic matter and subsequently improve soil tilth is to perform tillage operations designed and timed to leave crop residue on or near the soil surface consistently for many years. A long term objective for agriculture in Romania should be the elimination of the moldboard plow. Excessive tillage, particularly moldboard plowing, causes rapid loss of organic material needed for humus formation, and accumulation. There are constraints to immediate adoption of conservation tillage. However, the many of the farmers are familiar with the practice, but do not believe it is feasible under current economic conditions. If funds are made available to provide tillage tools for a proper long-term demonstration of reduced tillage, a gradual increase should occur over a ten to twenty year time period. This would represent the normal adoption of new agriculture technology.

Environmental-friendly Practices

There are approximately 40 environment-friendly conservation practices used on cropland in various locations to help solve natural resource problems. With the exception of conservation tillage, practices that are expensive to install and maintain are not considered candidate practices

for this project. This portion of the report will discuss a comprehensive list of **candidate practices** followed by a short list of **selected practices** determined to be acceptable to most of the farmers in the project area. Several systems of practices should be developed and made available to the decision makers during the term of the project.

Candidate Practices

1. **Conservation Tillage** is any tillage system that leaves about 1/3 of the soil covered after the crop is planted. To accomplish this objective only very limited tillage can be performed. Several residue management techniques are necessary to apply this practice. Straw spreaders must be attached to the combines or any accumulations of straw must be evenly distributed to allow proper operation of the planter. Conventional corn planters can often be converted for conservation tillage by installing coulters (disk blades) that run ahead of the seed placement part of the planter. The more sophisticated planters plant the seed, apply starter fertilizer and pesticides in one operation.
2. **Agro-forestry** is combining tree production with other crops on the same land at the same time. Between rows of trees, food crops, forage crops, vineyards, fruits and a number of specialty crops may be grown and harvested. This is a relatively new concept that is becoming accepted as a cost effective way to produce income from land partially devoted to tree production. Agro-forestry can also be used to reduce the effects of soil salinity, by growing trees tolerant to high salinity.
3. **Windbreaks/Shelterbelts** are rows of trees and/or shrubs planted for the purpose of reducing wind erosion, protect field crops, shelter livestock, provide food and cover for wildlife, and protection of farm buildings from harsh weather.
4. **Hedgerows** are shrubs planted along field edges (usually a single row) to provide environmental benefits such as protection from wind erosion, crop protection from wind damage, habitat for beneficial insects when integrated pest management is being applied, and food and cover for wildlife.
5. **Narrow Vegetative Barriers** are rows of stiff-upright-tall grass (about 1 meter wide) that provide benefits similar to windbreaks. They are very easy and inexpensive to install and become effective within the first year. They may be installed on the contour to help control small gullies, and reduce sheet and rill erosion. They may also be used in conjunction with other practices such as filter strips to prevent excessive amounts of sediments from entering the filter strip area. In this project area their primary purpose would be to trap winter snow for moisture management purposes.
6. **Contour Buffer Strips** are grass strips established on the contour to reduce runoff velocities and help control sheet and rill erosion. They are usually 5 to 10 meters wide and installed at 10 to 20 meters spacing down the slope on cropland fields.
7. **Riparian Area Buffers** are rows of trees, shrubs, and grass planted along the water edges to provide filtration, sequestration of nutrients, and increase opportunities for decomposition of pesticides and other potential pollutants.
8. **Filter Strips** are strips of perennial grass established along the lower portion of a field to filter out potential pollutants.
9. **Field Borders** are strips of perennial grass established around the borders of cropland fields to provide protection from water leaving and entering a field as well as to serve as a filter for potential pollutants.
10. **Grassed Waterways** are designed, shaped, and established in perennial vegetation for the purpose of transporting concentrated runoff water at a non-erosive velocity.

