Document of the Inter-American Development Bank

**HAITI**

**MODERNIZATION OF AGRICULTURAL HEALTH PUBLIC SERVICES**

**(HA-L1094)**

**monitoring and evaluation plan**

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**Abbreviations**

CSF Classical Swine Fever

DPV Plant Health Directorate (Direction de la Protection Végétale)

DSA Animal Health Directorate (Direction de la Santé Animale)

FF Fruit Fly

Ha Hectare

HTG Haitian Currency (Gourdes)

IE Impact Evaluation

IICA Inter-American Institute for Cooperation on Agriculture

LVCQAT Tamarinier’s National Veterinary and Food Control Laboratory

MARNDR Haitian Ministry of Agriculture *(Ministère de l’Agriculture, des Ressources Naturelles et*

*du Développement Rural)*

M&E Monitoring and Evaluation

OIE World Organization for Animal Health

PMR Progress Monitoring Report

PVS/IICA Performance, Vision and Strategy (IICA assessment tool)

PVS/OIE Performance of Veterinary Services (OIE assessment tool)

SPS Sanitary and PhytoSanitary

RDD Regression Discontinuity Design

USDA United States Department of Agriculture

UPS Agricultural Health Unit of the MARNDR (Unité de Protection Sanitaire)

1. **INTRODUCTION**
   1. The general objectives of the program are to increase agricultural productivity and to improve access of Haitian agricultural products to international markets. The specific objectives of the program are to strengthen the government’s capacity to provide integrated, decentralized and sustainable agricultural health services, and improve the plant and animal health conditions in the country. To reach these objectives, the program is structured in four components: (1) Institutional Management; (2) Plant Health; (3) Animal Health; and (4) Tamarinier National Veterinary and Food Quality Control Laboratory.
   2. The Monitoring and Evaluation System will rely on four components:
2. Biannual monitoring reports prepared by a monitoring officer affiliated to the Agricultural Health Unit (see Part II).
3. Mid-term and final independent evaluations (the latter will include an ex-post economic analysis of the project using the same methodology as the ex-ante economic analysis but with actual project data) focusing on the project’s effectiveness, efficiency, sustainability, relevance and coherence.
4. An evaluation of the application of the Environmental and Social Management Plan in Y5.
5. An external impact evaluation based on a quasi-experimental method (see Part III).
   1. The Agricultural Health Unit (UPS) is the program’s executing agency and will be responsible for the operational monitoring of the project at all levels (Components 1, 2, 3 and 4). Consulting firms will be contracted by the executing agency to carry out mid-term and final independent evaluations as well as for the implementation of the impact evaluation.
6. **MONITORING**

A. Output Indicators

* 1. Based on the complete results matrix of the project, the monitoring will consider the following output indicators:

