HAITI WINNER

WATERSHED INITIATIVE FOR NATIONAL NATURAL ENVIRONMENTAL RESOURCES

ENVIRONMENTAL ASSESSMENT OF AGRICULTURAL LAND PREPARATION USING TRACTORS IN THE CUL-DE-SAC AND MATHEUX CORRIDORS, HAITI

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ACRONYMS

BEO	Bureau Environmental Officer
CFR	Code of Federal Regulations (US)
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan
EMPR	Environmental Management Plan and Report
ESDM	Environmentally Sound Design and Management
GAP	Good Agricultural Practice
IEE	Initial Environmental Examination
IPM	Integrated Pest Management
MARNDR	Ministere de l'Agriculture Des Ressources Naturelles et du Developpement Rural
NEPA	National Environmental Policy Act (US)
PEA	Programmatic Environmental Assessment
PERSUAP	Pesticide Evaluation Report and Safer Use Action Plan
REA	Regional Environmental Advisor
USAID	United States Agency for International Development
WIF	Watershed Investment Fund
WINNER	Watershed Initiative for National Natural Environmental Resources

1: SUMMARY

This Environmental Assessment evaluates the potential adverse environmental and socio-economic impacts of WINNER's proposed program for agricultural land preparation using tractors in the Cul de Sac and Matheux corridors. Prepared according to the requirements of USAID's environmental procedures, the EA analyzes the direct, indirect, connected, and cumulative impacts of the proposed agricultural land preparation program along with alternate options with a view to recommend the most appropriate action(s). It reflects the key issues identified during the scoping process, and WINNER's team work in identifying and analyzing the various project activities aiming at addressing these issues.

The WINNER project, a USAID program implemented under the U.S. Feed the Future Initiative, aims at improving specific agricultural value chains in the Cul-de-Sac and the Matheux corridors. Its long-term vision is that people living within these corridors will have improved livelihoods, reduced threat from flooding, and will have invested in sustainable economic growth and environmental protection in these corridors.

Its agricultural production program contributes to the Feed the Future Initiative indicators 4.5.2.2 "*Number of (additional) hectares under improved technologies or management practices as a result of USG assistance*," and 4.5.2.5 "*Number of farmers and others who have applied new technologies or management practices as a result of USG assistance.*"

With the primary goal to significantly increase the production of selected food crops in the targeted corridors, WINNER creates economic linkages between small farmers, farmer organizations, larger land owners and agribusinesses to apply modern techniques, intervene at various stages of the value chains, and foster new business opportunities. Through a well targeted agricultural extension program, it works with farmer associations involved in the production of corn, rice, and beans in the Cul de Sac plains; and plantain, corn, and beans in the Matheux corridors to improve their access and use of appropriate and improved technologies. WINNER plans to promote the use of tractors for agricultural land preparation (plowing, harrowing and furrowing) to support its agricultural production program, which is well aligned with the Government of Haiti's new strategy for agricultural development.

Building on the scoping process for WINNER Programmatic Environmental Assessment completed at the end of 2010, the EA team has identified and recommended mitigation and monitoring measures to eliminate these impacts, reduce them to acceptable levels, or proposed/recommended alternative actions or activities with less an impact. It drew from USAID/LAC Environmental issues and best practices for agriculture and watershed management, USAID environmental guidelines for small scale activities in Africa – chapter 1: Agriculture, and the Global GAP guidelines to propose new or recommend WINNER's continuing promotion and implementation of relevant best practices.

2. PURPOSE

2.1 The WINNER Project

The WINNER project is a USAID program implemented under the U.S. Feed the Future Initiative, aimed at improving specific agricultural value chains in the low areas of the Cul-de-Sac and the Matheux corridors. It implements broad scale investments in sustainable natural resource management at the scale and density needed to produce future positive landscape level reductions in environmental, infrastructural, and economic vulnerability in the target corridors. Its long-term vision is that people living within these corridors will have improved livelihoods, reduced threat from flooding, and will have invested in sustainable economic growth and environmental protection in the corridor. Their experience will serve as a model approach to replicate both within and beyond the targeted corridors. Early 2011, the project focus changed from watershed management to agricultural production.

WINNER's agricultural production program falls under USAID Intermediary Result 1: Increase of agricultural productivity, and Intermediary Result 3: Reinforcement of agricultural markets. It contributes to the Feed the Future Initiative indicators 4.5.2.2 "*Number of (additional) hectares under improved technologies or management practices as a result of USG assistance,*" and 4.5.2.5 "*Number of farmers and others who have applied new technologies or management practices as a result of USG assistance.*"

WINNER takes a value-chain approach, which augments its past successes at the farm-level through analysis and investments in agricultural inputs production infrastructure, agricultural products handling, storage and processing, local and international wholesale and end markets, and support services (transport, communications, etc.). It also takes a greater look at policy and enabling environment issues. Such an approach increases the likelihood of sustainability through greater engagement of the private sector and local and national government. Through its agricultural extension program, WINNER seeks to help farmers acquire the resources and capacity necessary to become more productive, and generate higher incomes in a sustainable manner.

2.2 Proposed agricultural land preparation program using tractors: Purpose & Need

With the primary goal to significantly increase the production of selected food crops in the targeted corridors, WINNER creates economic linkages between small farmers, farmer organizations, larger land owners and agribusinesses to apply modern techniques, intervene at all the stages of the value chains, and foster new business opportunities. The agricultural production of activities includes among other aspects:

- Agricultural extension through WINNER's technical staff, agricultural extension agents, and master farmers;
- Improved access to, use and management of irrigation water;
- Increased access to and/or use of improved seeds;
- Improved management of soil fertility with chemical and/or organic fertilizers, and other soil amendment practices;

- Environmentally sound pest management, including integrated pest management;
- Improved agricultural land preparation using tractors of up to 100 HP;
- Reduction of post harvest losses;
- Value added through agricultural product transformation; and
- Improved access to market

As part of its program, WINNER works with farmer associations involved in the production of corn, rice, and beans in the Cul de Sac plains; and plantain, corn, and beans in the Matheux corridors to improve their access and use of appropriate and improved technologies through an agricultural extension program. Some of WINNER's technical itineraries for selected crops are presented in Appendices A-1 and A-2).

WINNER proposes to promote the use of tractors for agricultural land preparation (plowing, harrowing and furrowing) to support the agricultural production increased program, with the other practices such as seeding, weeding and harvesting remaining manual. Such an approach is consistent with the GOH new strategy for agricultural development (Appendix A-3). The proposed action (agricultural land preparation using tractors) responds to the farmers' needs to:

1. Break down crust and soil clumps in the cultivable soil horizon to foster water penetration in soils that have a high percentage of clay;
2. Break the cycle of weed development (and, if possible, uproot certain species) to prevent or limit competition for nutrients, water, space, and light;
3. Disrupt the habitats of parasites and encourage natural predators' activities;
4. Implement good on-farm water management by facilitating water management with gravity irrigation, and preventing drainage problems;
5. Improve availability of nutrients for the crop through mineralization of organic matter; and
6. Prepare the soil as quickly as possible to obtain a uniform field and prepare for planting.

The proposed action is described in detail in Section 3.

2.3 WINNER IEE and Environmental Threshold Decisions

This proposed program for agricultural land preparation using tractors comes with the full understanding that it can have both positive and negative impacts on the environment. For example, the positive effects include higher yields compared to hoeing, more timely field operations to reduce farmers' work in fields when conditions are poor, increased productivity per worker and area under cultivation, reduction of labor shortage bottlenecks (usually for land preparation), etc.; and potential negative environmental impact which would include expansion of agriculture into soils which are unsuitable or extremely fragile, increased risks of soil erosion and soil compaction, siltation of water bodies, etc.

This Environmental Assessment (EA) analyzes the significant environmental issues raised during the scoping process, assesses the environmental and socio-economic impacts of the various alternatives, and recommends the most appropriate option(s). It complies with the Initial Environmental Examination (IEE) for Watershed Initiative for National Natural Environmental

Resources (WINNER) and DEED (LAC-IEE-10-40), which recommended the following threshold decisions:

A. Technical Assistance – Categorical Exclusion, pursuant to 22 CFR §216.2(c)(2)(i)
B. Training – Categorical Exclusion, pursuant to 22 CFR §216.2(c)(2)(i) and 22 CFR §216.2(c)(2)(iii)
C. Procurement (non-pesticides) – Negative Determination [1]
D. Procurement (pesticides) – Preparation of a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) required, 22 CFR §216.2(e)
E. Physical Infrastructure Rehabilitation and Construction
1. Low or Moderate Risk Rehabilitation or Construction including road rehabilitation, subgrants with Watershed Investment Funds, and earthquake recovery actions including maintenance of tractors and use of fertilizers
Negative Determination with Conditions – Preparation and implementation of Environmental Mitigation Plan and Reports (see Appendix 1).
2. High Risk Rehabilitation or Construction
Positive Determination, 22 CFR §216.2(d)(1)(i, ii, iv, and v) – Environmental Assessment (EA)required
F. River Basin Development including river rechanneling, dredging, and overall watershed development.- Positive Determination and requires a Programmatic Environmental Assessment (PEA).
G. Restricted Use Pesticides if required after PERSUAP is developed- Positive Determination.

In compliance with the above recommended threshold decisions, WINNER:

- Actively participated in the development of, and is implementing USAID/Haiti Mission-wide Pesticides Evaluation Report and Safer Use Action Plan (PERSUAP) which evaluates pesticides proposed for use, as well as other mechanical, cultural and biological control alternatives, examines their risks and proposes mitigation measures to prevent or minimize negative impacts from pesticide use;
- Developed a Programmatic Environmental Assessment (LAC-EA-11-02) which covered, among other aspects the agricultural production program, not including long-term agricultural land preparation with tractors;
- Developed in close collaboration with USAID and the US Corps of Engineers, and implemented the EA for La Quinte river dredging and bank protection (LAC-EA-10-03);
- Developed and implemented various EMPRs: and
- Will develop this EA for agricultural land preparation using tractors in the Cul-de-Sac and Cabaret/Arcahaie (Matheux) corridors.

Committed to ensuring the sustainability of its project activities through the adoption and promotion of environmentally sound design and management (ESDM) principles, WINNER uses the PERSUAP, the PEA, and other relevant environmental impact assessment (EIA) methodology to evaluate planned activities, adjust them during design, recommend and implement mitigation measures, and monitor their impacts and effectiveness.

[1] Large procurements of some equipment, such as diesel generators, can have a cumulative negative environmental impact and should be evaluated for their environmental impact.

2.4 The Scoping Process

The scoping process for the PEA completed last year, identified the key stakeholders groups for the WINNER agricultural production improvement program, including national and local level government officials, representatives of non-governmental organizations (including community organizations), representatives of private sector firms and individual residents in project areas. As part of the agricultural production program, the WINNER team regularly meets with officials of the Haitian Government Ministry of Agriculture (former and current), agronomists of the Ministry of Agriculture, specialists of the University of Florida team supporting the WINNER Project, and farmers associations in the targeted areas to discuss WINNER agricultural development program, including agricultural land preparation using tractors in the targeted corridors. WINNER has solicited stakeholder inputs, comments, concerns and issues pertaining to the potential environmental and socio-economic impacts of agricultural land preparation using tractors (Appendix A-4). The discussions were as informal as possible so that the various stakeholders were able to express their views without reticence.

In addition to the PEA scoping activities, which took place between December 2009 and May 2010, and the various informal meetings, the project conducted several formal stakeholder meetings and consultations on the proposed agricultural land preparation. They included among several others:

- February 2, 2011 Technical Evaluation Committee meeting to review expressions of interest to WINNER's program for agricultural land preparation using tractors, in response to WINNER's Request for Expression of Interest released on November 23, 2010;
- March 16 & 17, 2011consultations with farmers associations in Mirebalais – Saut d'Eau. Subsequently WINNER activities in that area was reduced to the mango value chain;
- May 17, 2011 general meeting with all the farmer associations which expressed interest in the program of agricultural land preparation using tractors;
- October 20, 2011 meeting with Montes CHARLES, engineer and Marc-Edouard DIEUJUSTE, agricultural engineer of the Ministry of Agriculture;
- October 21, 2011 consultation at the Bas Boen CRDD with 19 tractor operators, owners and users;
- October 21, 2011 meeting senior staff of the Ministry of Agriculture to discuss the upcoming bean campaign, the land preparation approach, and the pertaining issues and concerns;
- October 22, 2011 consultation with 2 farmers associations: AIPA (that benefitted assistance form MARNDR for tractors) and KOPLARIKO (that bought a tractor, in Dominican Republic, 13 years ago);
- Various meetings with University of Florida: Florence Sergile, a specialist of Haitian flora and fauna, Brian Bowman, soil and irrigation experts in Florida, and Richard Fethière, among others.

The general information obtained and issues raised during these meetings/consultations are summarized below:

- The target areas, especially the plain of Cul-de-Sac is subjected to fast encroachment by uncontrolled urbanization due to lack of competitiveness of agriculture (low levels of productivity) in a context of lack of appropriate agricultural extension services, assistance to improve agricultural production, and absence of zoning causing land use conflicts; [2]
- Limited access to improved agricultural production packages and technologies, including agricultural inputs, pest control, water and appropriate land preparation services;
- Lack of local labor at peak moments of agricultural cycles, especially for land preparation, weeding and harvest operations;
- Poor, ill-maintained or lack of physical infrastructure, especially irrigation/ drainage systems and farm to market roads to support agricultural production;
- Limited or no-access to credit;
- Limited or poor market information on agricultural products; and
- Poor agricultural products standard measures.

The potentially significant impacts of the proposed activity are shown in Section 3.

[2] The only extension services available in the target areas come from the WINNER Project. Thanks to the package offered by WINNER, including access to irrigation water, the land area planted during the spring and winter 2010 agricultural campaigns doubled and resulted in significantly higher yields.

3. ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 Description of the Proposed Action and Alternatives

This section describes the proposed action and alternatives that were identified in the Scoping Statement (and revised below) as meeting the purpose and need, and addressing significant concerns of the proposed action. (The U.S.'s National Environmental Policy Act requires that a range of alternatives be formulated that fulfill the purpose and need, address the significant issues, and include a no action alternative and mitigation).

Alternative 1: The Proposed Action - agricultural land preparation using tractors

The proposed action is to increase targeted farmers' access to tractors (up to 100HP) and accessories for agricultural land preparation (plowing, harrowing and furrowing). The other agricultural operations (sowing, cultivation, harvest, etc.) will remain manual.

WINNER proposed agricultural land preparation program targets up to 30,000 farmers with an acreage of up to 25,000 hectares scattered throughout the irrigated productive plains in the two corridors, with an average farm size of about two hectares. Contiguous plots of more than 50 hectares are very rare in the targeted farmer associations; and WINNER does not target them. The 2011 winter bean campaign proposes to use fifty tractors of up to 100 HP with their accessories, and targets up to2,500 hectares and about 4,000 farmers in the Cul de Sac and Cabaret/Arcahaie plains. The Ministry of Agriculture has mobilized twenty-five tractors for the 2011 winter bean campaign, and WINNER will provide the remaining.

As a component of WINNER's agricultural production development program, the proposed action, agricultural land preparation using tractors will be implemented as follows:

1. State-owned tractors as well as private entities offering tillage services will be mobilized for land preparation on the irrigated perimeters.

2. Farmers Associations will be capitalized so as to be able to acquire their own tractors in the future. They will also be trained to be able to manage these associations as cooperatives.

3. Farmers will use 75 HP tractors to plough, harrow, and furrow lands.

4. Association's owned tractors will be primarily used for land preparation.

5. Maintenance will be provided by trained tractor repair workers.

6. Technical assistance will be provided on all aspects of tractor use for land preparation. (This will be complementary to WINNER's on-going agricultural extension program which provides training and support to the targeted farmers for the adoption of the proposed improved agricultural practices.)

Tools and actors involved

Plowing with tractors consists of cutting rows of no more than 20 centimeters deep, lifting up the soil with all the weeds and crop residues, and turning them over. Harrowing consists of loosening the arable soil previously plowed, and leveling the land. Furrowing consists of tracing the furrows that will allow irrigation by gravity.

Typically, a farmer will do three passes over the land for preparation: first for plowing, second for harrowing, and third for furrowing. The three operations can be performed for one hectare of land within half a day and are commonly performed for 9,000 gourdes/hectare.

Technical efficiency

- Land can be prepared in a minimum amount of time;
- Recovery of weeds is slower than with hoeing, significantly reducing the weeding frequency (some form of weed control will still be required);
- Excellent for re-profiling of land for irrigation by gravity (better use of water resources); and
- Seedling bed is loosened appropriately for better crop germination and root system development.

Constraints to sustainability from farmer's standpoint

Currently, the main constraint is availability and expense of tractors and the limited number of trained maintenance and repair personnel. Dependency on fossil fuel might also impact on this technology in times of economic crisis.

Alternatives to the Proposed Action

The following additional options for soil preparation are currently practiced in the Cul-de-Sac and Matheux corridors:

Alternative 2: Traditional land preparation (No Action: hoeing and burning); and
Alternative 3: agricultural land preparation with a rototiller.