11. **Field Terraces** are earthen structures constructed on the contour at designed intervals down the slope to reduce runoff and erosion. The terraces provide control of the water, slow the water and allow more time for infiltration.
12. **Diversions** are earthen structures designed to control runoff water, and reduce overland flow and subsequent erosion expected to occur below the structure.
13. **Nutrient Management** is utilizing available plant nutrients by developing and following a nutrient budget designed to prescribe correct field applications.
14. **Pest Management** is using pesticides only when necessary after considering more environmentally acceptable alternatives for pest control.
15. **Crop Rotation** is following a planned rotation of crops designed to improve soil quality, break pest cycles, and satisfy other crop production requirements.
16. **Grasses and Legumes in Rotation** is a crop rotation that includes grasses and/or legumes in the rotation to increase organic matter content, break pest cycles, and satisfy other crop production requirements.
17. **Wellhead Protection** is designing and installing structures to reduce the risk of pollutants entering the water system at or near the wellhead. The structures, for this project, would generally consist of a concrete or asphalt apron that prevents water accumulation around the wellhead.
18. **Wetland Restoration** is restoring the wetland characteristics of a site. It usually requires engineering structures that restrict drainage and cause accumulation of water and subsequent wetland plant growth.

The Selected Practices For Field Testing and Demonstration

The practices included in this section of the report were extracted from the above list of candidate practices for the following reasons:

- Cost effectiveness/low-input - *cost benefits are very favorable*
- *Has the effect of buffering for water quality purposes*
- Time proven technology/functionality - *the practices have proven to work*
- Technology is readily transferable - *training material is currently available upon request from USDA.*
- Aesthetic appeal - *trees and shrubs are pleasing to the eye and functional.*
- *The practices have positive social effects*
- Ease of installation using farm labor and inexpensive material - *these practices can be applied by the farmers with tools readily available*
- No adverse environmental effects - *the practices are environment-friendly*
- Acceptable to the farmers interviewed - *field interviews indicate the farmers will apply the practices*
- Effective as a stand-alone practice if necessary - *most of the practices are effective even if installed as a single practice*

The practices will function as stand-alone practices but field application has proven the benefits of applying systems of practices that benefit each other in synergistic ways.

1. **Conservation Tillage**
2. **Shelterbelts/Windbreaks**
3. **Hedge Rows**
4. **Narrow Vegetative Barriers**
5. **Filter Strips**
6. **Riparian Buffers**

7. **Nutrient Management**
8. **Wellhead Protection**
9. **Agro-forestry**
10. **Tree Planting**
11. **Land Reclamation**
12. **Grazing Management**

Criteria for selecting sites for T/D program

The sites selected for the testing and demonstrating (T/D) the practices were chosen for the following reasons:

- **Site adaptation for the specific practice -** Each practice has specific soil and site requirements for proper testing and demonstration. However, most of the practices chosen for demonstration are adapted to almost any location within the project area. Site selection was, therefore, based more on geographic and strategic locations than soil and site characteristics. For monitoring activities, it was determined to be advantageous to locate practices is in close proximity to each other.
- **Enthusiasm expressed by comuna representatives -** It is imperative that practices be located on sites where stakeholders are ready, willing, and able to apply and manage the conservation practice. The field review indicated a lot of enthusiasm exists for testing and demonstrating the practices.
- **Technical abilities of the stakeholder -** Most of the practices will require training to assure the practice is planned, applied, and managed to assure project objectives are met. Practices range from low-tech to very high-tech and care must be taken to assure the proper people are selected to apply and manage the practices.
- **Logistics for public display and monitoring activities -** It is important to locate the practices where people can see them and visit the sites efficiently. It is also advantageous to locate many of the sites in a central location to improve efficiency during the monitoring phase of the project.

First Year Program Activities

The following is the first year (2001) practice recommendations, and rational for selection. Each individual project will require a detailed plan of work prepared by participants specifying each individual necessary task, the person responsible, and the deadline date for successful completing of each step.

1. **Tree Planting (Project No. tp-001)** - I propose this project as the first tree planting demonstration. It will be installed on the bench terraced area near Vlad Tepes comuna. A tree planter needs to be purchased and delivered by October 1, 2001. Planting should be completed during the fall of 2001. (Rotaru indicated plant seedlings will be available)

2. **Shrub Rows (Project No. sr-001)** - I propose this project on Cuza Voda comuna with the Total Chim Commercial Society as the practice stockholder. Maria Dragomir is the General Manager of this farm organization. The shrubs will be established in the area between two existing tree windbreaks.