**Table 1**

**Output Indicators**

|  |  |  |
| --- | --- | --- |
| **Indicator** | **Frequency of Measurement** | **Source of Verification** |
| **Component I: Institutional Management** | | |
| **OUTPUT 1.1:** Departmental agricultural health and food safety centers built | Biannual | Executing agency reports and IDB inspection visits |
| **OUTPUT 1.2 :** Departmental agricultural health and food safety centers equipped | Executing agency reports and IDB inspection visits |
| **OUTPUT 1.3:** Administrative and financial procedures, plans and manuals prepared, officially approved and published on the MARNDR Website | MARNDR Website |
| **OUTPUT 1.4:**Key functions/programs of the Agricultural Health Unit (UPS) with a cost recovery mechanism defined, officially approved and published (with applicable fees) on the MARNDR Website | MARNDR Website |
| **OUTPUT 1.5:** Integrated Information System (plant health, animal health, quarantine, laboratory) available on the MARNDR Website | MARNDR Website |
| **Component II: Plant Health** | | |
| **OUTPUT 2.1.:** List of plant pests and diseases prepared/updated, submitted to the IPPC and published on the MARNDR’s Website | Biannual | MARNDR Website |
| **OUTPUT 2.2.:** Farmers members of the voluntary plant surveillance network trained | Plant Health Directorate reports |
| **OUTPUT 2.3.:** Monthly plant health surveillance bulletin distributed on the field and available on the MARNDR Website through the UPS information system | MARNDR Website and IDB inspection visits |
| **OUTPUT 2.4:** Traps for Fruit Fly control installed and refilled every week with baits without discontinuity during the entire control campaign | Plant Health Directorate reports and IDB inspection visits |
| **OUTPUT 2.5:** Traps for “Crazy Ant” control installed and refilled every week with baits without discontinuity during the entire control campaign | Plant Health Directorate reports and IDB inspection visits |
| **OUTPUT 2.6:** Phytopathology and virology sections of the Plant Health Laboratory upgraded and equipped | Plant Health Directorate reports, assets inventory register and IDB inspection visits |
| **OUTPUT 2.7.:** Biosecurity and Quality Plan and Laboratory Protocols prepared, officially approved and published on the MARNDR Website | MARNDR Website |
| **OUTPUT 2.8. :** Staff of the Plant Health Laboratory trained | Plant Health Directorate reports |
| **OUTPUT 2.9. :** Staff of the Plant Health Risk Analysis Unit trained | Plant Health Directorate reports |
| **Component III: Animal Health** | | |
| **OUTPUT 3.1.:** Farmers members of the voluntary animal surveillance network, trained | Biannual | Animal Health Directorate reports |
| **OUTPUT 3.2.:** Animal blood, tissue and organs samples collected and transmitted to LVCQAT for analysis | Animal Health Directorate reports and LVCQAT records |
| **OUTPUT 3.3.:** Classical Swine Fever and Teschen disease epidemiological surveys done | Epidemiological surveys reports |
| **OUTPUT 3.4.:** Monthly animal healthsurveillance bulletin distributed on the field and published on the MARNDR Website through the UPS information system | MARNDR Website and IDB inspection visits |
| **OUTPUT 3.5.:** Veterinary private professionals trained or recycled | Animal Health Directorate reports |
| **OUTPUT 3.6.:** Pigs simultaneously vaccinated against Classical Swine Fever and Teschen disease and identified with a tag | Animal Health Directorate reports and IDB inspection visits |
| **OUTPUT 3.7. :** Maintenance services of the national network of solar-powered refrigeration units completed | Animal Health Directorate reports |
| **OUTPUT 3.8.:** Staff of the Animal Health Risk Analysis Unit trained | Animal Health Directorate reports |
| **OUTPUT 3.9.:** List of veterinary private professionals (i) identified (ii) accredited by the MARNDR (iii) members of the National Veterinary Council established/updated and published on the MARNDR Website | MARNDR Website |
| **Component IV: Tamarinier National Veterinary and Food Control Laboratory** | | |
| **OUTPUT 4.1.:** LVCQAT infrastructures upgraded | Biannual | Work acceptance report and IDB inspection visits |
| **OUTPUT 4.2.**: LVCQAT equipped | Assets inventory register and IDB inspection visits |
| **OUTPUT 4.3.:** LVCQAT procedures and laboratory protocols (on biosecurity, quality assurance…) prepared, officially approved and published on the MARNDR Website | MARNDR Website |
| **OUTPUT 4.4.:** LVCQAT staff trained in quality assurance, biosecurity, laboratory practices, equipment maintenance | LVCQAT reports |

B. Data Collection and Instruments

* 1. All monitoring will be the responsibility of the full-time monitoring officer.
  2. The monitoring officer will compile data from:
* On-site visual inspections;
* The plant and animal health surveillance networks;
* The Agricultural Health Unit (UPS) information system available on MARNDR’s website;
* The MARNDR’s website;
* Reports by external consultants hired by the program for trainings, institutional strengthening and the establishment of improved practices;
* Reports by Plant Health Directorate, Animal Health Directorate and LVCQAT.

C. Reporting

* 1. The executing agency will prepare and transmit to the Bank a biannual activity report that will include the results of the monitoring of all the output indicators listed above. The preparation by the executing agency and the Bank’s approval of these reports is a contractual condition of the grant. At the end of the project (Y5), the executing agency will prepare a final report.
  2. These reports will provide all the required information for the PMR system of the Bank, to be updated on a biannual basis by the specialist in charge.
  3. The entity contracted to carry out the impact evaluation will submit a biannual report on data collection activities and data analysis. This report will be transmitted to the Bank for approval, which constitutes another contractual condition of the grant.
  4. Biannual monitoring reports are due one month after the end of the each semester (i.e. on January 31st and July 31st).