Two additional options are used elsewhere in Haiti or in other countries:

Alternative 4: Animal-drawn plowing; and
Alternative 5: No till.

The No Action alternative (#2) and the three additional alternatives (#s 3, 4, and 5) are described below. For each alternative, the tools, actors, technical efficiency, and constraints from farmers' standpoint are also described. Below the descriptions, the alternatives that will be considered further in the EA are compared against the significant concerns identified in the Scoping Statement.

Alternative 2: No Action (hoeing and burning)

Without WINNER, the vast majority of target farmers would continue to use the traditional land preparation technique, which is used extensively by small Haitian farmers. This traditional technique incorporates turning the soil using a hoe; followed by piling of crop residues and weeds in small mounds and burning them so that the mulch does not harbor pests. This form of tilling turns only the top seven to ten centimeters of soil, and produces lower yields than more modern technologies. It has possible benefits as well as potential environmental concerns.

While the financial returns are relatively low, there are benefits to this alternative. It addresses the following significant concerns associated with the proposed action:

- Potential impacts to natural vegetation, soil fertility, and soil micro-fauna (compaction, erosion as a result of tilling with a tractor);
- Potential impacts to soil, water, fish, and wildlife due to use of chemical fertilizers and pesticides (under the No Action alternative, farmers use few if any chemical inputs, and WINNER would not be available to facilitate access to inputs);
- Potential impacts to fish and wildlife outside the project area and to air quality (pesticide drift would not be a concern since the No Action alternative is low/no input);
- Potential impacts to livelihoods and the social-economic fabric of the surrounding communities.

Tools and actors involved

This alternative is labor-intensive; it involves the equivalent of 80 worker days per hectare. [3] Workers use hoes and sometimes are equipped with a small sickle called a *kouto digo.* They are contracted for rounds of three hours for which they are paid 75 gourdes plus a meal, which corresponds to the minimum legal wage of 200 gourdes for a working day of eight hours.

Technical efficiency

Depending on the texture of the soil and because of the size of their blade, hoes can penetrate the soil and loosen it up to ten centimeters deep. That allows a limited aeration of the seedling bed for cereals or pulses, but does not provide for optimum root system development, and only eliminates superficial roots of weeds. A weeding is critical within a fortnight (or even ten days) after emergence of seedlings to prevent competition and significant yield reduction. During a bean cycle production of seven weeks, only one such weeding will be required while two weedings may be needed for corn production.

[3] Jean Chesnel JEAN, in "Baseline pour le basin-versant Cabaret-Montrouis" (page 52) found similar figures for manual preparation of 1 hectare of land for bean production in irrigated plains in the Matheux Corridor: preliminary hoeing/weeding (41 worker-days), harrowing (28 worker-days), "piquetage"/implementation of level marks (4 worker-days), grading of irrigation basins (14 worker-days). That gives a total of 87 worker-days.

As for irrigation, with hoeing, the land is usually profiled in basins. Leveling of land is very difficult, and parts of these basins will get more water than others, creating wilt and fungus problems. Poor on-farm water management is typical, and inefficient use of water resources is common.

This traditional form of tillage is inefficient in dealing with parasites hosted by plant residues. This alternative usually includes gathering weeds and previous crop residues in mounds scattered through the field and burning them. The ashes provide a transient availability of potassium, phosphorus, calcium, and some trace elements. When the levels of pest infestations are too high to be managed this way, farmers leave the land in fallow. But nowadays, leaving land idle frequently means giving up agriculture and going after jobs in cities nearby, or other forest or bush-covered lands. This often leads to abandonment of previous agricultural field or its conversion to urban crawling and anarchic construction. It is generally accepted that it takes at least 15 years to reconstitute soil fertility in absence of organic and mineral fertilization.

In search for new fertile lands, these farmers traditionally slash and burn natural habitats and other important ecosystems; the root cause of Haitian environmental disaster. Ninety eight percent of Haitian forests have been destroyed through slash and burn. Unfortunately, this practice is still the system adopted by 90 percent of Haitian farmers.

Constraints to sustainability

The No Action alternative is a feasible option for very small farmers valuing their family manpower, who manage up to 0.5-0.7 hectares (about two acres) per season in close proximity to their houses. It is mostly practiced for production of higher value crops, such as vegetables. This is an inefficient form of tillage for larger land parcels for WINNER's targeted crops due to the difficulty in mobilizing labor for land preparation.

The No Action Alternative

Except for large-scale farms, farmers would continue to use soil preparation techniques that require more manual labor and are less efficient and effective than tractors. Using the traditional form of tilling, they will continue to have low productivity; and farm income will fail to keep up with other possible income generation opportunities.

Without WINNER support for the proposed action, these small farmers would be more likely to abandon their land since employment in urban areas is often more attractive; usually most types of urban employment are held in higher esteem than manual farm work. Farmers can earn more in cities for the same levels of effort put into the traditional land preparation method.

If agricultural land is abandoned, it could provide habitat for wildlife; however, most of the time, it is bought by developers and converted to commercial or residential infrastructure. When that occurs, any benefit to wildlife that agricultural land confers will be lost; the land will no longer provide ecological services. Its flood retention capacity will be lost. Furthermore, the conversion of prime agricultural lands to commercial or residential infrastructure also increases the country's vulnerability to food shortages, malnutrition, and dependency on food aid.

For those farmers remaining on the land, their production area will become constricted by developed areas growing up around them. The ensuing urban development could pollute surface and ground waters that farmers rely on for irrigation, impede irrigation water distribution. Since flood water retention will be diminished with more concrete pavement, flash flood events are more likely to occur.

With urban centers encroaching on farmland, more markets may become available to farmers, but they would likely be in low value crops. The potential to form associations or cooperatives and produce for international markets would be diminished because the small number of farmers and small-sized plots would not reach the scale needed for external markets. Without WINNER support for improved land preparation techniques, agricultural activities in the target areas will not meet the economies of scale required to significantly increase agricultural incomes.

Alternative 3: agricultural land preparation with a rototiller

Under this option, WINNER would facilitate access to rototillers, and would promote them as the preferred form of agricultural land preparation method. This would include support for an agricultural extension program that complements agricultural land preparation with rototillers. Rototilling would be attractive to farmers who would otherwise have to rely on manual labor (hoeing). It would also decrease dependency on manual labor for land preparation during the peak periods, increase the efficiency and speed of preparation, and help improve on-farm water management. It would be efficient on small plots of about one hectare.

This alternative addresses the following significant concern associated with the proposed action:

- Potential impacts to natural vegetation, soil fertility, and soil micro-fauna
- Potential impacts to livelihoods and the social-economic fabric of the surrounding communities (technology that still requires much more operators than tractors)

Tools and actors involved

Rototillers are small mechanized tools, powered by an engine of eight to ten HP (gasoline or diesel). They are equipped with rotative tiller blades that can penetrate and pulverize soil and crop residues up to 15 centimeters deep (20 centimeters in bare lands with sandy soils). They can be alternatively equipped with a furrower for land re-profiling after tillage, or shredders for chipping wood, litter or other plant material to facilitate their decomposition for composting or mulching.

A rototiller can plow one hectare in 9 to 10 hours, yet it is not meant for such intensive use over long period.

Technical efficiency of this alternative

- Good aeration and loosening of seedling bed;

- Effective against most weeds but not those that propagate by rhizomes or stolons (such as Bermuda grass common in the target corridors), and therefore, must be immediately accompanied with manual weeding or herbicides;
- Efficient for furrowing to support irrigation by gravity, it helps promote improved on-farm water management;
- Acceptable for plantations of up to one hectare over short periods; and
- Depending on whether tilling is practiced after or just before season where *coleopteres* like hannetons/June beetles (*Lachnosterna* spp.) lay their eggs, it can either be a good control measure or, contrarily, it can facilitate infestations.

Constraints to sustainability of this technique in the corridor considered

In the target corridors, there is no experience in the commercial operation of rototillers. At this stage, information is not available on use limitations, but they might not be appropriate for the region's clayey soils. They are also likely to be individually or family-owned, due to their size and efficiency, and currently there is no expertise in their maintenance and repair.

Alternative 4: No till

No-till farming (also called zero tillage) is a crop growing method that does not disturb the soil through tillage. It contributes to maintain or increase soil moisture and organic matter (nutrients), while reducing the risk of soil erosion. It also contributes to increase the amount and variety of soil micro-organisms. Its main environmental issue is the significant amount of herbicides typically required during the first years, as the soil is not turned over to help remove weeds.

No till addresses the following significant concerns associated with the proposed action:

- Potential impacts to natural vegetation, soil fertility, and soil micro-fauna (compaction, erosion as a result of tilling with a tractor);
- Potential impacts to water quantity (from evapo-transpiration and drying of the soil); and
- Potential impacts to TES and biodiversity.

Tools and actors involved

This technique is not practiced in the target corridors or in other parts of Haiti.

In the No Till Alternative, at least for the first two to three years, herbicides would be heavily used to control weeds and reduce competition with the planted crops. Residues are left in place after each season.

After two to three years, weed growth is slowed by the permanent layer of mulch (five to fifteen centimeter thick) resulting from residues of previous crops or cover crops. This mulch stimulates development of soil microorganisms, which helps loosen the topsoil, and improves soil nutrients availability for the crops.

Since the land is not loosened or re-profiled, irrigation must be accomplished by sprinkler, drip or central pivot, very expensive and requiring a higher level of maintenance and skill. Furthermore, these systems would require a much better quality of water than the turbid one available from the rivers. That would mean having access to some source of energy to pump underground water or filter the surface water.

On small plots, hand tools would be used for spraying and seeding, while quad-driven seeders would be needed for medium-size plots. On large plots, heavy-duty tractor-driven seeders would be needed. For small and medium size plots, even without considering the irrigation system, the investment costs are significantly higher than for the other alternatives.

Technical efficiency

Once well in place, soil preparation is faster and easier as seeding is done directly with no previous land preparation[4].

With effective technical assistance on integrated pest management and a good crop rotation plan, yields can be as high as in fields plowed with tractors. Drainage of field must be carefully planned beforehand otherwise water logging and inefficient water use can result.

Constraints to sustainability

Although simple in principle, it is a technique that requires assistance from skilled technicians, particularly given the level of soil degradation and river siltation in Haiti, and governance issues. This method would have to first be implemented on experimental plots to assess its feasibility in the climatic, biological, and socio-economic conditions found in Haiti and in the target corridors.

Alternative 5: Animal-drawn plowing

Tools and actors involved

This technique was introduced, elsewhere in the country, (in the Plateau Central and North East) by agricultural workers returning from Cuba or the Dominican Republic. From there, it was adopted in Plaine des Cayes thanks to farmers, and with the assistance of various state-managed agriculture development institutions. Mule or horse drawn plowing is not practiced in Haiti (nor in the Caribbean either); there are no breeds adapted to this work[5]

Strategic stakeholders for the expansion of this technique are cattle breeders and plow operators. The former must have enough pasture and the knowledge to select, raise, train, and care for the animals. The latter must have the skills to manipulate the equipment and the animals.

Plowing is usually done up to 20 centimeters deep. According to studies done in Plaine des Cayes, 25 to 47 hours are required for plowing one hectare of land depending on the content of

[4] CIRAD/AFD: "Manuel pratique du semis direct à Madagascar" 2 volumes
[5] In many places of the country, however, mules or horses are use for moving small sugar cane crushers or for pulling small carts requiring less strength.

clay in the soil, the soil moisture and the length of fallow (GRD, 1981). As the animals cannot work more than six hours a day (not counting pauses), that means a bit more than four to eight days are required for plowing one hectare of land. In addition, 1.5 days is needed for a rough harrowing and three days for furrowing.

Currently, in Plaine des Cayes, plowing using draught animals, without the subsequent operations, costs 4,800 to 5,600 gourdes per carreau (equivalent to 1.6 hectare).

On irrigated perimeters around St-Rafael, it was reported, in the early 80s, that 46% of farmers owned their own plows and would rent animals out for land preparation (Regis, 1983). That shows it may be a tool - provided capacity is built onsite for its manufacture and maintenance – that can be acquired by a large sector of the population, even in the absence of credit services.

Technical efficiency of this option

Where practiced, this technique is considered more efficient than manual tilling (hoeing) on one side and more flexible for small plots than tractor-driven plows on the other.

Constraints to sustainability of this technique in the corridor considered

The use of this technique is limited to areas where there is both a strong tradition of cattle raising and the capacity for maintaining and repairing the equipment. These capacities have been lost in the corridors considered and would have to be rebuilt.

3.2 Alternatives Excluded from Study

The EA team excluded animal-drawn plowing from further consideration in this EA because there is no draught animals in the target areas adapted for this work (as stated above in Alternative 5).

3.3 Comparative Analysis of the Alternatives

As required in 22 CFR 216 .6(c)(3), table 1 below presents the environmental impacts of the proposed action and the alternatives in comparative form, thereby sharpening the issues and providing a clear basis for choice among the options. The table shows how each alternative under consideration rates on the potentially significant concerns identified in the Scoping Statement. Section 5, Environmental Consequences, gives the justifications for the ratings by providing the analytic basis for the comparison of alternatives in Table 1.

Table 1: Comparative Analysis of the Alternatives

Key: (+2) highly positive effect/beneficial; (+1) positive/beneficial; (-2) significant negative effect/highly detrimental; (-1) negative effect/detrimental; (0) No effect

Category/Impact (from the Scoping Statement)	Alt 1: Proposed Action	Alt 2 No Action	Alt 3 Rototilling	Alt 4 No till
1. Potential impacts to natural vegetation, soil fertility, and soil micro-fauna	-1	-2	-1	-1
2. Potential impacts to soil, water, fish, and wildlife due to use of chemical fertilizers and pesticides	-1	0	-1	-1
3. Potential impacts to fish and wildlife outside the project area and to air quality	-1	-1	-1	-1
4. Potential impacts to livelihoods and the social-economic fabric of the surrounding communities	+1	-1	+1	-1
5. Potential impacts to natural habitats	0	-2	0	0
6. Potential impacts to water quantity	-1	-2	-1	N/A
7. Potential impacts to TES and biodiversity	-1	-2	-1	-1
8. Pollution due to fuel or oil leakage from machinery	-1	0	-1	N/A
9. Sustainability of the intervention	+1	-2	-1	No info
10. Air and noise pollution	-1	-2	-1	+1
11. Soil drying prior to seeding	-1	-2	-1	+1

4. AFFECTED ENVIRONMENT

4.1 Biophysical Environment

Location

WINNER's agricultural production program focuses in the low areas of the Cul-de-Sac and the South-West portion of the Matheux Corridor. This represents mostly the plains located in the Croix-des-Bouquets district (municipalities of Croix-des-Bouquets, Ganthier and Thomazeau) and those in the Arcahaie district (municipalities of Arcahaie and Cabaret). This area extends about 15 to 40 kilometers to the northeast and northwest of the metropolitan area.

Climate

Depending on the months, average temperatures in the area of intervention vary between 24 and 28 degrees Celsius, and annual average rainfall between 650 to 1,130 millimeters (Observatoire météorologique, 1950)[6]. It is characterized by two rainy seasons with peak rainfalls during the months of April and May and from August to October.

In this area, rainfall is influenced by the orientation of the mountain ranges and their elevation. The piedmont and adjacent plains in the west or in the south sides of mountains ranges are drier due to the rain shadow effect of the easterly trade winds. On the strip situated from Thomazeau to Cabaret and Arcahaie piedmonts, rainfall ranges from 680 to 830 millimeters per year. We get more rainfall going towards the south where it ranges from 673 to 1,376 millimeters per year (Centre National Météorologie at Mais-Gate Airport, 2000-2009). However, this is not enough to secure agricultural production, thus, access to irrigation systems is critical for increased agricultural production.

Soils and Hydrology

The farm lands targeted in this program, located within the alluvial plains of Cabaret and the Cul-de-Sac, have slopes of less than five percent. They are pretty fertile, but are vulnerable to salinization due to an excess evapotranspiration compared to the rainfall, poor draining and irrigations systems and depletion of groundwater reserves. Fertility maps presenting the lands' pH, nitrogen, phosphorus, and potassium levels in the area of intervention are in Appendix A-5. It is to be noted, however, that pockets exist where the pH is below 6.6. Such a situation may impede the absorption of nutriments by crops. This is probably a consequence of flooding from the Grise river and Blanche river. Similarly, the nitrogen content is low in most of the targeted area. This might be the impact of decades of poor agricultural practices with insufficient, inadequate or no soil amendment.

The irrigation systems in the target area are gravity-fed, except for about ten hectares under drip irrigation for the production of vegetables (high value cash crops) at Operation Double Harvest. That drip irrigation system relies totally on pumped underground water because the surface water

[6] Observatoire métérologique du Séminaire Collège Saint-Martial: "Bulletins pluviométriques 1909-1934 and 1948-1950" 6 vol.

is turbid and is heavily loaded with lime and other particulates that would plug the nozzles. Recently, USAID/WINNER got a US$ 3,750/hectare quotation for the tubing for drip irrigation. That makes that technology not financially sustainable for the production of the crops (corn, beans and plantain) the USAID/WINNER project has a mandate to support.