3. **Narrow Vegetative Barriers (Project No. vb-001)** - I propose this project on the same comuna and same general location as the shrub rows. This will provide a good comparison of the practices and be a decision tool for area farmers who observe performance of the practices. It will also enhance credibility of yield data collected by the farmer.

The Projected 3 to 5 Year Program/Schedule

Conservation Practice T/D - Year 2001 –2005*					
Practice	**2001**	**2002**	**2003**	**2004**	**2005**
Conservation Tillage		Ct-001		Ct-002	
Shrub Rows	Sr-001		Sr-002		
N.Vegetative Barriers	Vb-001				
Agro-forestry	Af-001		Af-002		
Riparian Buffers		Rb-001	Rb-002 Rb-003	Rb-004 Rb-005	
Land Reclamation		Lr-001			
Wellhead Protection		Wp-001			
Grazing Management			Gm-001		

* Practice application schedules will need to be reaffirmed following site planning activities with local farmers and community leaders. The above application schedule is based on discussions and tentative plans for project planning purposes.

Individual Project Descriptions

Demo. I.D. no's	Narrative Descriptions of Demo. Projects
Ct-001	This demonstration will be conducted as part of a total system on the Maria Dragomir farm in the Cuza Voda comuna. The project will provide a high tech tillage implement, attachments to make existing planted suitable for minimum tillage, and a high residue drill necessary for drilling cereal crops in high residue situations. The project will also provide a significant portion of the chemical inputs for the first two years. Training is also part of the project proposal and up to ten participants can be identified for a study tour hosted by USDA or a university located within the corn belt area of the United States.
Ct-002	An option for the polder
Sr-001	Shrub row planting included in this demonstration will utilize existing windbreak and enhance the effects for snow management and wildlife conservation. It will also be part of the total system on the Maria Dragomir farm.
Sr-002	Shrub rows will be planted on the organic vegetable farm. This project will demonstrate how vegetation can alter micro-environment to increase production and overall environmental quality.
Vb-001	Narrow vegetative barriers will be installed as part of the total system on the Maria Dragomir farm and the Vlad Tepes comuna. The barriers will be established to demonstrate how grass strips can trap snow and increase available moisture between the strips. These strips will be established within fields with existing tree windbreaks as part of the total system including conservation tillage. The strips should be established to an adapted tall growing perennial species.
Af-001	Tree planting for fuel wood will be established on the bench terraced area south of Vlad Tepes. It will involve about 40 hectares. Fencing for livestock exclusion should be demonstrated on this area to protect the trees for sustained use by the Vlad Tepes comuna.

Af-002	Tree planting for fuel wood will be established on the bench terraced area near Alexandru Odobescu. It will involve about 100 hectares. Fencing for livestock exclusion should be demonstrated on this area to protect the trees for sustained use by the comuna.
Rb-001	Riparian Buffer installed in the Mircea Voda comuna, in the polder area to improve water quality. **Information contained in the USDA job sheet will be used for specifications.**
Rb-002	Tree planting to restore natural plant cover will be the objective of this field trial on the polder area of the Ciocanesti comuna. This practice will help reduce pollutants in Romanian water draining into the Danube river. The project will result in about 678 hectares of low quality cropland converted to native tree species. **Information contained in the USDA job sheet will be used for specifications.**
Rb-003	Tree planting to restore natural plant cover will be the objective of this field trial on the polder area of the Ciocanesti comuna. This practice will help reduce pollutants in Romanian water draining into the Danube river. The project will result in about 162 hectares cropland converted to native tree species along a large canal. **Information contained in the USDA job sheet will be used for specifications.**
Rb-004	Tree and shrub planting approx. 100 ha. of bench terraced land in the Gradistea comuna. **Information contained in the USDA job sheet will be used for specifications.**
Rb-005	Tree and shrub planting on approx. 20 ha; the purpose will be bank stabilization and buffering for water quality around the perimeter of Galatui Lake in the Gradistea comuna. **Information contained in the USDA job sheet will be used for specifications.**
Lr-001	A specific location will be specified to demonstrate land reclamation of the current manure platform areas. Land reclamation is need to reduce pollution from water runoff and deep percolation of polluted water. The land should be cleaned of garbage, shaped and vegetated to restore aesthetics, provide fuel wood, grazing, wildlife food and cover, and possibly recreation areas for the public benefit.
Wp-001	Well head protection is needed for many wells in the 7 comunas. An inventory will be conducted by the local people and unprotected wellheads will be improved to drain water away from the wellheads. The project will provide material and local people will install the improvements.
Gm-001	Grazing management needs improvement. This project will demonstrate how rotation grazing can improve grass production. The wheat grazing component will demonstrate how grazing wheat in the fall and early winter can add another source of forage.