D. Independent Evaluations

* 1. A mid-term independent evaluation will be carried out at the end of Y3. The objective will be to determine whether execution is satisfactory (if there are delays, overcosts…) and whether the project’s strategy is generating the desired impact, or whether adjustments are needed. For each Component, it will highlight the key issues that are faced and which require responses from the executing agency. It will also provide a set of preliminary insights about the project’s design, implementation, and management.
  2. A final independent evaluation will be carried out a few months before the end of the project at Y5 to determine whether it has reached its objectives. The evaluation team will identify the lessons learned through the project and in particular its key successes and failures. The team will also assess the sustainability of the project’s results and propose a set of recommendations to the various project’s stakeholders in order to reinforce it.
  3. The Interamerican Institute for Cooperation in Agriculture (IICA) and the World Organization for Animal Health (OIE) will also be invited by the MARNDR to conduct their independent assessements at the end of the project (see also Table 4).
  4. Table 2 provides details on the entities responsible for the supervision of the independent evaluations as well as budgetary allocations for each activity and source of funding.

**Table 2**

**Independent Evaluations Work Plan**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **2015** | | | | **2016** | | | | **2017** | | | | **2018** | | | | **2019** | | | | **Responsible** | **Cost (currency)** | **Source of Funding** |
| **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| Mid-term evaluation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | MARNDR | US$ 40,000 | Project Budget (M&E category) |
| Final evaluation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | MARNDR | US$ 70,000 | Project Budget (M&E category) |
| IICA and OIE PVS assessments |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | MARNDR | N/A (IICA and OIE are technical cooperation agencies, conducting their assessments for free) | N/A |

E. Monitoring Coordination, Work Plan and Budget

* 1. Table 3 provides details on the responsible entities for the implementation of the monitoring plan, monitoring activities, budgetary allocations for each activities and sources of funding.

**Table 3**

**Monitoring Work Plan**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **2015** | | | | **2016** | | | | **2017** | | | | **2018** | | | | **2019** | | | | **Responsible** | **Cost (currency)** | **Source of Funding** |
| **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| Inspection visits |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | IDB | US$ 10,000 | IDB Transactional Budget |
| Day-to-day project monitoring |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Monitoring officer | US$ 227,500 | Project Budget (technical team of the executing unit) |

**Total Cost of the Monitoring Plan: US$ 347,500**

1. **EVALUATION**

A. Logic of Intervention and Main Evaluation Questions

As previously stated, the key objectives of the program are to increase agricultural productivity and to improve access of Haitian agricultural products to domestic and international markets. In order to achieve these objectives, the program is structured around four components: (i) Institutional Management; (ii) Plant Health; (iii) Animal Health and (iv) the Strengthening of Tamarinier’s National Veterinary and Food Control Laboratory.

**Component I**, Institutional Management, seeks to strengthen agricultural health and food safety services through the construction of 5 departmental agricultural health and food safety centers. New equipment will be distributed in these centers and modern administrative, operating as well as financial procedures will be established. Data, reports and procedures related to plant health, animal health, quarantine and the laboratory will all be channeled within a unified and integrated information system and will be made available to the public on the MARNDR website. This will improve the exchange of information not only across the different entities involved in the provision of agricultural health and food safety services, but also with other ministries such as the Ministry of Public Health. A central aspect of this component is also to establish a cost recovery mechanism in order to ensure the sustainability, through the use of public funds, of the following 5 key agricultural health and food safety services: Anthrax control and cattle identification program; Tamarinier’s National Veterinary and Food Control Laboratory (LVCQAT); quarantine; the Fruit Fly monitoring and control program; and the Classical Swine Fever and Teschen disease control and pig identification programs.

**Component II**, Plant Health, seeks to improve the performance of plant health services by training its laboratory and risk analysis unit staff, distributing new phytopathology and virology equipment, developing better biosecurity, quality and laboratory protocols, and facilitating the sharing of plant health data through the MARNDR website and with a monthly plant health surveillance bulletin. Throughout the whole country, 5,500 voluntary farmers will also be trained to identify and report plant pests, and will eventually form an active nationwide plant health surveillance network. Last but not least, Component II includes two pilot pest control programs targeting the fruit fly in Gros Morne and Terre Neuve, and the crazy ant in Abricot and Moron. Each of these two pilots will use traps and attractants specifically designed to kill the targeted pest and control the infestation.