Ecosystems and natural habitats: The area is characterized by three major agro-ecological zones: (i) an irrigated zone with heavy soil with a tendency for flooding in the coastal zones – the target area; (ii) a dry zone composed of dry plains, such as the area near Source Matelas), and dry piedmont including the valley zones between the mountains and the alluvial plain– not targeted by this agricultural land preparation program; and (iii) a humid zone consisting of the mountain peaks of the Matheux and the plateaus– not part of this program.

The natural habitats of the two corridors have been highly altered by agriculture, mining, urbanization and other forms of human activity during the last century. Very little of the original natural ecosystems remain – the patches that remain are highly fragmented and heavily impacted. None of the remaining patches of natural habitats are within or close to the target areas. For several decades, the targeted area has been under agricultural activities dominated by banana, corn, rice, beans and vegetable staples such as spinach, okra, shallot and tomato depending on the seasons, including animal husbandry. The area has seen an anarchic expansion of residential and commercial infrastructure over the last decades. A land use cover map is provided in Appendix A-6.

4.2 Socio-economic factors

Livelihoods

Revenues are very low compared to international standards due to lack of income-generating activities. Agriculture production represents the most important economic activity in the communities considered, followed by small commerce (e.g., Madam Sara, grocers), trades (carpenters, masons, woodworkers, tailors, artists, taxi drivers, and retailers), and fishing along the coast and in the two lakes within the watershed: Trou Caïman and Lac Azuëi. Non-agricultural jobs within the corridor are struggling due to limited financial resources and consumers' insolvency. So, the economy is closely linked with expansion of the nearby metropolis where people go after job opportunities.

More than eighty percent of the population works in the agricultural sector, thus increasing pressure on the lands. More than seventy percent of the farms are less than one hectare, and fifty-five percent have less than 0.6 hectare. Furthermore, most of these landholdings are not formally established. Revenues from agriculture production are low due to production techniques, soil erosion on the slopes, and lack of or poor agricultural infrastructures (USAID/WINNER WP).

Plantain is the main crop cultivated in the irrigated plain of the Matheux corridor— generally in rotation or in association with other crops such as beans, tomatoes, and manioc. On the perimeters planted with plantain, a three-year rotation is usually practiced. This includes 24 to 36 months under culture followed by 6 to 12 months of fallow. It is considered that, with a fallow period of 12 months followed by the burial of weeds, synthetic fertilizers would not be required

(KOPLARIKO, personal communication). In the drier areas, main crops cultivated are corn, sorghum, beans, potatoes, and melon. Most of these products are sold at markets in Cabaret, Source Matelas, and Arcahaie.

On the irrigated perimeters in the Cul-de Sac corridor, corn and vegetables (okra, eggplant, and spinach) are cultivated mainly from March to May; rice mainly from April to August; and beans between November and December. In rain-fed fields, sorghum, corn, and vegetables are planted between March and June according to the rains. The proposed agricultural land preparation with tractors is concentrated on irrigated lands.

In 2009, the WINNER project commissioned (Agroconsult) a study on agricultural land preparation for agricultural production. The report outlines:

The shortage of labor force during peak land preparation periods (80 workers per day per hectare);

Its high cost and low performance (the author indicates that this is due to job opportunities in the neighboring metropolitan area, which has become a competitor); and

Farmers' limited capacity to pay for plowing services; thus, plowed areas (thus planted) are very often limited.

5. ENVIRONMENTAL CONSEQUENCES

5.1 Potentially Significant Impacts of the Proposed Action and Alternatives

The following table discusses the potential significant environmental impacts of the proposed action and each alternative. It includes a discussion of direct, indirect, and short and long-term impacts, cumulative impacts, and any adverse effects that are unavoidable should the proposed action be implemented; and any irreversible or irretrievable commitments of resources which would result should the proposed action be implemented.

Table 2: Impacts Analysis of the Proposed Action and the Alternatives

Keys: (+2) highly positive effect/beneficial; (+1) positive/beneficial; (-2) significant negative effect/highly detrimental; (-1) negative effect/detrimental; (0) No effect

Alternative 1 **Agric. Land Prep** **w/tractors**	**Alternative 2** **No Action** **Hoeing and Burning**	**Alternative 3** **Agric. Land Prep** **w/Rototillers**	**Alternative 4** **No Till**
1. Potential impacts on natural vegetation, soil fertility, soil micro-fauna			
-1	-2	-1	-1
Potential removal of the protective mulch layer, compact the soil, and reduce overall soil fertility. Repeated plowing of same plot year after year and even twice a year (spring and winter seasons) could have important cumulative impacts. The problem would come from destruction of soil colloids by mineralization of important quantity of organic matter not compensated enough by biomass available onsite at time of plowing. Note that WINNER only targets farm lands, currently under production or under fallow, in existing irrigation perimeters	A hoe is used to till the soil and crop residue is burned. This technique remains attractive due to its relative autonomy from fossil fuels and crisis at macro level but there are also some negative environmental impacts. Continuous cultivation of the first 10 centimeters of land will trigger mineralization of organic matter and runoff of nutriments particularly nitrogen from this horizon. Also, this process destroys soil microfauna on the burned patches, and the current practice of uprooting the whole plants at harvest of beans leaves very little biomass on site. The abandonment of prime agricultural land for more attractive income generation options in the cities will lead to the construction of physical residential and commercial infrastructures with – very probably no waste management systems or structure.	Potential removal of the protective mulch layer, compact the soil, and reduce overall soil fertility. Repeated plowing of same plot year after year and even twice a year (spring and winter seasons) could have important cumulative impacts. The problem would come from destruction of soil colloids by mineralization of important quantity of organic matter not compensated enough by biomass available onsite at time of plowing. Note that WINNER only targets farm lands, currently under production or under fallow, in existing irrigation perimeters	The least disruptive to the soil fertility and soil micro-fauna, since the soil is not turned over and soil ecosystem is not disturb; however, it faces serious challenges in term of herbicide use for weed control. Groups like the Rodale Institute promote the use of concentrated vinegar as an organic herbicide but the long term impacts of its use on soil fertility are not yet evaluated.
2. Potential impacts to soil, water, fish, and wildlife due to use of chemical fertilizers and pesticides			
-1	0	-1	-2
3. Potential impacts to fish and wildlife outside the project area and to air quality due to pesticide drift			

-1	-1	-1	-1
May increase the need for chemical fertilizers and some pesticides which could pollute soil and water with runoff, but herbicides will not be needed since weeds are plowed. In any case, WINNER provides the appropriate training and technical assistance necessary to accompany its proposed technical packages.	Very limited use of pesticides is expected to occur for difficulties of access; however should some farmers decide to use chemical fertilizers and pesticides, the possibility exist that they could use inappropriate ones and/or the wrong dosages. Cases of losses of human lives have been reported as farmers turn to unreliable sources of pesticides	May increase the need for chemical fertilizers and some pesticides which could pollute soil and water with runoff, but herbicides will not be needed since weeds are plowed. In any case, WINNER provides the appropriate training and technical assistance necessary to accompany its proposed technical packages.	Herbicide will need to be used to eliminate deep rooted weeds like crotalaria and stoloniferous grass like bermuda and yaguidi grass during the first two cropping seasons. The control of pests harbored by the mulch will require significant use of pesticides. Fertilizer application will also be needed in order to maintain yield. These chemicals could pollute soil and water with infiltration and runoff. PennState University pinpoints that "the potential for denitrification and ammonia losses are greater in no-till, especially on poorly drained soils. Ammonia losses can be substantial if surface application of urea or manure is followed by a hot, dry period (up to 30 percent of the nitrogen can be lost).
4. Potential impacts on livelihoods and the social-economic in surrounding communities			
+1	-1	+1	-1
Will contribute to increase agricultural productivity and production, thereby the profitability of farming, which in turn will have positive impacts on the quality of life of the farmers and his family. The increase in agricultural production is expected to lead to the development of agro-industry, including employment and rural economic growth.	At least 80 person-days to hoe one hectare (AgroConsult-Haiti, 2009, page 146)[7]. Since 2009 minimum daily wages increased to $5, making manual labor non-competitive ($400/ha) compared to mechanized land preparation ($200/ha). Also, there is a shortage of labor during the peak agricultural seasons, especially at the time of land preparation. These two significantly contribute to reduce the surface areas under cultivation. Furthermore, urban expansion makes job opportunities in construction, transportation (particularly moto taxi), and sale of phone cards available; and these are seen as more attractive for the agricultural workers who often	Almost same as for alternative 1, but to a lesser extent	Serious conflicts could arise between neighbors, as the plant residues left on the ground could be seen as harboring rats, snakes, etc. Neighbors could set the land on fire. The farmers could also find it difficult to get laborers.

[7] Jean Chesnel JEAN, in "Baseline pour le basin-versant Cabaret-Montruis" (page 52) found similar figures for manual preparation of 1 hectare of land for bean production in irrigated plains in the Matheux Corridor: preliminary hoeing/weeding (41 worker-days), harrowing (28 worker-days), "piquetage"/implementation of level marks (4 worker-days), grading of irrigation basins (14 worker-days). That gives a total of 87 worker-days.

	abandoned the rural areas for the cities, often in the slums.		
5. Potential impacts to natural habitats Note: The natural habitats of the two corridors have been highly altered by agriculture, mining, urbanization and other forms of human activity during the last century. Very little of the original natural ecosystems remain – the patches that remain are highly fragmented and heavily impacted. None of the remaining patches of natural habitats are within or close to the target areas. For several decades, the targeted area has been under agricultural activities dominated by banana, corn, rice, beans and vegetable staples such as spinach, okra, shallot and tomato depending on the seasons, including animal husbandry. The area has also seen an anarchic expansion of residential and commercial infrastructure over the last decades			
0	-2	0	0
7. Potential impacts to threatened and endangered species (TES) and biodiversity			
-1	-2	-1	-1
No expected impacts on natural habitats. No known threatened and endangered species exist in the target areas. Man made activities generally have a potential risk to impact biological diversity.	No expected impacts on natural habitats. No known threatened and endangered species exist in the target areas. Man made activities generally have a potential risk to impact biological diversity. The practice of slash and burn push farmers to always look for additional lands.	No expected impacts on natural habitats. No known threatened and endangered species exist in the target areas. Man made activities generally have a potential risk to impact biological diversity.	No expected impacts on natural habitats. No known threatened and endangered species exist in the target areas. Man made activities generally have a potential risk to impact biological diversity.
6. Potential impacts on water quantity			
-1	-2	-1	Not applicable
Soil being bare, when there is wind while the soil is not yet covered by crops, it will dry faster. Mechanized land preparation provides for good land reprofiling and furrowing for better distribution, use and management of the irrigation water.	Soil being bare, when there is wind while the soil is not yet covered by crops, it will dry faster. Land leveling with hand tools is tedious, and often results in flooding of some land sections with very poor control of the irrigation water.	Soil being bare, when there is wind while the soil is not yet covered by crops, it will dry faster. Mechanized land preparation allows better performance than hoeing for land reprofiling, thus provides more efficiency with gravity irrigation which means less waste of irrigation water.	Given that reprofiling of fields surface is required, the gravity-fed systems available with turbid water would not be appropriate. Drip and center pivot irrigation, the most appropriate would require important financial investments, and significantly improved skills, as well as a water quality not currently available. Underground water would be needed with the installation of water pumping stations and access to a power source.
8. Pollution due to fuel or oil leakage from machinery			
-1	0	-1	Not applicable
This would mostly due to neglect or poor maintenance of tractors. Risk of inappropriate disposal of used oil.	Not applicable	This would mostly due to neglect or poor maintenance of tractors. Risk of inappropriate disposal of used oil.	Not Applicable, assuming that no machine is used for planting.

9. Sustainability of the intervention (operation, maintenance and replacement of equipment)			
+1	-2	-1	No info available
Farmers could have difficulties to continue tractors use beyond the life of the WINNER Project. They could also have difficulties to maintain, operate and/or replace tractors originally funded by WINNER. However the cost benefit analysis concluded that these would not be an issue.	The practice of hoeing and burning for agricultural land preparation has severe negative environmental, economic and socio-political impacts, not only in the target corridors, but also at the national and eventually hemispheric level. It resulted in Haiti's environmental degradation by, among other aspects, slash-and-burn, archaic subsistence agricultural production, tree cutting, conversion of prime agricultural lands into residential and commercial infrastructure. This would eventually lead to increased rural population exodus to ill-planned urban areas or slums, risk of food shortage, increased food products import, increasing need for food aid, and possibly political unrest.	Farmers could have difficulties to continue tractors use beyond the life of the WINNER Project. They could also have difficulties to maintain, operate and/or replace tractors originally funded by WINNER. Individual farmers' family might need to invest in their own rototillers.	
10. Air and noise pollution			
-1	- 2	-1	+ 1
May cause an increase in dust and noise during hours of operation. Noise and air pollution can be mitigated with best practices, included in the EMMP	Burning of crop wastes organic matter; and smoke may drift very far from the farm.	May cause an increase in dust and noise during hours of operation. Noise and air pollution can be mitigated with best practices, included in the EMMP	None. Unless neighbors decide to burn the crop residues in order to get rid of rats and other pests.
11. Soil drying prior to seeding Note: This is not an issue in the target areas under WINNER's operation, unless the irrigation systems stop working.			
-1	-2	-1	+ 1
This could be an issue if the relevant irrigation system stops working.	Generally associated with rain-fed agriculture or very poor use of water and poorly maintained irrigation canals.	This could be an issue if the relevant irrigation system stops working.	With the protecting mulch, soil moisture last longer

5.2 Irreversible or irretrievable commitment or resources with the proposed action

Any irreversible or irretrievable commitments of resources involved in the proposed action have been considered and are either unanticipated at this time, or have been considered and determined to present minor impacts.

Adverse environmental impacts which cannot be avoided

Any adverse environmental effects, which cannot be avoided during implementation of the proposed action (mechanized agricultural land preparation), are expected to be minor both individually and cumulatively. Unavoidable impacts are those, previously described, that are associated with the proposed action and are not separable from it. The mitigation plan described below reduces those impacts to zero or to an acceptable level.

The No Action alternative is excluded from the mitigation measures as WINNER's mandate would not allow it to promote or support such practice. The no-till method presents significant challenges, including socio-cultural. If promoted, it is likely to take very long to be accepted and adopted by Haitian farmers, if ever; in any case, beyond the life of this project. The land preparation method using tractors and rototillers stand to be the best two for the target areas. The use of rototillers should be tested and subsequently demonstrated at the CRDDs, but their promotion and adoption would be a long process beyond the life of this project, as they are not yet known by the Haitian farmers. Furthermore a flotilla of hundreds of rototillers would be needed to respond to the current and future agricultural land preparation needs – 2,500 hectares for the 2011 winter bean campaign, and about 25,000 for the remaining life of the project. It is likely that the rototillers would need to be owned by individual farmers or farmers' family, which is very difficult with the current level of agricultural production. Therefore the use of tractors for agricultural land preparation is the recommended alternative with the implementation of the mitigations measures presented in the following Table 3.

The EA team recommended, and WINNER has agreed to work with the farmers associations, especially the "Association Champyon" toward applying for Global GAP (Good Agricultural Practices) certification. Appendix A-7 presents the GAP guidelines WINNER will promote with the aim that about 20% of the "Association Champyon" would achieve certification by the end of the Project life.