Project Cost Tables

Cost Statement for Developing/Translating Training Material in Romanian
The training material and job sheets are available in English language. Translation to Romanian with some local pictures will be completed in the early stages to assure training is completed before beginning the physical practice implementation. For efficient translation, the technical material can be provided electronically upon request from USDA/ Natural Resources Conservation Service. Translation, printing, dividers, and binders will cost an estimated $*10,000.00* for 50 copies of the workbook and 300 copies each of the 10 job sheets.

Cost table for Tree Plants needed for Buffer Practice Demonstrations								
Component	unit	unit cost	2001	2002	2003	2004	2005	2006
Tree planters	2 each	$6000	$12000					

Cost Distribution Table for Establishing Trees/Shrubs (Per Hectare)							
Plant Cost (includes planting operation)	Seed bed Preparation	Technical Assistance for planning	Tractor Cost	Care after Planting (3 years)	Vehicle Cost	Misc. supplies	Totals
$700.00	$30.00	$50.00	$35.00	$150.00	$20.00	$15.00	$1000.00 per hectare

Cost Table For Conservation Tillage Demonstration CT-001								
component	**unit**	**unit cost**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Mulch tillage implement	one unit for 65 hp tractor	$12,000		$12,000				
field sprayer	field sprayer	$10,000		$10,000				
High residue drill	coulter drill	$15,000		$15,000				
planter coulters and tool bar (6 ea)	coulters to be added to existing planter 6 each	$250		$1500				
fertilizer and herbicides for 20 ha	misc. inputs	$40.00		$800	$800	$800 Farmer assumed	$800 Farmer assumed	$800 Farmer assumed
#1Training component	Study tour for 6	$4000 per person	$24000					
#2 Training component	Training 100 farmers	$100 per person	$10,000					
Totals for conservation tillage			$34000	**$39,300**	**$800**	**$800**	**$800**	**$800**
This demonstration will evaluate a total system including conservation tillage, windbreaks, and shrub rows on the same field for ultimate moisture management and efficiency in fuel usage. Within the timeframe of the project noticeable soil improvement will be observed and the trend in soil quality will be upward. Close supervision and management is recommended for this project.								

Cost Table For Conservation Tillage Demonstration CT-002								
component	**unit**	**unit cost**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Mulch tillage implement	one unit for 65 hp tractor	$12,000		$12,000				
field sprayer	field sprayer	$10,000		$10,000				
High residue drill	coulter drill	$15,000		$15,000				
planter coulters and tool bar (6 ea)	coulters to be added to existing planter 6 each	$250		$1500				
fertilizer and herbicides for 20 ha	misc. inputs	$40.00		$800	$800	$800 Farmer assumed	$800 Farmer assumed	$800 Farmer assumed
#1Training component	Study tour for 6	$4000 per person	$24000					
#2 Training component	Training 100 farmers	$100 per person	$10,000					
Totals for conservation tillage			**$34000**	**$39,300**	**$800**	**$800**	**$800**	**$800**
This demonstration will located in the polder area to evaluate and demonstrate soil improvement, moisture management and efficiency in fuel usage. Within the timeframe of the project noticeable soil improvement will be observed and the trend in soil quality will be upward. Close supervision and management is recommended for this project. The specific location has not been determined, but several excellent choices are available.								

Cost Table for Shrub Row Demonstration								
Component	**unit**	**unit cost**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Sr—001 Seedbed preparation, plants and planting	2 ha	$1000	$2000					
Training	50	$100	$5000					
totals for sr-001			**$7000**					
This project will be implemented within the Cuza Voda comuna, on the farm of Maria Dragomir, Director of the Total Chim Co . This project will evaluate the effects of windbreaks and shrub rows on the same field.								
Sr—002 Seedbed preparation, plants and planting	2 ha	$1000					$2000	
Training	50	$100	$5000					
totals for sr-002							**$2000**	
This project will be implemented within the selected areas on the organic vegetable farm.								