**Component III**, Animal Health, seeks to improve the performance of animal health services through the regular maintenance of the national network of solar-powered refrigeration units used to store vaccines and samples, the training of its risk analysis unit staff, the training and accreditation of 1,250 private veterinary professionals, and the better sharing of animal health data through the MARNDR website and a monthly bulletin. Throughout the whole country, 5,500 voluntary farmers will also be trained to identify and report animal diseases, and will eventually form an active nationwide animal health surveillance network. Component III also includes a nationwide vaccination campaign aimed at immunizing 800,000 pigs from the classical swine fever and the Teschen disease, as well as three rounds of epidemiological surveys at Y1, Y3 and Y5 aimed at collecting data on these two specific diseases.

**Component IV** aims at strengthening Tamarinier’s National Veterinary and Food Control Laboratory (LVCQAT) through the upgrading of its infrastructures, the distribution of new laboratory equipment, the establishment of improved procedures and practices, and the training of the laboratory’s staff.

This evaluation will focus on component II. The other components will be evaluated following a reflexive approach as it is not feasible to identify a clear counterfactual for these interventions. Specifically, for component II, the impact of the two pilot pest control programs targeting the fruit fly in Gros Morne and Terre Neuve, and the crazy ant in Abricot and Moron will be evaluated. For each pilot, it will be possible to identify a clear group of beneficiaries as well as a proper counterfactual in order to measure the pilot’s impact.

The interventions from component I involve the construction of new infrastructures, the distribution of new equipment, the improvement of procedures and protocols, the training of staff and the better sharing of animal and plant health data will benefit to the Haitian population as a whole and therefore, it would not be possible to compare beneficiaries with non-beneficiaries in order to estimate the impact of these interventions. Instead, an overall assessment of the performance of animal and plant health services will be performed in Y5 by the IICA and the OIE respectively. These new scores will then be compared to baseline levels in order to assess whether the quality of these two services have improved as a result of the project following (reflexive approach).

The interventions from component III will also be evaluated using a reflexive approach, Specifically, the impact of the nationwide pig vaccination campaign against the Teschen disease and the classical swine fever on the rate of prevalence of these two diseases as well as on the associated mortality and morbidity rates will be measured through a series of rigorous nationwide epidemiological surveys. Two rounds of epidemiological surveys will take place: one just before the start of the vaccination campaign; and the second just after. Thus the quasi-experimental evaluation will be divided in two main parts. The first part aims at identifying the impact of the first pilot targeting the crazy ant in the communes of Abricot and Moron, while the second part aims at identifying the impact of the second pilot targeting the fruit fly in the communes of Gros Morne and Terre Neuve.

The first part focusing on the crazy ant aims at answering the following evaluation questions:

* Does the crazy ant pilot program translate into a decrease in crop losses?
* Does the crazy ant pilot program also lead to a decrease in livestock losses?

The second part focusing on the fruit fly aims at answering the following evaluation questions:

* Does the fruit fly pilot program allow mango producers to sell a larger share of their production to mango exporters?
* Is targeting the fruit fly justified from a cost-benefit analysis perspective?



**Picture 1: Haitian Mango Factory**

B. Impact and Outcome Indicators

Table 4 gives the impact and outcome indicators that will be part of the project’s evaluation as well as their formula, frequency of measurement and means of verification:

**Table 4**

**Impact and Outcome Indicators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **Formula / Definition** | **Frequency of Measurement** | **Means of Verification** |
| **Impact** | | | |
| Increase exports of Haitian agricultural products | Quantity of mango “Francisque” exports to the USA (in tons/Ha) | Annual | Data from mango "Francisque" exporters and USDA |
| Annual crop and livestock losses caused by crazy ants (in %) | Average annual percentage of crop and livestock losses due to crazy ants infestation (in %) | 2016; 2017; 2018 | Baseline and follow up household surveys |
| Annual crop losses caused by fruit fly (in %) | Average annual percentage of crop lost due to fruit fly infestation (in %) | 2016; 2017; 2018 | Baseline and follow up household surveys |
| Annual loss of pigs caused by the classical swine fever (in US$) | Average # of pigs killed by CSF (in US$) | 2016; 2017 | Epidemiological surveys |
| Annual loss of pigs caused by the Teschen disease (in US$) | Average # of pigs killed by Teschen (in US$) | 2016; 2017 | Epidemiological surveys |
| **Component I: Institutional Management** | | | |
| Number of farmers who will benefit from provision of decentralized plant and health services | # of farmers | Annual | Monitoring reports from the ministry |
| Cost covered by fees in the fruit fly monitoring and control program |  | Annual | Data and reports from the Agricultural Health Unit |
| Cost covered by fees in the CSF and Teschen disease control and pig identification program |  | Annual | Data and reports from the Agricultural Health Unit |
| Cost covered by fees in the Anthrax control and cattle identification program |  | Annual | Data and reports from the Agricultural Health Unit |
| Costs covered by fees at LVCQAT |  | Annual | Data and reports from the Agricultural Health Unit |
| Costs covered by fees in the Quarantine services |  | Annual | Data and reports from the Agricultural Health Unit |
| **Component II: Plant Health** | | | |
| Performance of plant health services | Score PVS/IICA (in %) | 2019 | PVS/IICA evaluation |
| Number of farmers who benefit from improved plant health (fruit fly and crazy ant pilots) | # of farmers | Annual | Monitoring reports from the ministry |
| In Gros Morne and Terre Neuve: infestation rate of fruit flies | Flies per trap per day | Daily (during mango season) | Data and reports from DPV |
| **Component III: Animal Health** | | | |
| Improve performance of animal health services | Score PVS/OIE (*in points*) | 2019 | PVS/OIE evaluation |
| Number of farmers who benefit from improved animal health (CFS and Teschen disease vaccination campaign) | # of farmers | Annual | Monitoring reports from the ministry |
| Improve animal health conditions in the country | Prevalence rate of the Classical Swine Fever *(in: %)* | 2016; 2017 | Epidemiological surveys |
| Prevalence rate of the Teschen disease *(in: %)* | 2016; 2017 | Epidemiological surveys |
| **Component IV: Tamarinier National Veterinary and Food Control Laboratory** | | | |
| Improve performance of the Tamarinier National Veterinary and Food Quality Control Laboratory | Obtention of P2 Accreditation | 2018 | Accreditation certificate |
| # of veterinary analyses that the LVCQAT is able to perform | Annual | UPS Information System; Tuskegee University and Cuban veterinary mission reports. |
| Average # of days between the reception of a sample and the transmission of the results of the analysis to clients | Annual | UPS Information System |

C. Impact Evaluation Methodology for the Crazy Ant Pilot

1. **Methodology**

The infestation of crazy ants is a relatively new phenomenon in Haiti. In the Grande Anse department, which is the most affected area in the country, it dates back to 2009. The lack of data on crazy ants combined with MARNDR’s institutional weaknesses and limited funding have up to now prevented the development and implementation of an efficient and sustainable mechanism to control the infestation of crazy ants, let alone eradication. As a result, crazy ants have spread extensively over 9 out of 12 communes located in Grande Anse.

In March 2014, during the project design phase, the MARNDR conducted a small survey over a sample of 97 farmers in these 9 communes in order to estimate the effect of the crazy ant infestation on agricultural production and farmers in their daily lives. According to the results of this survey, average losses per hectare range from 88.3% of total harvest for pigeon pea (“pois congo” in French) to 97% of total harvest for corn. The data indicates that the four crops the most affected by crazy ants are pigeon pea, corn, beans and yam (henceforth referred to as “reference crops”). In addition to destroying crops, crazy ants also prevent in some instances farmers from accessing their plots because of their bites and the allergies they cause. The consequences from such a plague also include killing farmer’s livestock such as chicks, calves and piglets, and attack food reserves inside homes thus affecting farmers in every aspect of their daily lives. Despite the shortcomings of this survey such as small sample size and potential selection bias, it shows unambiguously that the effects of the crazy ant infestation on agricultural production are large. It also shows that this effect is relatively homogeneous across all 9 communes.