5.3 Mitigation Measures

Table 3. MITIGATION MEASURES - PROPOSED ACTION: AGRICULTURAL LAND PREPARATION USING TRACTORS		
Potential Impacts	**Significance**	**Mitigation Measures**
1. Potential impacts to natural vegetation, soil fertility, and soil micro-fauna: • *Lowering of fertility and of water holding capacity of soils resulting from depletion of organic matter content and nutrient.* • *Hardpan formation*	Depletion of soil organic matter is the most significant potential impact.	**On-going:** a. Corn crop residues are buried at tilling; b. Soil amendment with fertilizer (appropriate types and dosages) based on soil analysis; c. collaboration with Agrabio to test the introduction of inoculants in compost to improve the quality d. Work with a private enterprise to assess the feasibility of establish a mineral and organic fertilizer plant; e. Promotion of mandatory of environmentally friendly practices among WINNER assisted organizations.
		Additional Recommendations: a. Limit beans harvest to the beans pods in order to leave the whole plants in the field after harvest; b. Winter bean crop residues must be left on fields or returned to it after harvest so as to served as mulch and be buried at next plowing; c. Take advantage of chicken production in the area (commercial and familial) to intensify the use of manure; d. Work with the UF team to introduce/promote green manure in a cereal/bean rotation; e. Test the use of certified organic fertilizer with a view to maintain or amend soil texture and water retention capacity. Should this lead to significant results, WINNER will also explore the possibility of in-country production of organic fertilizers. f. Promotion of mandatory environmentally friendly practices among WINNER-assisted associations (no burning, utilization of compost, no tree cutting, no annual crops on slopes}. Those associations are certified "Champyon", which means Winner in Creole.
2. Potential impacts to soil, water, fish, and wildlife due to use of chemical fertilizers and pesticides 3. Potential impacts to fish and wildlife outside the project area and to air quality due to pesticide drift • *Pollution from fertilizer runoff* • *Pollution from pesticides drift*	Under control currently, but monitoring must continue	**On-going:** a. Crop residues are buried at tilling; b. Soil amendment with fertilizer (appropriate types and dosages) based on soil analysis; c. Trainings of the agr extension agents, master farmers and managers of local agri-supply stores on fertilizer management and use; d. Training on the implementation of promoted technical itineraries (A-1 & A-2), and monitoring of implementation; e. Short-term but regular technical assistance from University of Florida specialists; f. Sub-contract with Sun Mountain for the revision of the PERSUAP, development of a training manual for its implementation, and training of WINNER staff, agr extension and master farmers on implementation of PERSUAP; g. Promotion of IPM.
		Additional Recommendations: a. Expansion of the technical itineraries to cover the whole value chain for the selected crops with a focus on post harvest operations; b. No pesticide spraying less than 10 meters from a public road, 20 meters from any building under permanent use (Rain Forest Alliance); c. Buffer zones of 10 meters from lagoons, swamps, marshes; and of 15 meters from springs should respected

		between crop plants and aquatic ecosystems (Rain Forest Alliance).
4. Potential impacts to natural habitats. 5. Potential impacts to TES and biodiversity	No natural habitats exist within or close to the targeted areas.	**On-going:** a. Target only areas used for agricultural production during the last decades (currently under production or in fallow); b. Promotion of agroforestry, mostly on the hillsides; c. Development of a zoning plan for discussions with local authorities to foster protection of natural habitats, TES and biodiversity in the overall corridors; d. Public awareness campaign on the needs and stakes of zoning for protection of biodiversity.
		Additional Recommendations: a. Intensify public awareness campaigns on biodiversity, the services it provides and its importance. b. Continued monitoring of impacts predators of agricultural pests are to be protected and valued in IPM c. Develop and maintain an inventory of wildlife and wildlife habitats found on the farm with a view to ensure their protection. (Rain Forest Alliance)
6. Potential impacts to livelihoods and the social-economic fabric of the surrounding communities due to decrease/change in job opportunities. • *Temporary displacement of unskilled laborers;*	Currently, there is a shortage of labor at land preparation time. The currently available farm workers are expected to find employment with the non-participating farmers.	**On-going:** a. Promotion of post harvest handling and packing which create new opportunities for unskilled workers; b. PPP for example contracts between farmers' associations and Hotel associations to supply agricultural products that used to be imported up to recently – new types of agr related job opportunities; c. Promotion of "Association Champyon" label based the principles in Appendix A-7. More than 300 farmers associations are expected to be recognized in December 2011.
		Additional Recommendations: a. Expand and intensify PPP efforts in order to promote the creation of agri-business to take advantage of the increased production; b. Train and assist community members in agricultural product transformation using community-based owned and managed facilities; c. Expand the "Association Champyon" label to include the GAP guidelines with a view to seek and obtain independently audited GAP certification for at least 20% of the "Association Champyon" by the end of the WINNER project.
7. Potential impacts to water quantity due to increased evapo-transpiration (stressing water resources) • *Bare plowed land subject to be dried by wind*	Mitigation will be obtained by management of organic matter of soil as considered above	**On-going:** a. Corn crop residues are buried at tilling; b. Soil amendment with fertilizer (appropriate types and dosages) based on soil analysis; c. collaboration with Agrabio to test the introduction of inoculants in compost to improve the quality; d. Rehabilitation of additional irrigation systems; e. Establishment of water users associations who are being trained in irrigation water management.
		Additional Recommendations: a. Limit beans harvest to the beans pods in order to leave the whole plants in the field after harvest; b. Winter bean crop residues must be left on fields or returned to it after harvest so as to served as mulch and be buried at next plowing; c. Take advantage of chicken production in the area (commercial and familial) to intensify the use of manure; d. Improve irrigation techniques (better control of furrow irrigation with UF assistance;

		e. Promote no-flooding irrigation; f. Improve governance for irrigation water management and maintenance with strong partnership with the GOH Ministry of Agriculture; g. Provide training to small farmer to improve irrigation water management, especially to reduce and eventually stop over irrigation; h. Training of tractor operators on sound and appropriate practices.
8. Pollution due to fuel or oil leakage from machinery	Not a significantly important issue	**On-going:** a. Under a partnership between the GOH Ministry of Agriculture, the private sector and the farmer association ANAPAAH, 25 tractors and accessories are available to support the campaign. They have just been serviced in preparation for the bean campaign, and a fully equipped mechanical service shop (privately managed) is available for their regular maintenance and service; b. Ensure that rented tractors and equipment are in good working conditions.
		Additional Recommendations: a. Ensure that the mechanical garage service has a plan for the environmentally sound disposal of used oil and other tractor related waste materials; b. Ensure regular and timely inspection and maintenance of all the tractors and accessories to prevent and avoid any risk of oil and/or fuel leakages; c. Immediately stop the use of any material and equipment which fails inspection until they are adequately repaired; d. Train tractor operators to "*adhere to safety regulations and observe established safety standards for the operation of equipment and machinery for crop and fodder production*."(FAO GAP).
9. Sustainability of the intervention • *Farmers difficulties to continue tractors use beyond the life of the WINNER Project* • *Farmers difficulties to maintain, operate and/or replace tractors originally funded by WINNER*	Need to ensure adequate cost/benefit ratio, and that USG funds bring the expected results beyond the life of the Project.	**On-going:** a. Cost-benefit analysis on mechanized vs. manual land preparation (Appendix A-8) concluded that the targeted "*farmers and farmers' associations will gain substantial benefits when they shift from manual to mechanized land preparation practices*" using 75 to 85HP tractors; b. Three farmers associations in the Matheux corridor have successfully owned and operated 3 Veneran tractors and accessories since 2009. They are still providing land preparation services to the community; c. When tractors are available, many farmers in the target areas have been able to acquire their services. (The issue today is that there are not enough tractors available to respond to the needs. Less than 10% of land are currently prepared with tractors); d. Continue to accompany the farmers on tractor use, maintenance and operation through guidance and technical assistance.
		Additional Recommendations: a. Transfer ownership of tractors to associations, only after monitoring and verifying during one year that members have the capacity to maintain and operate those tractors properly b. Provision of technical assistance to the target associations to strengthen farmers associations management capability, including book-keeping; c. Assist farmers associations in opening and managing their bank accounts, and the revolving funds.
10. Air and noise pollution		**On-going:**

	Not a significantly important issue. Operations in rural areas for very limited periods	**Additional Recommendations:** a. Work with relevant communities in a participatory process to decide on tractors' hours of operation for the specific areas; b. Control hours of operation to limit nuisance to a minimum
11. Soil drying prior to seeding	Not a significantly important issue in the target areas	**On-going:** a. Target areas are irrigated areas; b. Assistance to farmers in irrigation water management to make sure that lands are properly irrigated before seeding.
		Additional Recommendations: a. Rehabilitation of additional irrigation systems to increase water availability; b. Establishment of water user association in close collaboration with the GOH Ministry of Agriculture; c. Training of farmers in improved irrigation water management.

5.4 Environmental Mitigation and Monitoring Plan

A Preliminary Environmental Mitigation and Monitoring Plan is presented below. The plan presents and discusses the proposed actions and describes the accompanying monitoring process. Monitoring must be conducted throughout the life of the WINNER project to assure compliance. Reporting will be in semi-annual progress reports to USAID in a separate Environmental Compliance section. The EMMP will be completed within the next few days. The completed plan must be approved by USAID/Haiti Mission Environmental Officer.

Table 4. Preliminary Environmental Mitigation & Monitoring Plan (EMMP)

Potential significant impacts of Alternative 2, proposed action	Mitigation Measures (from previous table)	Monitoring Indicators	Monitoring Frequency
2. Potential impacts to natural vegetation, soil fertility, and soil micro-fauna: • *Lowering of fertility and of water holding capacity of soils resulting from depletion of organic matter content and nutrient.* • *Hardpan formation*	WINNER shall ensure that crop residues (either spring corn or winter beans) are left on fields or returned to it after harvest so as to serve as mulch and be buried at next plowing	% of crop residues left in field a fortnight to 1 month after harvest	Semestrial, in the fortnight following harvest of each of the two cropping seasons
	WINNER shall collaborate with Agrabio to test the introduction of inoculants in compost to improve the quality	• Report produced showing results of test of inoculants for compost • Feasibility study produced showing potential economic and ecologic impacts of these inoculants • Incorporation into WINNER interventions of Agrabio recommendations	Quarterly reports for 2012
	WINNER shall support the testing of the use of certified organic fertilizer with a view to maintain or amend soil texture and water retention	• Report produced showing results of test of this organic fertilizer. • Feasibility study produced showing potential	Quarterly reports for 2012

Potential significant impacts of Alternative 2, proposed action	Mitigation Measures (from previous table)	Monitoring Indicators	Monitoring Frequency
	capacity. Should this lead to significant results, WINNER will also explore the possibility of in-country production of organic fertilizers.	economic and ecologic impacts of this organic fertilizer. • Organic fertilizers produced in-country	
4. Potential impacts to soil, water, fish, and wildlife due to use of chemical fertilizers and pesticides 5. Potential impacts to fish and wildlife outside the project area and to air quality due to pesticide drift • *Pollution from fertilizer runoff* • *Pollution from pesticides drift*	WINNER shall ensure that at all levels, decision on fertilizer types and dosage are based on soils analysis	• WINNER trainings on use of fertilizer (# of trainings/types of trainings/participants in trainings) • Diversity of types of fertilizers available • Number of soil analysis made • Profile and number of people able to prescribe fertilizer based on soil analysis	Monthly reports for 2011 winter bean season the quarterly reports for 2012
	WINNER shall support the development/use of a training manual to train WINNER staff, agr extension and master farmers on implementation of PERSUAP requirements, including campaign to promote no pesticide spraying less than 10 meters from a public road, 20 meters from any building under permanent use + Buffer zones of 10 meters from lagoons, swamps, marshes; and of 15 meters from springs (these limits should be respected between crop plants and aquatic ecosystems (as promoted by Rain Forest Alliance))	• Production of documents for trainings • # of public trainings provided • Profiles and number of people trained	As per contract, but at least quarterly reports
6. Potential impacts to natural habitats. 7. Potential impacts to TES and biodiversity	WINNER shall target only areas used for agricultural production currently under production or in fallow. WINNER shall develop MOUs for farmer associations that require that they will use tractors only for fields currently under production or in fallow.	Map of plowed fields MOUs developed, signed, implemented.	Daily during plowing season
	WINNER shall support the development of a zoning plan for discussions with local authorities to foster protection of natural habitats,	• % of stakeholders, (particularly farmers and members of local governments) aware of criteria and methods of zoning	Quarterly reports

Potential significant impacts of Alternative 2, proposed action	Mitigation Measures (from previous table)	Monitoring Indicators	Monitoring Frequency
	TES and biodiversity in the overall corridors;	• Number of ordinance adopted	
	WINNER shall support XXX public awareness campaigns in both corridors on services provided by natural predators of agricultural pests and how to contribute to preservation of their habitats	• Development of support documents for campaigns • Number of campaigns supported • Number of people targeted in campaigns	Quarterly reports
7. Potential impacts to livelihoods and the social-economic fabric of the surrounding communities due to decrease/change in job opportunities. • *Temporary displacement of unskilled laborers;*	WINNER shall train and assist community members in agricultural product transformation (value-addition) using community-based owned and managed facilities;	• Number of enterprises emerging from this initiative • Number and profile (including gender) of people benefitting revenues from these enterprises	Quarterly reports
8. Potential impacts to water quantity due to increased evapo-transpiration (stressing water resources) • *Bare plowed land subject to be dried by wind*	WINNER shall train tractor operators on sound and appropriate practices for land leveling and furrowing.	• Availability of curriculum for training • Number of tractor operators trained	At launch of plowing season
8. Pollution due to fuel or oil leakage from machinery	WINNER shall ensure that rented tractors and equipment are in good working conditions. WINNER shall train farmer associations to ensure they can maintain tractors. WINNER shall support recycling/reuse of fuel as a connected enterprise.	• Reports of inspection by qualified mechanic • # of trainings/# of operators trained • # of recycling enterprises operating	At launch of plowing season
	WINNER shall train operators to immediately stop the use of any equipment which fails inspection until they are adequately repaired;	• Availability of qualified mechanics • Knowledge and opinion of tractor operators about maintenance service available • Absence of signs of pollution and of complaints for such issue	At launch of plowing season
9. Sustainability of the intervention • *Farmers difficulties to continue tractors use beyond the life of the WINNER Project*	WINNER shall refine the cost-benefit analysis at the end of the seasons WINNER shall assess the return on investment	• Revised reports on cost benefit analysis of tractor use for land preparation • Return on investment report • Reports on association management capability and	At the end of the seasons At the beginning of 2013 and 2014 Mid 2013

Potential significant impacts of Alternative 2, proposed action	Mitigation Measures (from previous table)	Monitoring Indicators	Monitoring Frequency
• *Farmers difficulties to maintain, operate and/or replace tractors originally funded by WINNER*	WINNER shall assess each association management capability and commitment to manage the equipment and materials sustainably	commitment to the sustainable management of the tractors	
10. Air and noise pollution	WINNER shall work with relevant communities in a participatory process to decide on tractors' hours of operation for the specific areas. WINNER shall monitor and keep track of the tractors' hours of operation with a view to limiting nuisance to a minimum	• Report on hours of operation decided with the different communities • Trackers on hours of operation for each tractor	At launch of plowing season Daily tracker
11. Soil drying prior to seeding	WINNER shall work with relevant associations on the rehabilitation of additional irrigation systems WINNER shall foster the establishment of water user associations, WINNER shall provide assistance and training to water users associations and to farmers for improved irrigation water management.	• Regular WINNER reports with info on # of systems rehabilitated, # of kms of canals, and # of new hectares irrigated • Special reports on water users' associations • # of training sessions and evaluation reports	Six-month basis Six-month basis Six-month basis

6. LIST OF PREPARERS

The EA team is composed of:

- Karen Menczer, short-term consultant: an environmental specialist with more than 25 years of experience conducting environmental reviews and assessments (EAs), programmatic and strategic EAs, environmental management plans, and environmental mitigation and monitoring plans.

- Michelet Fontaine, Chemonics WINNER Project Management Unit Director: an agronomist and environmental specialist with more than 30 years of experience in agricultural production, natural resources management, environmental impact assessments and Regulation 216 compliance, developing IEEs and environmental mitigation and monitoring plans, and conducting environmental reviews.

- Yves-Andre Wainright, WINNER Environmental Specialist: an agronomist and environmental specialist with more than 25 years of experience in agricultural production, natural resources and environmental management, environmental assessment and protected areas management. He served twice as Minister of the Environment, and led the development and adoption of landmark environmental legislation and policy in Haiti.