Cost table for Grazing Management Demonstration Gm-001

Component	unit	unit cost	2001	2002	2003	2004	2005	2006
Interseeding legumes	50 ha	$15.00			$750.00			
Fencing - electric	2000 meters	$0.50			$1000			

Cost Table for wellhead protection Wp-001								
Component	unit	unit cost	2001	2002	2003	2004	2005	2006
Inventory 7 comunas	7	$500				$3500		
Install concrete drainage aprons	14	$200				$2800		

Cost Table for Land Reclamation Lr-001								
Component	unit	unit cost	2001	2002	2003	2004	2005	2006
Surface shaping and garbage removal	2 ha	$1500				$3000		
Tree Planting (plants, seedbed, planting, managing)	2 ha	$1000				$3000		

Cost table for Agro-forestry Demonstration (Af-001,002)								
Component	unit	unit cost	2001	2002	2003	2004	2005	2006
Tree planter	Tree Planter	$5000	$5000					
Seedbed Prep, Plants and planting tp-001	50 ha	$1000 per ha		$25000 (25 ha)	$25000 (25 ha)			
Fencing for livestock exclusion tp-001	2000 meters	$3.00 per meter	$6000					
Training	100 people	$100	$10000					
totals for Af-001			$21000	$25000	$25000			
Notes: This agro-forestry demonstration will be on the bench terraced area near Vlad Tepes comuna. It will provide a buffer near the lake and a sustained supply of fuel wood.								
Seedbed prep. plants and planting for Af-002	100 ha Alexandru Odobescu	$1000 per ha					$100000	
Fencing for livestock exclusion Af-002	2000 meters	$3.00 per meter			$6000			
Training	100 people	$100				$10000		

Totals for Af-002				$6000	$10000	$100000	
Notes: This demonstration will be agro-forestry on a benched terraced area near the Alexandru Odobescu comuna. It will be used to protect the canal and provide a sustained supply of fuel wood								

Cost Tables for Riparian Buffers								
Component	Unit	Unit cost	2001	2002	2003	2004	2005	2006
Seedbed prep. plants and planting for Rb-001	150 ha Mircea Voda	$1000 per ha			$150000			
Training	100 people	$100		$10000				
Totals for Rb-001					$150000			
Notes:								
Seedbed prep. plants and planting for Rb-002	678 ha Ciocanesti	$1000 per ha				$678000		
Training	100 people	$100		$10000				
Totals for Rb-002				$10000		$678000		
Seedbed prep. plants and planting for Rb-003	162 ha Ciocanesti	$1000 per ha				$162000		
Training	100 people	$100			$10000			
Totals for Rb-003					$10000	$162000		
Seedbed prep. plants and planting for Rb-004	100 ha Gradistea	$1000 per ha					$100000	
Training	100 people	$100				$10000		
Totals for Rb-004						$10000	$100000	
Seedbed prep. plants and planting for Rb-005	20 ha Gradistea	$1000 per ha					$20000	
Training	100 people	$100			$10000			
Totals for Rb-005							$20000	
Notes: This demonstration will be a riparian area surrounding lake Galatui								

Performance Indicators to Evaluate Impact on Productivity and the Environment

Measuring the environmental impacts of agronomic land treatment practices requires a long term evaluation. Reduction in soil erosions is a visible impact and easily documented. Impacts that occur beneath the soil surface are insidious and require very precise data collection.