The pilot’s strategy is to control the infestation of crazy ants through the installation of traps. In order to provide significant results, it is estimated that there must be a density of 750 traps per km². Since traps cannot all be installed simultaneously over large geographical areas, the most effective way to install them is to follow a “sweeping” pattern: starting on one geographical boundary of the targeted area and then cover it progressively until the opposite boundary is reached. Molasses will be used as bait and each trap will have to be refilled with bait every two weeks. Molasses will be combined with boric acid, a slow and contagious poison whose objective will be to kill working crazy ants slowly in order to leave them enough time to go back to the anthill and contaminate the queen ant. The larger the number of working crazy ants contaminated with the poison, the more likely it is that the queen ant will also be contaminated and thus killed. Once the queen dies, the remaining working crazy ants become much less active and will eventually also die from the poison. The likelihood that crazy ants will move systematically from treated halves to non-treated ones is small because crazy ants tend to stay within a 0.5 km radius of the anthill to which they belong.

The crazy ant pilot will be implemented in the 2 adjacent communes of Abricot (108 km²) and Moron (183 km²). These two communes have been selected by the Plant Health Directorate for the following reasons:

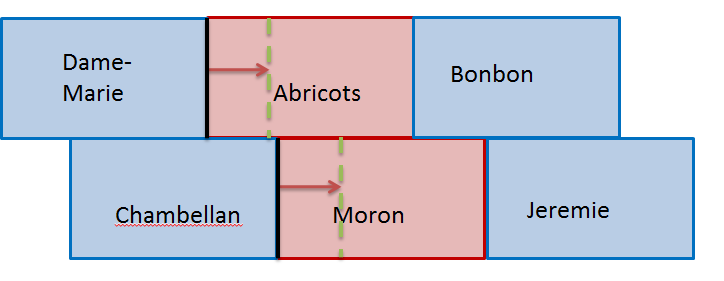
* + Easy accessibility: the installation of traps and the distribution of baits and poison require extensive travels around the entire treated area, which implies that operating costs and the length of time needed to perform these field operations can be minimized by working in these two communes.
  + High level of agricultural production: the agricultural production of these two communes is among the highest of the department, specifically with regard to the production of beans, pigeon peas (or Pois Congo) and corn, thanks to their proximity with Jérémie, the department’s capital, and their ecological characteristics.[[1]](#footnote-1)

The main expected impact from this pilot is a decrease in agricultural losses. The control of the crazy ant infestation will indeed significantly decrease the quantity of crops destroyed as well as facilitate farmers’ access to their plots. According to the Plant Health Directorate (DPV), this decrease in agricultural losses will, for the most part, be observable within a year since most of the crops that are affected by the crazy ant, such as the reference crops, grow annually.

The impact evaluation methodology proposed is a quasi-experimental regression discontinuity design (RDD). This methodology requires that the program be assigned using a random (i.e. non-biased) criterion, which, in the context of the crazy ant pilot, will be the geographical boundary. Given that the installation of traps will follow a “sweeping” pattern, it will be possible to compare early-beneficiaries (i.e. farmers living and working in the half of the commune in which traps have been installed first) with late-beneficiaries who live and work in the same commune but in the other half in which traps have not yet been installed. It will also be possible to compare early- and late-beneficiaries with another group of farmers living and working in other communes such as Dame-Marie and Chambellan, which are directly adjacent to Abricot and Moron and which are not included in the pilot in order to measure longer term impacts. We can refer to this group of farmers as the control group. In other words, the only criterion assigning farmers to the early-treatment, the late-treatment or the control group will be the geographical boundary and the identification of the project’s causal effect will come from comparing farmers (the unit of analysis) living and working in each of these three groups. This random criterion prevents any selection bias and thus ensures that these three groups will be truly comparable to each other.

Within the 2 selected communes, a total of 218,000 traps will be installed between March 2016 and July 2017. The first 109,000 traps will be installed between mid-March and mid-June 2016 in the first half of each of these 2 communes (henceforth referred to as early-treatment halves). The remaining 109,000 traps will be installed between mid-May and mid-July 2017 in the other half of each of these 2 communes (the late-treatment halves). In the illustration below, if the installation of traps starts simultaneously on the western borders of both Abricot and Moron (the dark line) and then follows a sweeping pattern (the pink arrows) toward the other side of each commune until all first 109,000 traps are installed (the green dotted line), then we will be able to measure:

* **1-year effects**:
  + By comparing early-treatments (farmers living and working in the area located between the dark and the green dotted line of both Abricot and Moron) with late-treatments (farmers living and working in either Abricot or Moron but in the area located on the right side of the green dotted line) right before the remaining 109,000 traps are installed.
  + By comparing late-treatments with the control group (farmers living and working in the area located on the left side of the dark line of both Dame-Marie and Chambellan) one year after the remaining 109,000 traps are installed.
* **2-year effects**:
  + By comparing early-treatments with the control group one year after the remaining 109,000 traps are installed.