APPENDICES

A-1 WINNER ITINERAIRES TECHNIQUES

WINNER – Itineraires Techniques

1. Culture de Maïs

Itinéraires techniques de la culture du maïs

- Nettoyage/Dessouchage si nécessaire;
- Labourage avec charrue à traction motorisée à une profondeur de variant de 20 à 30 cm'
- Épandage de compost ou du fumier bien décomposé à la dose de 15T-20/Ha avant le deuxième passage de la charrue si sol est pauvre en matière organique si non ce n'est pas nécessaire;
- Hersage 10 jours après labours;
- Billonnage des billons distants de 80 cm et
- Érection des canaux de parcelles séparant le terrain en des blocs de billons larges de 10 m si terrain n'est pas bien nivelé afin de faciliter l'arrosage
- Arrosage avant semis;
- Semis à flanc de billon distant de 20 cm, 1 graine par poquet (soit taux de semences 20Kg/Ha). Densité de semis de 62,500 plants. Profondeur de semis : 4cm. Semer à 2 graines par poquet si taux de germination au dessous de 85%; (Variétés souhaitées :DK1040(MONSANTO) et 30F87 (PIOONNEER) tolérantes aux maladies (Helminthosporiose, rouille et Mildiou)
- 1ere Application Engrais minéral : Engrais complet 20-20-10 appliqué à la plantation ou immédiatement après émergence à la dose de 300Kg/Ha pour le 20-20-10 ou 400Kg/Ha pour le 15-15-15);
- 1 ère dose d'arrosage après levée, chaque 8 jour renouvèlement
- 1e Sarclage au stade 3-4 feuilles ou 15 -22 jours après semis ;
- Démariage au moment 1er sarclage si semis se fait à 2 graines/poquet et laisser à un plant par poquet soit une densité de 62,500 plants/Ha;
- 2e Application Engrais azoté : urée (46-0-0) à la dose de 130 Kg/Ha immédiatement après le 1er sarclage soit au stade 3-4 feuilles (c'est-à-dire gaine 3e ou 4e feuille est visible)
- 2e Sarclage effectué au stade 5-7 feuilles ou 20 jours après 1er sarclage
- 3e Application d'engrais : urée (46-0-0) à la dose de 130 Kg/Ha au stade 6-8 feuilles ou après le 2e sarclage
- Lutte phytosanitaire
    a. Après semis : appât contre les criquets (Grillidae) avec : 1marmite de paille de maïs, 1 litre d'eau, demi bouteille de sirop de canne, 15 cc actellic
    b. 15jours après semis : aspersion au dipel 6gr pour un gallon d'eau contre Chenille, spodotera quand 5% des plants sont attaqués ou application sevin à la dose de 7g/gallon d'eau. Melanger avec dithane en prévention aux maladies (Rouille,Mildiou). Répéter l'application si attaque persiste
    c. Avant Floraison avec Actellic à la dose de 10 cc/galon d'eau
    d. Poudrage au Sevin de la barbe du maïs contre Heliothis zeae

- Récolte
    a. A la main ou au la machine entre 120-130 jours après semis quand l'humidité grains atteint 18.6%
- Traitement post-récolte
    a. Séchage au soleil sur bâche durant 4 a 5 jours
    b. Égrainage à la machine
    c. Tri et Calibrage avec Matériel approprié
    d. Mise en sac
- Rendement espéré 5.5-8T/Ha
- Évaluation du rendement
    a. Poids de la récolte en grains
    b. Mesure de l'humidité des grains à l'aide d'un humidimètre

Itinéraire technique de la culture du Haricot

- Nettoyage /Dessouchage
- Labourage avec charrue
- Épandage fumier bien décomposé ou compost à la dose de 450 Kg/Ha avant 2e passage de la charrue
- Fumure de fond avec engrais 15-15-15 à la dose de 225 kg /ha;
- Hersage
- Billonnage en réalisant des billons distants de 60 cm et de 10 m de long
- Arrosage 2-4 jours avant semis
- Semis à flanc de billon distant de 20 cm, 2 graines par poquet des deux cotés du billon;
- 1 ère dose d'arrosage chaque 8 jour renouvèlement
- 1er sarclage : 15 jours après levée
- 2e Sarclage au moment de la préfloraison
- Lutte phytosanitaire

a. Après semis : appât contre les criquets (Grillidae) avec : 1marmite de paille de maïs, 1 litre d'eau, demi bouteille de sirop de canne et 15cc d'actellic
b. 10 jours après levée ou les feuilles sont complètement ouvertes: aspersion avec Dimethoate à la dose de 10cc pour un gallon d'eau contre les aphides, mouche blanche
c. 10-15 jours après la première dose soit au stade de préfloraison
d. Si attaque à la période de mise à gousse

- Contre les maladies

a. Mélanger Dithane ou Ridomil mz 72, 15 gr pour 1 gallon d'eau avec les insecticides au moment de l'application

- Épandage d'engrais azoté : urée à la dose de 70Kg/Ha au moment de la floraison.
- Récolte

a. A la main avec les plants ou au Thresher Triton

- Traitement post-récolte

a. Séchage au soleil sur glacis ou bâche durant 4 a 5 jours
b. Ecossage à l'aide de l'égraineuse
c. Mise en sac

- Évaluation du rendement

a. Poids de la récolte en grain
b. Humidité des grains
c. Rendement espéré 1.2-1.6T/Ha

A-2 WINNER ITINERAIRES TECHNIQUES

Fiche Technique SRI pour Haïti

Inspirée des premières expériences SRI dans la Plaine Cul de Sac, le Plateau Central de Mirebalais et la Plaine de Gonaives
Adapté de la Fiche Technique de Tombouctou, Mali et de Madagascar

Version préliminaire, Septembre 2010

1. Application de la fumure organique **1.** Application de fumier ou compost bien décomposé, de 10-15t/ha - (10 t correspond à peu près à 15 sacs (sac de riz de 100 kg) par *tallet* **2.** Bien repartir le fumier sur la rizière avant labour. **3.** Le fumier est enfoui à travers le labour.	**2. Le labour** **4.** Le labour peut se faire à la houe, à la charrue tirée par des bœufs ou au tracteur **5.** Réaliser un labour profond pour un bon développement racinaire

3. Irrigation et mise en boue **6.** Faire entrer de l'eau dans la rizière **7.** Emotter avec de la houe, des zebus ou de la herse	**4. Nivelage** **8.** Planage de la parcelle la veille du repiquage **Quand la boue est bien épaisse et collante, le sol est prêt pour le repiquage**

5. Canal de ceinture ou rigole

9. Nettoyage des bordures
10. Aménagement d'une rigole périphérique de 30 cm de large et de 30cm de profondeur à l'intérieur de la parcelle.
11. L'eau d'irrigation circule d'abord dans la rigole avant d'irriguer la parcelle de culture.
12. Le niveau de l'eau peut être ajusté avec précision.

6. Endroit d'installation de la pépinière

13. La pépinière sèche est installée à côté de la rizière et tout près d'une source d'eau.
14. Cela permet de diminuer le temps entre le prélèvement des plants et leur transplantation, qui ne devrait pas dépasser 15 minutes.

7. Préparation de la Pépinière

15. Dimension: 1m de largeur sur 6m de longueur (longueur variable) pour le repiquage d'une rizière de 600m2 ou *1/20ème de carreau* .
16. Le sol de pépinière doit être meuble constituée d'une terre humifiée, légère, aérée et réduite en poudre au dessus, mais pas sableuse. Pour cela on mélange l'argile avec du sable et du fumier.
17. Profondeur du lit de pépinière: 12-15cm, (racines des plants de 8-12 jours sont 7.5cm long)

8. Préparation de Semences

18. Vannage de semences
19. Triage des semences dans l'eau : Les graines vides qui surnagent sont enlevées
20. Trempage des semences pendant 24 heures dans un seau avec de l'eau tiède
21. Pré-germination facultative de 24 heures dans un endroit chaud ou dans un trou préchauffé après le trempage
22. Quantité de semences pour 1/20ème de *carreau* : 0.9 livres (cela inclut des réserves au cas des pertes) semé sur 6 m^2 de pépinière

9. Le Semis de la Pépinière

23. Bien arroser la pépinière, pour que le sol soit bien entassé et humide.
24. Diviser le lot de semences en 3 parties : semer chaque moitié de la pépinière avec une partie de semence, et combler les vides avec la 3ème partie.
25. Les semences ne doivent pas se toucher (distance entre deux graines : la longueur d'une graine).
26. Semer en début de matinée ou en fin d'après-midi.

10. Gestion de la pépinière

27. On recouvre les semences avec une couche fine de fumier bien décomposé ou du terreau.
28. On tasse le sol un peu
29. On couvre le sol avec la paille sèche (mais sans graines !) pour protéger les semences contre la chaleur, la pluie, les oiseaux et les rats
30. Arrosage chaque matin et soir avec un arrosoir, ou au besoin
31. Vérifier la levée à partir du 2ieme jour après semis et enlever progressivement la paille jusqu'au 5ieme jour.
32. On recouvre les semences qui apparaissent en surface avec un peu de terre.

11. Prélèvement des plants de la pépinière

33. Arrosage de la pépinière avant prélèvement
34. Avec une pelle, enlever la motte entière à une profondeur de 10-12 cm
35. Transport de la motte sur une assiette, dans une cuvette ou autre

12. Le transport des plants

37. Les plantules à 2 feuilles sont transplantées,
38. Elles sont âgées entre 8-12 jours
39. Entre le prélèvement des plants de la pépinière et le repiquage, il ne faut pas dépasser 15 minutes si possible (30 minutes maximum !)

récipient au champ

36. Prélèvement et transport des plants doit être échelonné, au fur et à mesure de l'avancement du repiquage.

13. Le repiquage

1. La boue doit être bien épaisse et collante
2. Il ne doit pas y avoir de l'eau stagnante dans la parcelle
3. Le repiquage peut se faire:
   - à l'aide d'une corde graduée de 25cm, sur ligne et entre poquets avec un repiquage en reculant
   - sur rayonnage croisé à l'aide d'un rayonneur gradué de 25cm avec un repiquage en avançant.
4. On assure l'alignement des rangées de transplantation dans les deux directions du champ (ce qui va permettre de faire un sarclage croisé)

Le repiquage doit être fait avec beaucoup de soin :

40. Prélever la plantule avec la graine et une motte de terre

14. Gestion du champ pendant 2 semaines après le repiquage

44. Après la plantation, le champ peut être légèrement irrigué et maintenu humide pour assurer le bon enracinement des plants –
45. On fait le regarnissage au fur et à mesure qu'on constate des manquants avec le reliquat de la pépinière SRI
46. Pendant 2 semaines où les plantules s'établissent, le champ doit rester bien humide.

41. Chaque plantule est glissée latéralement dans la boue, les racines sont horizontalement couchées dans la boue

42. Les racines doivent avoir la forme d'un L et pas d'un J

43. On appuie un peu avec le pouce pour que le plant soit enfoncé à 1-2cm de profondeur et colle dans la boue

15. Le sarclage

47. Premier sarcleuse avec la sarcleuse conique à 15jours après repiquage quand les plantules sont bien installées et ancrées dans le sol.

48. On sarcle tous les 10 à 15 jours selon la pression des mauvaises herbes et fréquence d'irrigation. Idéalement, on sarcle 4 fois par saison.

49. Une lame d'eau doit être présente au moment de sarclage

50. Le sarclage doit se faire quand les MH sont encore petites

51. Les mauvaises herbes se trouvant tout près des pieds de la plante peuvent être enlevées à la main et enfouies tout près des pieds du riz

52. L'eau ne doit pas être évacuée de la parcelle après le sarclage pour ne pas perdre les nutriments de la parcelle

53. Un sarclage croisé dans les deux sens est recommandé

16. Irrigation

54. Pendant 2 semaines après repiquage, le sol est gardé humide.

55. Par après on adopte le système d' '**irrigation et assèchement alternatif'** : Une lame d'eau de 1 à 2 cm est introduite dans la parcelle, on laisse dessécher jusqu'à l'apparition des fissures du sol avant une nouvelle irrigation.

56. Il est conseillé de ne pas garder très longtemps la rizière sèche sur sol argileux

57. La fréquence d'irrigation n'est pas déterminée, mais dépend du sol et climat

58. Début de montaison, une couche d'eau de 2 à 3 cm est retenue en permanence

59. 3 semaines avant la récolte, la parcelle est drainée pendant la maturation

17. Fertilisation

60. L'application de la fumure organique constitue la base de fertilisation.

61. Au moment des carences apparentes (jaunissement), un sarclage est recommandé afin de mobiliser les nutriments dans le sol.

62. Au cas de carences persistantes, une application réduite des fertilisants

	chimiques peut se faire pour correction. **63.** Il est à éviter d'appliquer les engrais dans l'eau présente dans la parcelle, mais de les appliquer immédiatement avant le sarclage pour les enfouir davantage dans le sol.

Unités de mesures en Haïti :

- 1 *carreau* = 1.29 ha
- 1 *tallet* = 1/12 ha
- Quantité de semences pour 1/20ème de *carreau* : 0.9 livres sur une pépinière de 6m2
- Quantité de semences pour 1 *tallet* : 2 livres ou 2 *gobelets* (cela inclut des réserves)
- Superficie de pépinière pour 1 *tallet* : 1m x 8 m de pépinière ($8m^2$)
- Application de fumure organique pour 1 *tallet* : 15 sacs de 100 kg

A-3 GOH AGRICULTURAL PRODUCTION APPROACH AND STRATEGY

GROUPE AGRICULTURE - FEUILLE DE ROUTE

La réforme du secteur agricole

64. Contexte

Bénéficiant de très peu de capitaux, l'agriculture haïtienne est faiblement productive et compétitive. Le peu de ressources disponibles est exploité de façon anarchique. La croissance démographique annuelle d'environ 2,5%, accompagnée d'un taux global d'inactivité estimé à 51,1% (en 2009) et en l'absence de développement technologique, se traduit par une forte pression sur les exploitations et les parcelles qui ne cessent d'être morcelées. La dispersion de la production et la précarité des infrastructures agricoles rendent difficile la valorisation des marchés local, national, régional et mondial.

Durant les cinq dernières années, à l'instar de la production nationale, l'offre nationale de produits alimentaires a peu varié. La contribution de la branche d'activité "agriculture, sylviculture, élevage et pêche" s'est maintenue autour de 3,3 milliards de gourdes, soit près de 25% du PIB. La dépendance des importations de produits alimentaires est estimée à près de 60 %. Le riz qui constitue la base de la ration alimentaire est importé à près de 80%. Une telle dépendance expose le pays aux variations des prix internationaux des produits alimentaires. Accrochés à ces derniers, les prix alimentaires nationaux suivent une tendance haussière et fluctuent parfois de façon erratique. Cependant, cette hausse offre aussi des perspectives d'investissement dans la production agricole nationale.

La pauvreté est deux fois plus élevée en milieu rural qu'en milieu urbain, sachant que le revenu per capita à la campagne n'est que de 400 $ l'an. La majorité de la population rurale a faiblement accès à l'éducation, aux soins de santé, à l'eau potable, à l'électricité. Des 3 millions de personnes souffrant d'insuffisance alimentaire 77% vivent en milieu rural.

65. Position officielle du Président Martelly

Élu sous la bannière du parti Repons Peyizan, le Président accorde une importance toute particulière au secteur agricole. Ce dernier *ne peut pas générer lui-même les ressources nécessaires à une relance de la croissance de la production agricole. Il faut un apport extérieur qui, compte tenu de l'état de sous-capitalisation de ce secteur, doit prendre la forme d'investissements ordonnés et importants sur une période d'au moins 10 ans. Ces investissements doivent être orientés vers une amélioration de la capacité de production et de valorisation des produits ainsi que vers un meilleur développement du potentiel humain. Le milieu rural devant être tout à fait intégré au reste de l'économie, l'État va investir dans le secteur agricole. Cependant l'investissement public seul est tout à fait insuffisant pour le faire décoller. L'investissement public va donc être stratégique et permettra de stimuler l'investissement privé.*
L'agriculture doit être rentable afin de fournir un revenu acceptable aux producteurs; productive et performante pour répondre aux besoins d'une population croissante; moderne Durable, donc respectueuse de l'environnement, articulée avec les autres secteurs économiques et formelle, c'est-à-dire organisée autour d'unités de production bien structurées. Elle doit créer des emplois stables et générer des devises pour l'économie nationale.

66. Les grandes orientations de la politique du Gouvernement

Pour les 5 prochaines années, le Gouvernement se donne pour objectifs de:

5. **Augmenter de 50% le revenu per capita rural.**

6. **Réduire de 25% la dépendance alimentaire pour atteindre un taux d'autosuffisance de 60%.**

7. **Augmenter les exportations de produits agricoles 100% sur les 5 prochaines années.**

8. **Améliorer la couverture végétale pour réduire la vulnérabilité de nos écosystèmes.**

Pour ce faire, les interventions du gouvernement s'articuleront autour de **8 lignes d'actions** :

1. Promouvoir l'intensification de la production dans les zones appropriées (plaines)

En vue de doubler la superficie irriguée, les infrastructures d'irrigation et les systèmes de gestion des périmètres irrigués seront amélioration. Un réseau de centres de services équipés de tracteurs, pompes d'irrigation mobiles, pompes d'aspersion, moulins mobiles sera implanté. Ces centres seront mis en œuvre par des entreprises privés ou des associations locales dans une perspective de rentabilité.

2. Augmenter la valeur ajoutée par l'allongement des filières

Le gouvernement encouragera, par des mesures incitatives, toutes les initiatives visant la transformation des produits agricoles. Tous les sous-secteurs seront concernés : production végétale, production animale, produits halieutiques. Ainsi, l'agro-industrie et le secteur agro-artisanal seront-ils supportés à travers une politique de financement préférentiel, de formation technique et de recherche de débouchés locaux et internationaux.

3. Faciliter l'émergence d'un secteur de pointe, moderne et productif, techniquement et technologiquement avancé capable de tirer l'ensemble du secteur vers le haut

Le Gouvernement stimulera la mise en valeur des réserves foncières du pays (Nord, Nord-est, Plateau Central) en facilitant la création d'exploitations agricoles modernes. Il donnera aussi des incitatifs pour stimuler la reprise des exploitations agricoles importantes qui ont été délaissées (plaines des Cayes/Cavaillon, Léogane/Culs de Sac/Arcahaie, Plaine du Nord). Le développement d'une agriculture périurbaine intensive orientée vers des produits à forte valeur commerciale (œufs, lait, viande volailles, maraîchers) sera favorisé

4. Améliorer l'organisation, la sécurisation et le développement des marchés agricoles:

Le gouvernement entreprendra un vaste programme de réhabilitation et de percement de pistes rurales et de chemins muletiers sur la base de travaux à haute intensité de main d'œuvre (HIMO). Un réseau d'unités de collecte et de pré-conditionnement de produits agricoles sera établi. De plus, dans les zones de consommation, des infrastructures pour la distribution en gros seront construites.