Practice/system	Project I.D.	Performance Indicators
Total System Demonstration. This will include conservation tillage, Windbreaks, Shrub Row planting, Narrow Vegetative Barriers, and crop rotation. This will demonstrate a sustainable system.	Ct-001,Sr-001, Vb-001 (combined to work as a system)	The practices included in the total system will have additive benefits a multitude of performance indicators. Soil improvement will be significant within 5 years. Crop yields can be documented as soon as the vegetative strips are effective. Wildlife food and cover will increase significantly and a more diverse animal inventory should be documentable within a few years. Earthworms and other soil organisms are depleted in the soil and changes in this soil parameter will be significant. Any runoff water will be significantly cleaner, and groundwater quality may improve if it is currently polluted.
Conservation Tillage (functions as a buffer)	Ct-001	Conservation tillage should be evaluated based on soil quality improvement due primarily to increased amounts of organic matter at or near the soil surface. It is critical to evaluate the surface rather than the entire plow layer. Other indicators will include measuring soil crust strength or describing crusts at initiation of the practice and each spring afterward. Soil aggregate stability is an indicator of the effects of tillage. Laboratory procedures are available for the simple field test necessary to measure this parameter.
Shelterbelts/ Windbreaks (functions as a buffer)	Not yet planned	Shelterbelts and windbreaks should result in increased yield by modifying the micro-climate and improving moisture management. Wildlife habitat will be enhanced and measurable changes should be the result when the practice is widespread over the landscape.
Shrub Rows (functions as a buffer)	Sr-001	Shrub rows will provide the same impacts as windbreaks but possibly to a smaller degree.
Filter Strips (functions as a buffer)	Not yet planned	Will provide improved water quality provided by the filtering action and increased opportunity time for decomposition, denitrification and other chemical processes that cleanse the water intercepted by the strips of vegetation
Riparian Buffers	Rb-001, 002,003, 004,005	Riparian buffers provide the same function as natural riparian areas. The filter the surface flow as well as the lateral spring flow and tie up potential pollutants. The pollutants may be harvested in biomass removed from the site or stored in the organic form within the biomass. They also provide an opportunity for bacterial action to decompose harmful compounds back into elements.
Wellhead Protection	Wp-001	The effects of wellhead protection would be difficult to

		measure due to more significant waste management problems associated with contaminated well water within the communities. A narrative description of the before and after situation would adequately describe the effects of this practice.
Agro-forestry	Applies to Tree Planting	Agro-forestry will provide measurable benefits to both surface and subsurface water. There will be wildlife benefits, and economic benefits by increasing diversity and taking advantage of synergistic effects of this practice. The practice will also provide the possibility for a sustained supply of fuel wood for the comunas. The effect on wildlife habitat food and cover are measurable effects that can be described.
Tree Planting (serves as a component to several buffer practices including agro-forestry	Tp-001	Trees provide many measurable benefits. Water quality measurements should reflect these benefits within 3-5 years following establishment. The effects will be reflected in both surface and ground water. Other benefits will include improved wildlife habitat, and improved recreation opportunities for people.
Grazing Management	gm-001	Grazing management can be evaluated by clipping studies that compare management techniques. A narrative description comparing managed verses non managed pastures would probably be sufficient due to lack of technical expertise in this discipline. Runoff studies can also provide and indication of the effects of applying improved grazing management.
Land Reclamation	Lr001	Reclaiming the old manure platforms for crop production should provide measurable benefits in cleaner surface runoff as well as improved ground water quality.

Organization Requirements for Managing the Projects

Managing the planning, application, and maintenance of the demonstrations is critical to success. Responsibility for the entire demonstration project must be assigned. In addition, the correct technical personnel must be assigned to specific projects. Each project leader must prepare a plan of work specifying the following:

1. Specific Project Assigned
2. Person with responsibility
3. Specify each step needed for completion
4. Specify a precise date for completion of the step

Follow-up Assistance

I agree to provide the following information upon return to my official duty station:

1. Information on planning, specifications, and installing quality livestock fencing for exclusion of grazing on the Vlad Tepes reforestation project.
2. Plant material information concerning Afghan Pine (Pinus elderica) and other species that may be adapted to project site conditions. I will inquire about plant material availability from a private nursery about the possibility of providing a supply of seed or seedlings for testing. I agreed to provide information directly to Rotaru Constantin. Getting plant material into Romania might be easier going that route.
3. Information on tillage equipment necessary to solicit bids for necessary machinery for the Cuza Voda total system project. With this project we have an excellent opportunity to demonstrate a total conservation plan to area farmers. The equipment is absolutely necessary to implement a sustained demonstration and the investment is small for the potential returns.