**Illustration 1: Abricot, Moron and neighboring communes**

Thus we have two discontinuities: the green dotted line for the early- and the late-treatment group; and the dark line for the early-treatment group and the control.

In the absence of the project, the impact and outcome indicators for both groups would be equal on average. Thus we would have:

*Yi (t=1, P=0) = Yj (t=1, P=0) = Yk (t=1, P=0)*

Where,

*Y* is an outcome indicator

*i*  represents farmers in the early-treatment halves

*j*  represents farmers in the late-treatment halves

*k*  represents farmers in the control halves

*t=0* is before the start of the pilot

*t=1*  is after the start of the pilot

*P=0* indicates no treatment

*P=1* indicates treatment

Because of the risk of spillovers (control farmers installing the same traps and baits as those used in the pilot after having observed their positive impacts), it is more reasonable to describe this RDD as fuzzy: one in which the geographical boundary variable “does not perfectly determines treatment and control but influences the probability of treatment”[[2]](#footnote-2). As a result, the geographical boundary, or more specifically the distance from the discontinuity, will be used as an instrumental variable (IV) to predict treatment and the causal effect of the pilot will be estimated using two-stage least squares.

*First stage*: *P = α + ρZ + ε*

Where,

*P=1* indicates treatment

*α*  is a constant

*Z* is the distance from the discontinuity (the IV)

*ε*  is a the error term

In the second stage, the estimated values of treatment () from the first stage are used to estimate the impact:

*Second stage*: *Y = α + θ + ε*

Where,

*Y* is the outcome of interest

*α*  is a constant

*ε*  is a the error term

Using the two-stage least squares thus allows us to measure the causal effect of the pilot on the various outcomes of interest such as agricultural productivity.

It is crucial for the RDD methodology proposed here that GPS data is collected on the discontinuity borders. Moreover, GPS coordinates of the house and plots of all sampled farmers must be collected.

1. **Power Calculations**

Statistical power calculations were performed to establish the number of households (HH) needed in the early-treatment, the late-treatment and the control groups. In the absence of agricultural productivity data, these calculations are based on the expected increase in rural HH income taken from the Survey of Living Condition in Haiti (ECVH, 2001). The survey conducted by MARNDR in March 2014 provides data on agricultural losses caused by crazy ants but the sample used was so small, and the losses declared so large, that the detectable effect would have certainly been overestimated. As a result, it was decided to estimate a more conservative sample using income as the main variable.

In addition, given that rural HH income was only available at the department level and thus had a large variance, the top and lowest 5% of the data was removed in order to better reflect the fact that the area targeted by the program is smaller (a commune being an administrative unit smaller than a department) and thus likely to be more homogeneous. After this modification, the data indicates that the average agricultural income per HH in rural areas of the Grande Anse department is 2,674 HTG, with a standard deviation of 2,450 HTG. The calculations assume an expected increase in rural HH income of 20%. Based on the expected 25%decrease in agricultural losses resulting from the intervention (see economic analysis) and on the assumption that most of the income from rural HH comes from agriculture, such an increase in rural HH income is realistic.

The calculations were done with a power of 0.80 and a 5% significance level, and based on the hypotheses of complete take-up up (i.e. all farmers who are offered participation to the project will accept) and no attrition (since the time lag between baseline and the second follow up is just two years and the expected benefits of the project are high).

Based on this, we estimated the following:

**Table 5**

**Power Calculations**



A sample of 700 farmers at baseline and the same number for each follow up will provide sufficient power to detect increases in rural HH income of 19.4% or more. Thus the total sample size will be 2,100.

1. **Individual sampling**

MARNDR’s 2009-2010 agricultural census (RGA for its French acronym), which contains information on crops grown and residence, will be used as the sampling frame.

1. **Data Collection**

There will be three rounds of surveys: a baseline and two follow up surveys. In order to match the schedule of intervention with the agricultural calendar of key crops affected by crazy ants (**Table 6**), surveys should be administered between end of January and February of 2016 (baseline), 2017 (first follow up) and 2018 (second follow up).