Sur le plan national, le gouvernement favorisera le développement de marchés captifs: (PNCS, PNH/APENA, Programmes d'aide alimentaire: PAM, CRS, CARE, BND, Food for the Poor, Hôpitaux, missions, etc.) et appuiera les initiatives de contractualisation Producteurs/Industriels.

Sur le plan international, le gouvernement entreprendra une recherche systématique d'ouverture sur les marchés extérieurs, particulièrement les marchés caribéens, américains et européens. Des marchés niches seront dynamisés pour certains produits à haute valeur commerciale.

5. La protection de l'environnement et de la biodiversité

En accord avec le Ministère de l'Environnement, des mesures strictes seront mise en œuvre pour la protection des zones de châteaux d'eaux et des sources ainsi que des réserves naturelles: parcs, forêts. Le gouvernement éliminera toute subvention concernant les cultures érosives sur sols déclives: maïs, haricot, arachide, etc. Par contre, les cultures non érosives, en particulier les forêts énergétiques, l'arboriculture, les cultures pérennes: café, cacao, les cultures fourragères, etc. seront favorisées. Un programme spécial de récupération des terres très dégradées sera mis en œuvre au niveau des communes et sections communales.

6. L'amélioration de la gouvernance du secteur

Le déploiement du ministère de l'Agriculture sur le terrain sera révisé pour plus d'efficacité. Les fermes agricoles vont être restructurées et transformées en centres de recherche/formation (R&F). Le redéploiement du ministère se fera autour de ces centres sur le terrain et des services spécialisés (laboratoires, quarantaine, etc.) au niveau central. Des relations étroites seront développées avec les unités d'enseignement pour stimuler la formation d'entrepreneurs agricoles en articulation avec les centres de R&F. Les organisations, associations, corporations et autres structures privées seront stimulées en priorisant des regroupements par domaine d'intérêt.

7. La transformation du cadre réglementaire et légal et l'adaptation du cadre macroéconomique.

La modernisation du secteur agricole nécessite une profonde transformation du cadre réglementaire et légal ainsi que l'adaptation du cadre macroéconomique. Sont visées en priorité la loi organique du Ministère, les règlements sur l'utilisation de l'espace agricole, les lois sur le foncier: transmission, sécurisation des investissements; le statut de l'exploitant agricole; la standardisation des poids et mesures. Les accords commerciaux internationaux seront aussi renégociés pour assurer une meilleure protection du secteur.

8. L'accompagnement financier

Une institution financière nationale destinée au financement du secteur agricole et agro-industriel sera créée. Un fonds de garantie auprès de la Banque centrale sera aussi constitué pour stimuler les institutions bancaires et de micro finance privées à financer le secteur agricole tant au niveau de la production qu'à celui de la transformation.

Ces lignes d'actions se traduisent par les grands programmes suivants :

Programmes	Composantes	Activités
Amélioration des infrastructures agricoles	Développement de l'irrigation	*Entretien des systèmes entièrement fonctionnels*
		Réhabilitation et extension des systèmes existants
		Aménagement de nouveaux périmètres
		Développement de la micro-irrigation
		Renforcement de la gestion
	Amélioration des pistes agricoles	*Amélioration des pistes existantes*
		Percement de nouvelles pistes
		Instauration d'un système de cantonnage.
Mise en valeur et intensification	Amélioration de l'accès aux outils et intrants agricoles	*Mise en place de lignes de crédit pour les investisseurs privés dans pour les productions végétales que pour les productions animales*
		Création, avec les associations privées, de centres de services agricoles dotés d'équipements agricoles (tracteurs, pompes d'irrigation, pompes d'aspersion, etc.) et de structures de commercialisation d'intrants (engrais, pesticides, médicaments pour élevage, etc.)
		Implantation de centres régionaux de mécanisation agricole
	Amélioration de l'accès aux techniques agricoles	*Création d'un réseau de centres de recherche/formation par la restructuration des fermes agricoles et l'implantation de nouvelles fermes*
	Appui à la restructuration des unités de production	*Support à la création de nouvelles unités de production modernes*
		Support au remembrement des unités actuelles pour créer des unités plus performantes
Valorisation de la production agricole	Support à l'agro-industrie	*Filières agro-industrielles prioritaires :* • *Fruits : mangues, avocats, véritable, citrus, ananas* • *Maraichage : Tomate, carotte, oignon, pomme de terre, Pois congo* • *Oléagineux : Ricin* • *Café, cacao*
	Amélioration de l'approvisionnement	*Création d'un réseau de centres de collecte et de préconditionnement*
		Mise en place d'une unité de production d'équipements d'emballage

	Sécurisation du marché interne	*Développement des marchés captifs : aide alimentaire, protection civile, PNH, etc.*
Les programmes d'accompagnement	Amélioration de la gouvernance du secteur	*Redéploiement du ministère sur le terrain*
		Articulation avec les structures d'enseignement agricole publiques et privées
		Systématisation des tables de concertation et des tables sectorielles
		Renforcement et stimulation des organisations socioprofessionnelles agricoles
	Ajustement du cadre légal et réglementaire	*Modification de la loi organique du ministère*
		Élaboration d'une loi sur le statut de l'exploitant agricole en Haïti
		Modification des lois sur la succession
		Élaboration de lois sur la sécurisation des investissements.
		Standardisation des poids et mesures
		Réaménagement des accords commerciaux internationaux : OMC; APE, Caricom/Cariforum
	Accompagnement financier	*Création d'une banque de Développement agricole et industriel*
		Création d'un fonds d'investissement spécial pour stimuler la création de nouvelles entreprises dans le secteur
		Constitution, au niveau de la banque centrale d'un fonds de garantie pour stimuler la participation des banques et institutions de micro-finance privées au financement du secteur agricole

67. L'organisation institutionnelle et les principales ressources humaines du secteur

Il est nécessaire de redonner le leadership du secteur au Ministère de l'Agriculture dont le rôle deviendra plus stratégique. Il sera le centre d'orientation des politiques publiques, de coordination des intervenants, de règlementation et de contrôle. Pour ce faire, sera mise en place une structure centrale relativement légère avec des unités de services techniques bien pourvues en personnel qualifié, des structures départementales jouant essentiellement un rôle de coordination, de planification et de suivi-évaluation. Le personnel de terrain sera essentiellement déployé dans des centres de Recherche/Formation distribués sur le territoire en fonction des potentialités et des priorités définies.

Les organisations d'encadrement du secteur agricole (ONGs, Fondations, etc.) devront respecter les grandes orientations définies et contribuer à leur opérationnalisation. L'état favorisera l'émergence d'associations socioprofessionnelles solides capables de représenter des partenaires.

68. Actions pour les 100 premiers jours

Les actions qui seront menées durant les 100 premiers jours du Gouvernement viseront à donner confiance à la population. Pour ce faire, une dynamique de changement sera lancée en réorientant les actions en cours suivant la nouvelle vision politique. Des activités à la fois concrètes, visibles et utiles seront réalisées aussi bien dans la zone métropolitaine que dans le reste du pays.
Les actions pour les 100 premiers sont les suivantes :

- Évaluation des structures techniques et administratives du Ministère qui doivent s'adapter aux besoins de la nouvelle politique du secteur. Redéploiement sur le terrain du personnel et des moyens en fonction de la stratégie opérationnelle retenue.

- Inventaires des ressources humaines et matérielles. Les projets les plus importants seront audités.

- Préparation du budget 2011 – 2012.

- Accélération des programmes et projets qui marchent bien afin d'exposer rapidement les résultats. Ceux qui marchent moins bien seront améliorés.

- Identification des projets dont les études sont disponibles. Le financement sera recherché et l'exécution programmée. Une grande priorité sera accordée à l'aménagement hydro-agricole.

- Programmes d'urgences en période pré-désastre : Curage de rivières et renforcement des berges traitement mécaniques des ravines, Il faut réduire le flux des eaux.

- Inventaire des zones d'intervention prioritaires en vue de la préparation des plans directeurs. Ces plans permettront de mieux orienter les ressources des bailleurs, les actions des ONG et les investissements privés.

- Mise en fonctionnement de quatre(4) centres de recherche / formation à Levy dans le département du Sud ; Dondon dans le Nord ; Baptiste dans le Plateau Central ; Savane zombi dans l'Ouest.

- Commande de 1500 tonnes de semence de haricot et de 10.000 tonnes d'engrais, de l2.000 outils aratoires pour la campagne d'hiver. une nouvelle stratégie de distribution de l'engrais sera mise au point pour garantir l'accès des producteurs, réduire les détournements et la spéculation.

- Planification des travaux de réhabilitation de systèmes d'irrigation en très mauvais état.

- Planification du curage de tous les systèmes d'irrigation qui le méritent pendant le prochain hiver.

- Lancement d’un vaste programme d’amélioration des pistes rurales sous forme de travaux à haute intensité en main d’œuvre.
- Début d’étude pour la mise en place d’une banque de crédit agricole et industriel.
- Mise en place de ligne de crédit au Bureau de crédit agricole de 24.000.000 gourdes en faveur des usines d’aliments pour bétail afin de soutenir l’élevage des poulets et des porcs.
- Finalisation avec WINNER du programme de relance de la culture de tomate sur 2000 ha dans la plaine du Cul-de-Sac en vue de la réouverture de la Famosa.
- Mise au point, avec la FAO et les autres partenaires internationaux d’une stratégie pour faire face aux risques de mauvaise récolte dues aux mauvaises conditions climatiques qui prévalent cette année

69. Récapitulatif des projets du MARNDR

Les projets coordonnées par le Ministère des Ressources Naturelles et du Développement Rural (MARNDR) sont financés tant par des bailleurs de fonds internationaux que par le Trésor Public. On peut distinguer quatre types de projets : les projets en cours d'exécution coordonnées au niveau central du ministère, les projets en cours d'exécution coordonnés au niveau départemental, les projets de l'exercice 2010-2011 financés par le Trésor Public et les projets en cours d'élaboration ou de négociation. Ces projets sont présentés dans les tableaux en annexe

Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural (MARNDR)

Plan d'Action pour l'année fiscale 2011-2012

Novembre 2011

I- CONTEXTE SECTORIEL

Le secteur agricole doit affronter aujourd'hui des défis considérables. L'un d'entre eux est de parvenir à satisfaire la croissance de la demande alimentaire nationale ; celle-ci résulte en grande partie de la croissance démographique qui se poursuit à un rythme élevé (2.5% par an). La production nationale n'assure, de nos jours, que 45% de l'offre alimentaire. Au cours des prochaines années, l'agriculture haïtienne devra donc produire davantage, commercialiser une part accrue de cette production (puisque la part des consommateurs non producteurs va augmenter) et assurer un revenu décent à un nombre croissant d'actifs agricoles.

Ce défi devra être relevé en surmontant plusieurs contraintes dont les plus importantes sont: le problème foncier toujours peu sécurisé, l'accès limité aux intrants et matériels agricoles, les difficultés d'accès au crédit avec des formules en faible adéquation en rapport aux réalités du monde paysan haïtien, le déficit important en matière d'infrastructures (de production, de stockage et de commercialisation) et de services d'accompagnement de proximité au monde rural, etc. Cet état de fait a évidemment entraîné un net recul du secteur privé formel qui avait pourtant consenti d'importants investissements dans ce secteur.

C'est donc dans ce contexte qu'il convient d'intensifier les efforts pour améliorer les conditions de l'agriculture haïtienne en termes de productivité et de compétitivité pouvant garantir des revenus accrus aux populations rurales.

II- CADRE D'ORIENTATION DU PLAN D'ACTIONS

Les orientations du plan d'actions tirent leur essence de la Déclaration de Politique Générale du Gouvernement. Sont également pris en considération :

- les discours de campagne du Président de la République
- la feuille de route préparée par le Groupe Agriculture pendant la période de transition (juin-septembre 2011)
- les documents cadres (politique de développement agricole 2010-2025, plan national d'investissement agricole 2010-2016) élaborés par le Ministère de l'agriculture, en 2010, au terme d'un processus participatif impliquant de larges couches de la société civile et avec l'appui des partenaires techniques et financiers
- le programme quinquennal en cours de préparation

Les actions de la politique agricole du Gouvernement sont orientées suivant la vision du Gouvernement, les objectifs de la politique agricole et les grands axes d'intervention.

2.1. La vision du Gouvernement

La vision qui sous-tend les actions de la politique agricole du Gouvernement donne la primauté à la CREATION DE LA RICHESSE au lieu de simplement « lutter contre la pauvreté ». A cet effet, cette vision s'exprime par une agriculture : moderne, fortement mécanisée et industrialisée, performante et compétitive, rentable et génératrice d'emplois et de revenus, dominée par l'irrigation, durable, dynamique et équitable.

2.2. Les objectifs de la politique agricole du Gouvernement

Afin d'assurer aux populations une alimentation en quantité et en qualité suffisantes et de procurer des revenus décents aux producteurs agricoles, le Gouvernement s'est fixé les objectifs suivants :

- Augmenter de 50% le revenu per capita rural ;
- Réduire de 25% la dépendance alimentaire pour atteindre un taux d'autosuffisance de 60% au bout des cinq prochaines années ;
- Accroître de 100% les exportations de produits agricoles ;
- augmenter de 5% la couverture végétale.

2.3. Les grands axes d'intervention

Pour atteindre ces objectifs, le Gouvernement privilégie quatre grands axes d'intervention :

- Le renforcement des capacités institutionnelles qui se fera en termes d'amélioration de la gouvernance du secteur et de développement du cadre légal et réglementaire
- Le développement des infrastructures agricoles, incluant les infrastructures hydro-agricoles (entretien, amélioration et extension des infrastructures d'irrigation et des systèmes de gestion des périmètres irrigués, aménagement de lacs collinaires, de citernes et des de barrages de retenue) et les voies d'accès agricoles (réhabilitation et percement de routes, de pistes agricoles et de chemins muletiers).
- Le développement des filières (priorisation des filières de céréales, de l'agroforesterie, de l'élevage, de la pêche et de l'aquaculture) qui se déclinera en termes d'amélioration de l'accès aux intrants et services agricoles, de promotion de l'agro-industrie et de la facilitation de la commercialisation
- Le financement de l'agriculture qui sera concrétisé par la mise en place d'un système de crédit, comprenant, après étude de faisabilité, une banque de crédit agricole pour l'ouverture de prêts et d'octroi de crédit à des taux préférentiels.

III- LE PROGRAMME D'ACTIONS POUR L'ANNEE FISCALE 2011/2012

- **Les principales activités envisagées**

Les activités envisagées pour l'année fiscale 2011/2012 sont les suivantes :

70. Évaluation des structures techniques et administratives du Ministère qui doivent s'adapter aux besoins de la nouvelle politique du secteur. Redéploiement sur le terrain du personnel et des moyens en fonction de la stratégie opérationnelle retenue.

71. Renforcement des capacités organisationnelles et institutionnelles (révision de la loi organique du Ministère, élaboration et soumission au parlement de projets de loi, notamment ceux relatifs à la réglementation zoo et phytosanitaire, au statut du métier d'agriculteur, au régime foncier…).

72. Rajeunissement du personnel du Ministère (+40% éligibles à la retraite) et redéploiement sur le terrain du personnel et des moyens en fonction de la stratégie opérationnelle retenue.

73.

74. Préparation du budget du MARNDR pour l'exercice 2011 – 2012.

75. Accélération des programmes et projets qui marchent bien afin d'exposer rapidement les résultats. Ceux qui marchent moins bien seront améliorés.

76. Identification des projets dont les études sont disponibles. Le financement sera recherché et l'exécution programmée. Une grande priorité sera accordée à l'aménagement hydro-agricole.

77. Réunions avec les partenaires techniques et financiers en vue de faire le point sur les stratégies, les perspectives d'investissement dans le secteur agricole

78. Elaboration d'un plan opérationnel quinquennal, permettant de mieux orienter les ressources des bailleurs, les actions des ONG et les investissements privés.

79. Curage de systèmes d'irrigation touchant 27.000 hectares de terre répartis sur 9 départements géographiques du pays.

80. Réhabilitation et extension de systèmes d'irrigation touchant 15.000 ha dans les plaines du Nord (construction du barrage Latanier), du Cul de Sac (Systèmes Rivières Blanche et Grise et de la Vallée de l'Artibonite (études disponibles).

81. Réalisation d'études en vue de la création de 2 nouveaux périmètres irrigués: plaine de Maribaroux dans le Nord-est (6000 ha), plaine des Moustiques et Lacoma dans le bas Nord-ouest (5000 ha), rive droite de la rivière L'Estère (1200 ha).

82. Appui au renforcement de la gestion des périmètres irrigués par les associations d'irrigants.

83. Réhabilitation ou construction de pistes agricoles.

84. Protection des bassins versants (notamment les sous-bassins surplombant les périmètres irrigués) :contrôle des rivières et des ravins.

85. Réalisation des campagnes agricoles 2011 : mise à disposition de 310 TM de semences, fourniture de services de préparation des sols…, emblavage de 5.000 ha de terre dans la plaine du Cul de Sac en collaboration avec WINNER.

86. Finalisation avec WINNER du programme de relance de la culture de la tomate sur 2.000 hectares dans la plaine du Cul de Sac en vue de la réouverture de la FAMOSA.

87. Appui à la production de céréales pour répondre aux demandes des Moulins d'Haïti (60 000T), de Haiti Brothers (20 000T), et de la Jamaica Brothers (75 000T).

88. Appui à la production de ricin pour le biodiesel (1000 ha).

89. Installation de quatre (4) centres régionaux d'équipements agricoles.

90. Intensification de l'utilisation de nouvelles technologies: système goutte à goutte, cultures sous serres (implantation d'un atelier de production de serres).

91. Relance accélérée de l'industrie des oeufs et des poulets de chair (inauguration prochaine de Haiti Brothers qui vise 36% du marché en 3 ans).

92. Réhabilitation des 4 centre de recherche et de formation (Levy, dondon, Savane Zombi, Thiotte).

93. Lancement des actions liées à la mise en œuvre d'une stratégie nationale de vulgarisation agricole

94. Lancement d'études pour la mise en place d'une banque de crédit agricole et industriel.

95. Appui au développement de la pêche maritime, de l'aquaculture et la pêche continentale par :

9. Le renforcement organisationnel des pêcheurs et des marchandes

10. L'actualisation de la loi de pêche

11. L'acquisition et la mise à disposition de certains matériels et équipements (DCP) de pêche

12. L’empoissonnement des plans d’eau

13. L’établissement de nouveaux centres de production d’alevins

14. La production d’aliments pour poissons

96. Lancement d’études pour la mise en place d’une banque de crédit rural.

97. Renforcement du Bureau de rédit Agricole en attendant la création de la banque de crédit rural

98. Mise en place de guichets de crédit compte tenu des marchés niches identifiés comme ceux de la tomate, farine de maïs, tabac.

99. Mise en œuvre du Système de Financement et d’Assurance Agricole Haïtien (SYFAAH) de concert avec l’ACDI et l’IICA.

100. Etablissement d’un fond de garantie.

101. Intervention de la banque centrale pour garantir des taux attractifs pour le secteur agricole (6 à 8% au lieu de 34% actuellement).

3.2 Calendrier d'exécution des activités

Axes d'intervention & Activités	Indicateurs de résultats	Mois de réalisation											Parties prenantes
		Nov	Déc	Janv	Fév	Mars	Avr	Mai	Juin	Juil	Août	Sept	
Renforcement des capacités institutionnelles													
Évaluation des structures techniques et administratives du Ministère	Rapport d'évaluation préparé	XX											MARNDR
Renforcement des capacités financières du MARNDR	Budget du MARNDR révisé Audit du Ministère	XX	 XX										Cabinet Ministre, UEP
Renforcement des capacités organisationnelles et institutionnelles	Loi organique actualisée Projets de loi élaborés et soumis		XX		XX	XX	XX						MARNDR, Consultant
Renforcement des capacités techniques et professionnelles du MARNDR	Cadres mis à la retraite Jeunes cadres recrutés Formation		XX	XX	XX	 XX	 XX	 XX	 XX	 XX			Ministre, DG, DAF
Elaboration d'un plan opérationnel quinquennal	Document élaboré et validé	XX	XX										MARNDR
Echanges avec les partenaires techniques et financiers	Ressources financières mobilisées Projets identifiés	XX	XX										MARNDR, OI, ONG,

Activités	Indicateurs de résultats	Mois de réalisation											Parties prenantes
		Nov	Déc	Janv	Fév	Mars	Avr	Mai	Juin	Juil	Août	Sept	
Développement des infrastructures agricoles													
Exécution des travaux de curage des systèmes d'irrigation	Irrigation améliorée sur 48.000 hectares	XX	XX			XX	XX						DIA, DDA, OPS, Irrigants
Réhabilitation et extension de systèmes d'irrigation	Irrigation améliorée sur 27.000 hectares	XX	XX	XX		XX	XX	XX					DIA, DDA, OPS
Lancement d'études pour la création de nouveaux périmètres irrigués	Rapports d'études élaborés/27.000 has Plans directeurs préparés Avant Projets Détaillés disponibles			XX	XX	XX	XX	XX	XX	XX	XX		DIA/MARNDR, Partenaires financiers, Firme de consultation
Renforcement de la gestion des périmètres irrigués	Capacités des Associations d'irrigants renforcées		XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	DIA, DDA, Consultants
Lancement d'un programme d'amélioration des pistes rurales	585 Km de pistes réhabilités ou construits				XX	XX	XX						DIA/MARNDR, DDA, TPTC, CNE
Préparation et mise en œuvre de Programmes d'urgences en période pré-désastre	Km de lits de rivière curés Km de berges renforcés				XX	XX	XX	XX	XX	XX	XX		DIA/MARNDR, DDA
Réalisation d'actions liées à la protection des versants surplombant les périmètres irrigués	Rapport d'étude Cartes disponibles Superficie protégée		XX	XX	XX	XX	XX	XX	XX	XX			MARNDR, Exploitants agricoles
Développement des filières													
Appui à la planification et la réalisation de la	Dossiers préparés Intrants disponibles	XX	XX										SNS, PSF, DDA prestataires de

campagne de production d'hiver	Services de préparation de sols fournis 5.000 hectares additionnels emblavés en haricot dans la plaine du Cul de Sac												services, ONG, agriculteurs…
Appui à campagne de production de printemps	Intrants disponibles dont 1.400 TM de semences Services de préparation de sols fournis					XX	XX						SNS, PSF, DDA prestataires de services, ONG, agriculteur
Installation de centres régionaux d'équipements agricoles	4 centres de services équipés de tracteurs, motoculteurs…)		XX	XX		XX	XX						DIA, DDA
Affectation de ressources nécessaires à la mise en fonctionnement de quatre(4) centres de recherche	4 centres de recherche fonctionnels			XX	XX								DG/MARNDR, Projet DEFI
Lancement des actions liées à la mise en œuvre d'une stratégie nationale de vulgarisation agricole	Structure de vulgarisation mise en place				X	X	X	X	X	X	X	X	UEP/MARNDR, Projet RESEPAG
Mise en place de modèles de systèmes d'irrigation faiblement consommateurs en eau (goutte à goutte, aspersion, cultures sous serre	Séances de formation réalisées 100 hectares de démonstration Plantules produites		XX	XX	XX	XX	XX	XX					MARNDR, IICA, Gouvernement du Mexique
Actions de développement de la pêche maritime, de l'aquaculture et de la pêche continentale	Matériels et équipements disponibles 4.000 Tonnes de production de poissons additionnelle		XX	XX	XX	XX	XX	XX	XX	XX	XX		

Financement de l'agriculture													
Lancement d'études pour la mise en place d'une banque de crédit rural.	Document élaboré et validé		XX	XX	XX	XX							MARNDR/BCR/ MEF
Renforcement du Bureau de crédit agricole en attendant la création de la banque de crédit rural	De nouveaux cadres sont recrutés		XX	XX	XX	XX	XX	XX					MARNDR
Mise en place de guichets de crédit compte tenu des marchés niches identifiés comme ceux de la tomate, farine de maïs, tabac.	Crédit accordé au secteur agricole						XX	XX	XX	XX			BCR/MARNDR/ MEF
Mise en œuvre du Système de Financement et d'Assurance Agricole Haïtien (SYFAAH) de concert avec l'ACDI et l'IICA.					XX	XX	XX	XX	XX	XX	XX	XX	BCR/MARNDR/ MEF
Etablissement d'un fond de garantie.	Garantie accordée						XX	XX	XX	XX	XX	XX	BCR/MARNDR/ MEF
Intervention de la banque centrale pour garantir des taux attractifs pour le secteur agricole (6 à 8% au lieu de 34% actuellement).	Taux d'intérêt pour le prêt agricole								XX	XX	XX	XX	BCR/MARNDR

A-4 LIST OF PEOPLE WHO PROVIDED INPUTS TO THE PROCESS

Technical inputs were received from various members of the WINNER project team and USAID representatives, including:

WINNER Project

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Mario Kerby, Deputy Chief of Party
Roosevelt Decimus, Livelihoods component Director
Florence Sergile, University of Florida team Coordinator
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Debra Allen Reid, Mission Environmental Officer
Joe Torres, Regional Environmental Advisor, Caribbean

List of stakeholders interviewed

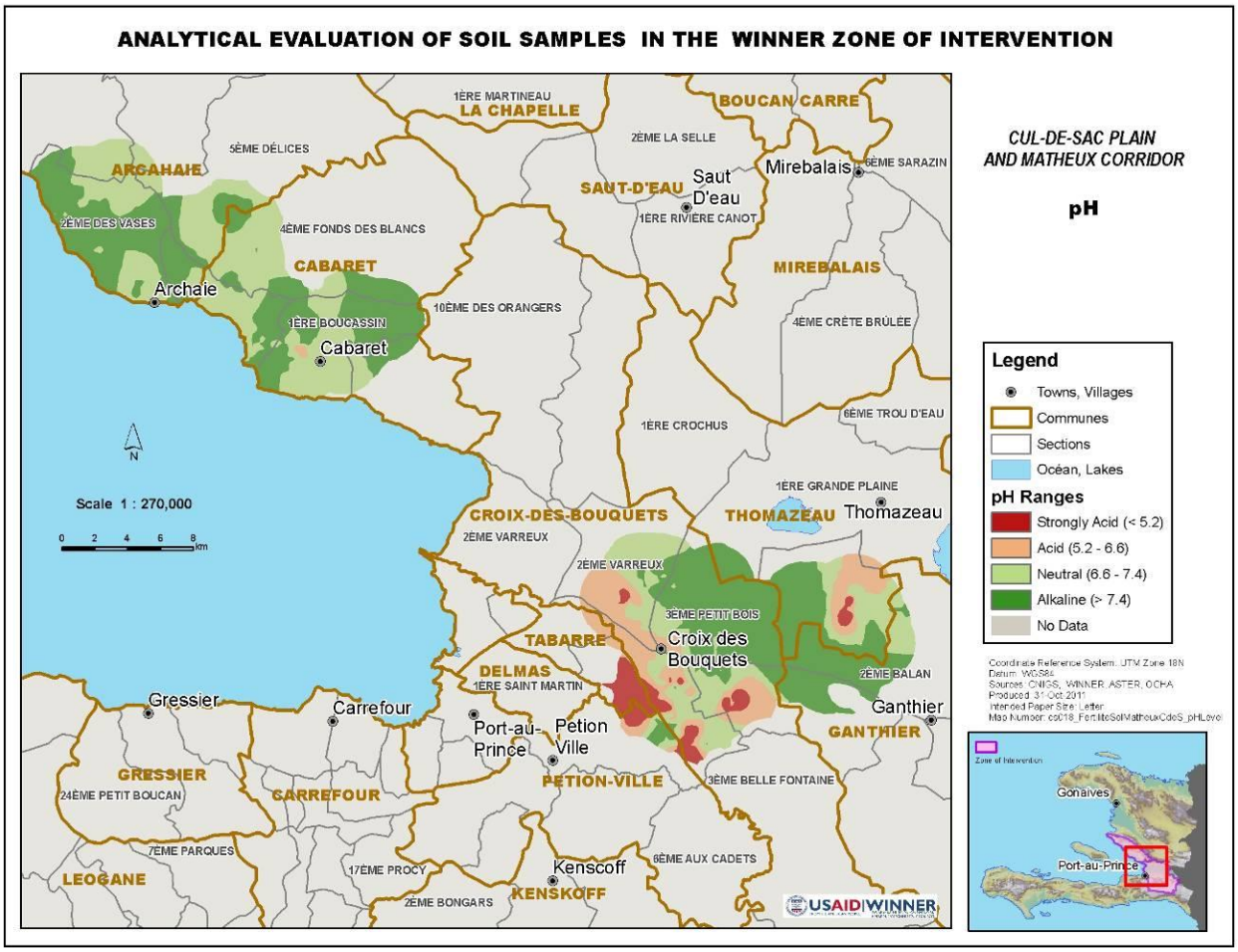
This annex includes a list of stakeholders with whom the WINNER team consulted during the scoping process.

- Herbert DOCTEUR, Agronomist, current Minister of Agriculture, Natural Resources and Rural Development
- Joanas GUE, Agronomist, former Minister of Agriculture, Natural Resources and Rural Development
- Ariel AZAEL, PhD, Special Adviser to Minister Joanas GUE
- Carl MONDE, Agronomist, Adviser to Minister Herbert DOCTEUR
- Jocelyn LOUISSAINT, Specialist in pedology, professor of soil science, School of Agriculture, Universite d'Etat d'Haiti
- Montès CHARLES, engineer, Director of Agricultural Infrastructures, Ministry of Agriculture
- Marc-Edouard DIEUJUSTE, engineer, Deputy-director of Agriculture Infrastructures, Ministry of Agriculture
- Jean-Michelet PIERRE, tractor operator
- Evens CARTEL, tractor operator

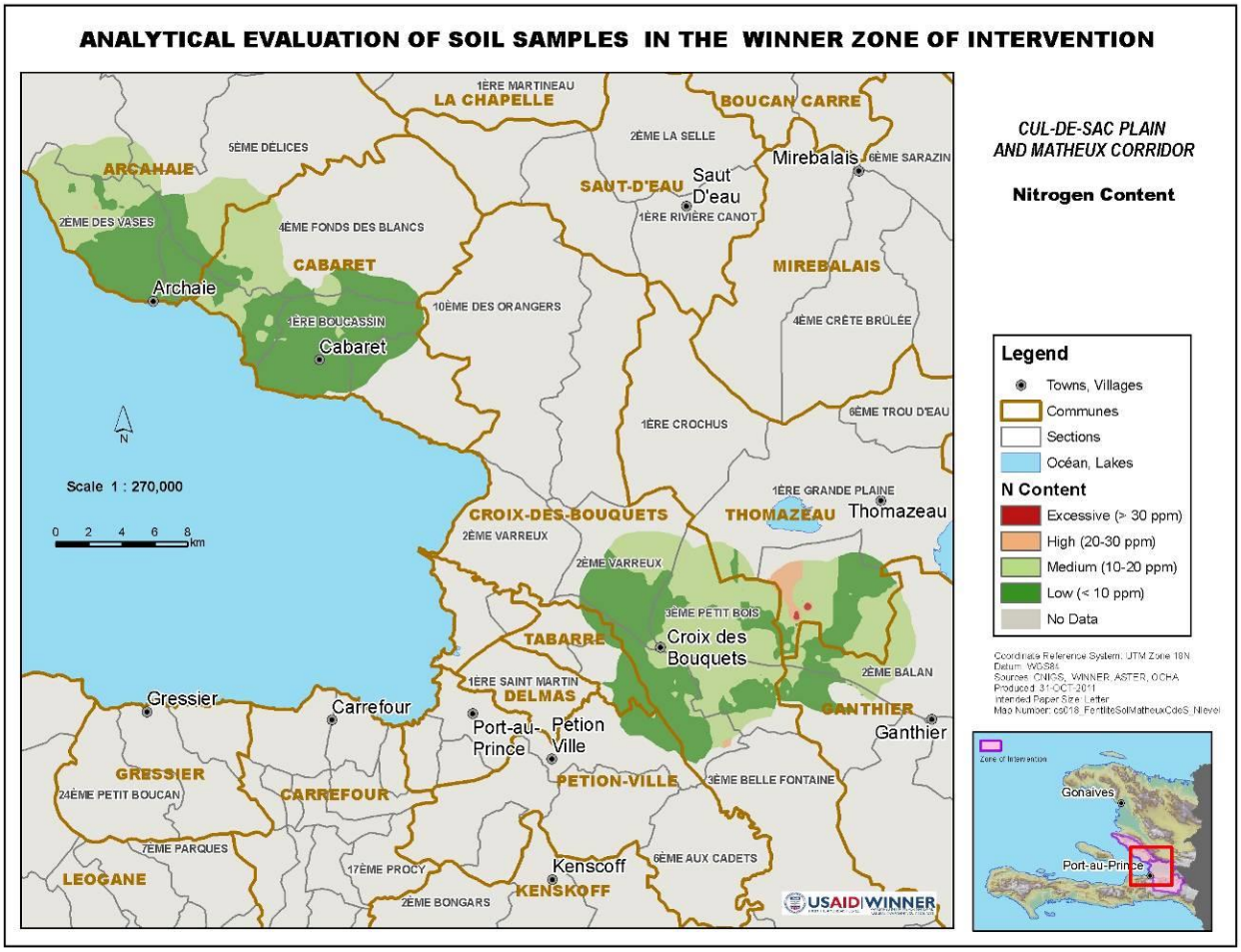
- Charles PETERSON, tractor operator
- Jean-Fritz MARCELLUS, tractor operator
- Lamarrre NICKENSON, tractor operator
- Joseph CARFOUL, tractor operator
- Karl MOREAU, Président of Association des Irrigants de Plaine de Arcahaie (AIPA)
- Gabriel LORISTON, Treasurer of KOPLARIKO (Arcahaie)
- Odilon , Treasurer of Kès Popilè Kabarè
- Jean Berno BRICE, Coordinator of Association des Paysans pour Développement de Merceron (Thomazeau, Cul-de-Sac)

A-5. SOIL FERTILITY MAPS FOR AREA OF INTERVENTION

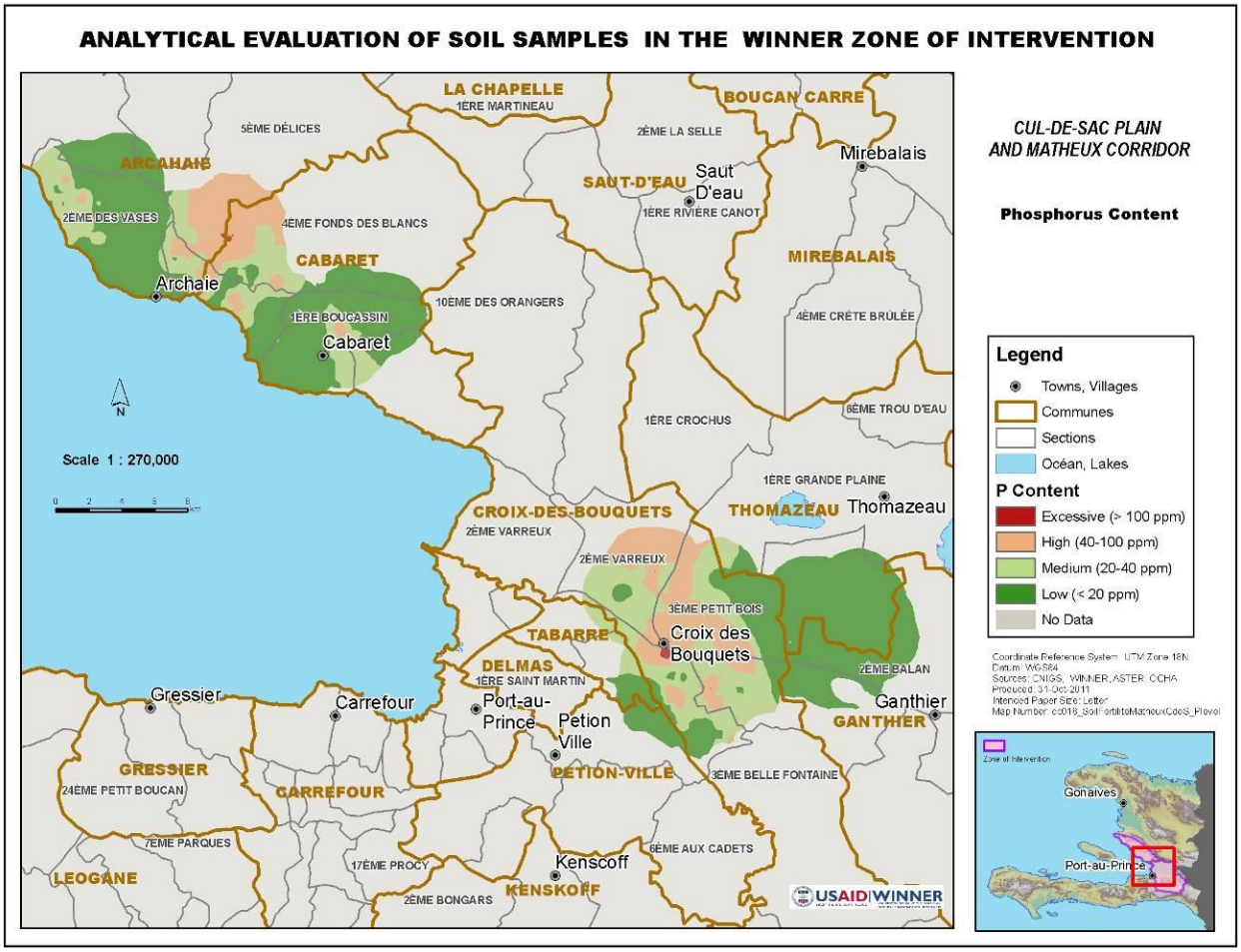
pH



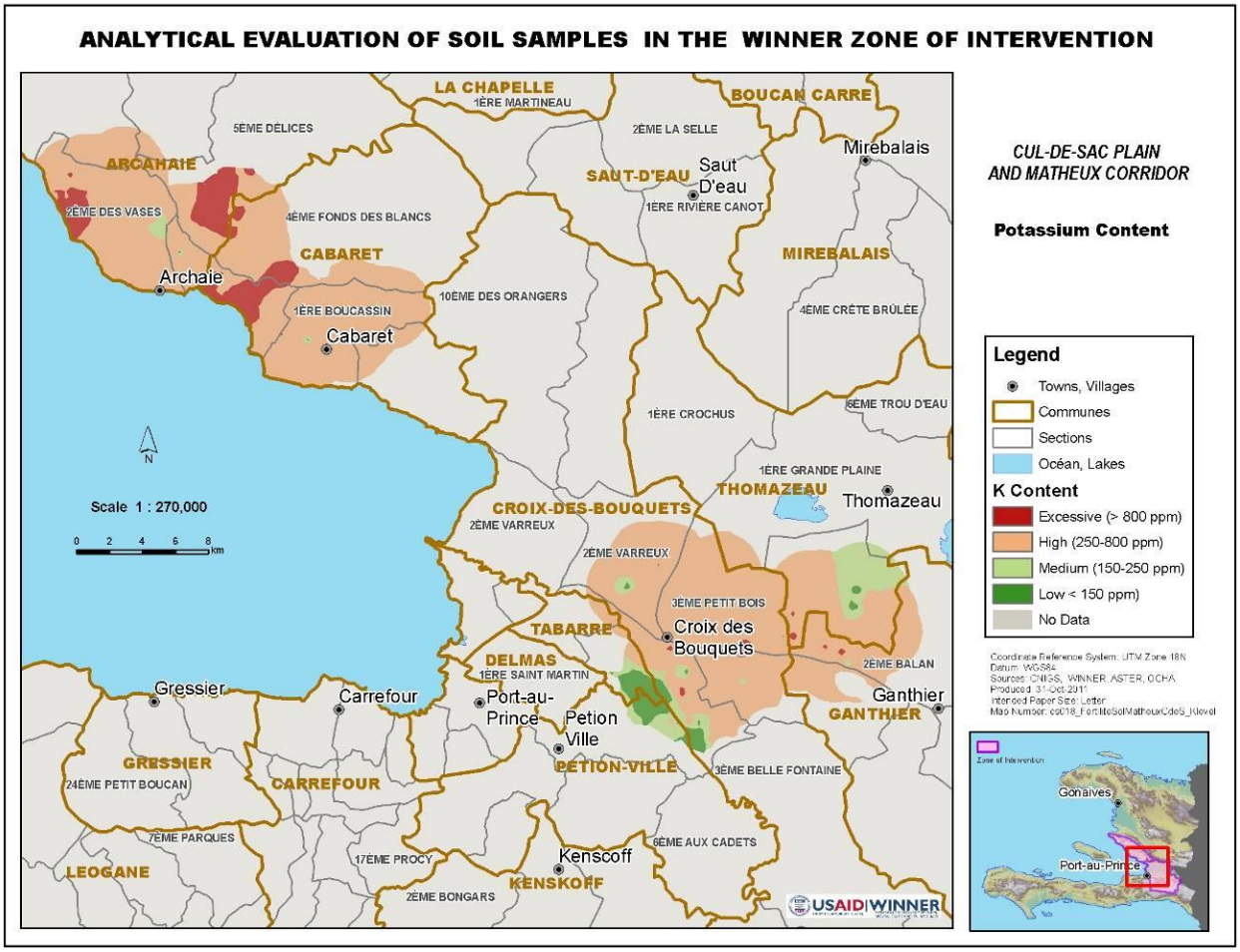
NITROGEN LEVELS



PHOSPHORUS LEVELS



POTASSIUM LEVELS



A-6. GUIDING PRINCIPLES OF THE "ASSOCIATIONS CHAMPYON"

Les 10 principes en version française, modifiés comme suit :

1) Ne pas couper ou mutiler les arbres et ne pas non plus les utiliser pour la fabrication de charbon de bois;
2)) Ne pas cultiver sur les pentes supérieures à 35°, conformément à la loi, et aménager en zone de montagne, chaque année, une aire d'agroforesterie représentant 200 m² par membre d'association et des pépinières représentant 50 plants par membre.
3) Utiliser dans les parcelles de production des semences commerciales notamment celles disponibles dans les BIA.
4) Fabriquer et utiliser du compost dans leurs jardins ; ne pas brûler la végétation et les résidus de récolte avant de planter;
5) Suivre les recommandations des agronomes et des paysans vulgarisateurs (techniques de plantation, conduite et entretien des cultures etc.)
6) Installer en montagne des haies antiérosives (vétiver) et faire des terrasses.
7) Consacrer deux (2) jours par mois à des travaux communautaires (sans rémunération) pour l'entretien des infrastructures rurales de sa région (système d'irrigation, eau potable, routes et autres) ;
8) Dynamiser et rentabiliser les actifs de l'association par des activités économiques sérieuses. Savoir élaborer et mettre en pratique un plan d'affaires, un budget annuel, un système comptable ; savoir rentabiliser les actifs de l'association en général : tracteurs, décortiqueuse, BIA, etc.
9) Respecter les consignes dispensées sur l'hygiène et le planning familial ;
10) Maintenir le bétail attaché en dehors des espaces reboisés.

Une fois ces nouveaux principes acceptés, intégrés et respectés par tous ses membres, les associations deviennent des associations admises « chanpyon ».

A-7 COST BENEFIT ANALYSIS: AGRICULTURAL LAND PREPARATION (TRACTORS VS. MANUAL)

COST-BENEFIT ANALYSIS
VS MANUAL LAND PREPARATION

I. COST-BENEFIT ANALYSIS

A. WORKING HYPOTHESES:

This analysis is done for the following conditions:

1. Farmers Association will acquire of tractors through loans. The tractors will belong to the farmers associations which will become cooperatives. They will forge a private entity for management and maintenance of their equipment.

2. Farmers will use 75 HP tractors to plough, harrow and furrow lands, operate irrigation pumps, carry goods and power post-harvest operations (ex: Threshing corn, rice, beans ect…). To be conservative, we estimate that a tractor will complete all three operations (ploughing, harrowing, furrowing) for two (2) hectares / day.

3. The tractor will work 150 days for land preparation. The tractor will generate other income by carrying out other activities as mentioned in point 1, but we do not have yet data to estimate them.

4. Repairs costs are based on standard maintenance costs for a 75 HP modern tractors of a reputable trademark with a good operator working on the Plaine du Cul-de-Sac. These costs can change according to the machine and the operator. Currently, there are several tractors from countries WINNER project cannot buy products that have known reliability problems.

5. *Variable (operation)* costs are based on current fuel and lubricant costs.

6. Variable costs are based costs on actual numbers for a 75 HP tractor in the plain du Cul-de-Sac using 25 gallons of diesel / day and 6,000 gourdes of lubricants / month. *These numbers are based upon what the current owners of tractors under contract with WINNER are spending*.

7. We consider that tractors are amortized in five years.

8. Conversion rate: USD 1 = 40 Gourdes

B. COMPARISON TRACTOR VERSUS MANUAL LABOR LAND PREPARATION

1. Demand side:

If a small farmer wants to prepare one hectare of land, he/she can either rent a tractor or pay for manual labor.

A tractor costs 9,000 gdes / ha (based on WINNER contract in the Cul-de-Sac) for the three operations. It takes an average 80 men /day to do the same work.

Cost per Hectare Comparison

	Unit	Cost / unit	Quantity	Total	Total in USD
Manual	Man/ hour	200 gdes	80	16,000gdes	400
	Tractor / day	9,000 gdes	1	9,000 gdes	225
Difference				***7,000 gdes***	***175***

A farmer saves 7,000 gourdes per hectare when he realizes all three plowing operations with a tractor.

Furthermore with the plowing:

- The land is better prepared since the plow goes deeper and prepares the land more uniformly than with manual labor.
- Crop residues will be mixed with the soils, thus, increasing the content of organic matter in it.
- Manual labor is less and less available due to the lack of interest of the young people for agricultural work coupled with the fear of cholera contamination,

2. Supply Side:

The goal of the analysis is to assess the income generated by a tractor for a farmer association

Calculating Net Income per year for a 75HP tractor with equipment:

Items	Comments	Total in USD
Lists of Data		
Cost of a 75 HP tractor		40,000
Salvage Value		8,000
Useful life	5 years	
Estimated annual use	150 days	
Interest rate on loan	10%	
Fixed Costs		
1. Depreciation	Calculated by straight line method	6,400
2. Payment on loan	yearly amount for monthly payment –fix monthly payments-	10,200
Sub-Total Fixed Costs		*16,600*
Variable Costs		

3. Fuel	[(Gal. 25x 150 days x Gde162)]/40	15,188
4. Lubricants	[5 months -150 JOURS- x Gdes 6,000]/40	750
5. Labor (operator)	[150 days x 2,000] /40	7,500
6. Repairs	5% of the total cost-40,000-	2,000
Sub-total variable costs		*25,438*
TOTAL COSTS		***42,038***
INCOME		
7. Income	***[(9,000 gdes x 150 days x 2 ha)] / 40***	***67,500***
NET INCOME		***25,462***

III. ENVIRONMENTAL MITIGATION MEASURES

In order to prevent some negative factors that plowing can, sometimes, cause, like soil compacting and loss of organic materials, the following mitigation measures will be taken:

1. The tractors will be used mostly on the plains or on the flat parts of the "Plateau Central" on continuous area of less than 100 ha.
2. Organic residues like compost will be applied to the soil on a regular basis.
3. The plowed land will regularly lie in fallow (the schedule of the fallow will depend on the cultures).
4. Three plowing operations will always be made on the lands (plowing, harrowing, furrowing) particularly harrowing (every tractor will have its harrow machine).
5. The depth of the plow will be changed every year in order to avoid compacting soil.

IV. CONCLUSION:

Per both analyses, supply side and demand side, it has been established that the Haitian farmers and farmers associations will gain substantial benefits when they shift from manual to labor practices.

The shifting will help not only save money on one side but also increase revenue by having better yield due to better land preparation.

Farmer associations will also have a new source of income (the renting of the tractor) that can help them to acquire other materials and carrying out activities.

LIST OF ASSOCIATIONS PARTICIPATING IN THE 2011 PLOWING CAMPAIGN

Association	Commune	Localite	Superficie Labouree en ha	Recette	Personne Responsable	No Téléphone
AJPD	Croix des bouquets	Drouillard	60	300000		3735-0047
OJEUDEC	Croix des bouquets	Dumay, Pont Dumay, Campeche, Denis	170	850000	Fritzner Ossé	3607-7606
OPTDC	Thomazeau	Cotin	61	305000	Miguel	3429-1379
OTPDBC	Thomazeau	Cotin	31	155000	Mait Pierre	3450-8748
FEPBSH	Thomazeau	Balan	123	615000	Lucner	3794-3991
ODEB	Ganthier	Baugé et Bois Leger	10	50000	Joubert Came	3455-0535
MOPROF	Ganthier	Baugé et Bois Leger	90	450000	Yvon Démosthène	3666-0575
UPB	Ganthier	Baugé et Bois Leger	20	100000	Franckel Gédéon	3711-3529
ASAM	Ganthier	Ti maché	15	75000	Oreste M.	3869-0792
AJHAB	Ganthier	Descloche	11	55000	Alovy	3998-1176
APCC	Ganthier	Croix Coq	10	50000	Wilson	3649-1382
OPDAC	Croix des bouquets	Michaud	30	150000	Patrick	3670-5441
OAHC	Ganthier	Hatte Cadette	5	25000	Rebeca	3737-3494
ADAF	Ganthier	Dafoice	2	10000	Nadie	3850-0374
MAPPAP	Croix des bouquets	Jumecourt	30	150000	Fresnel	3618-0497
MITH	Croix des bouquets	Cuvier	10	50000	Jn Miguel	3738-3053
ORFEBD	Ganthier	Bas Boen	45	225000	Mirielle	3867-1612
PHASS	Croix des bouquets	Laferonay	15	75000	Vilcene	3784-4996
AJDCGD	Ganthier	Galette	8	40000	Reginald	3754-8560
APADAPC	Croix des bouquets	Roche Blanche	97	485000	Azor Fanfan	3781-1659
APD	Croix des bouquets	Pieurroux, Turbe	30	150000	Kesnel	
ACPDD	Croix des bouquets	Duvivier	107.19	535950	Ronald C.	3809-7774
GFVCT	Thomazeau	Cotin	45	225000		
ORP	Thomazeau	Merceron	115	575000		
APDAHCOM	Thomazeau	Merceron	90	450000		
AAS	Thomazeau	Merceron	15	75000		
ATRADEM	Thomazeau	Merceron	25	125000		
OPDMO	Thomazeau	Merceron	60	300000		
ASPADED	Thomazeau	Merceron	15	75000		
ASV	Thomazeau	Merceron	45	225000		
APEAPACT	Thomazeau	Merceron	50	250000		
Total			**1,440.19**	**7200950**		