**Table 6**

**Agricultural Calendar in Grande Anse**[[3]](#footnote-3)



1. **Questionnaire**

The main data collection instrument for this evaluation will be a household survey with detailed plot-level and crop information (**Table 7**).

**Table 7**

**Survey Instrument**

|  |
| --- |
| **SECTION** |
| **Section 1: HH information** |
|  |
| Section 1.1: Identification of HH members |
| Section 1.2: Information on education, health and work |
| **Section 2: Plots information** |
|  |
| Section 2.1: List of plots |
| Section 2.2: Information about plots owned |
| Section 2.3: Information about plots rented |
| Section 2.4: Information about leased plots |
| Section 2.5: Information about purchase and sale of land |
| Section 2.6: Information about the use of agricultural technologies on plots |
| **Section 3: Crop information** |
|  |
| Section 3.1: List of annual crops |
| Section 3.2: Seeding of annual crops |
| Section 3.3: Use of agricultural inputs on annual crops |
| Section 3.4: Labor used for annual crops |
| Section 3.5: Annual crops production |
| Section 3.6: Annual crops storage and commercialization |
| Section 3.7: Production of perennial crops and fruits |
| Section 3.8: Labor used for perennial crops |
| Section 3.9: Perennial crops storage and commercialization  Section 3.10: Crop losses (including losses from crazy ants) |
| **Section 4: Livestock information** |
|  |
| Section 4.1: Livestock inventory |
| Section 4.2: Livestock production  Section 4.3: Livestock losses (including losses from crazy ants) |
| **Section 5: Farmers organization membership** |
| **Section 6: Housing:** |
|  |
| Section 6.1: Status of housing occupancy |
| Section 6.2: Physical characteristics of the house |
| Section 6.3: Water and sanitation |
| Section 6.4: Electricity |
| **Section 7: Assets, Income and expenditures** |
|  |
| Section 7.1: HH assets |
| Section 7.2: HH incomes |
| Section 7.3: HH expenditures |
| Section 7.4: Food expenditure and consumption |
| **Section 8: Access to finance** |
|  |
| Section 8.1: Informal savings |
| Section 8.2: Bank accounts |
| Section 8.3: Credit |
| **Section 9: Food security** |
|  |
| Section 9.1: Dietary diversity |
| Section 9.2: HH hunger scale |
|  |

1. **External Validity**

The one factor that could threaten the external validity of this design is that the 2 communes of Abricot and Moron have been selected for their accessibility and their relatively large level of agricultural production in the Grande Anse department. Although this factor must be taken into account when drawing conclusions from this study, it should still provide a reliable indicator for the success of similar projects.

D. Impact Evaluation Methodology for the Fruit Fly Pilot

1. **Methodology**

The fruit fly (*Anastrepha obliqua*) is currently one of the most important pests affecting the production of mangoes in Haiti. Fruit flies (FF) lay eggs in mangoes and larvae then nourish themselves with the fruit’s pulp. In the Artibonite department, one of the country’s largest mango producing areas, mango “Francisque” producers can sell their fruits for 60 HTG the dozen to exporters, instead of only 20 HTG in the local market.[[4]](#footnote-4) This price differential is explained by the fact that exports of mango “Francisque” to the US is a niche market (for the rest of this document, the term “mango” will exclusively refer to “Francisque” mango). However, in order to qualify for selling these mangoes to export factories, producers must be operating in an area in which monitoring traps are installed (with a density of at least one monitoring trap per km²) and in which the average number of flies caught per trap per day measured with these traps is less than two (a threshold established by the US Department of Agriculture, USDA).



**Picture 2: Mangoes “Francisque” sold in a US fruit market**

In collaboration with USDA, MARNDR has installed monitoring traps in several mango producing areas around the country. While these monitoring traps have helped mango exports to the US, Canada and the Dominican Republic to reach about US$10 million per year, the current system is not entirely reliable and has shown some limitations. In 2007 for instance, US mango importers decided to suspend shipments from Haiti just 3 months after the the season started (which usually lasts for 4 to 5 months) because of the presence of fruit fly larvae inside some containers, which led to losses estimated to about US$4 million for mango exporters. Moreover, because of their low density (one per km² on average), monitoring traps alone do nothing to control the fruit fly infestation. As a result, the fruit fly infestation represents today the biggest threat to the export of mangoes and to the development of this crop in general.

This pilot’s strategy is to control the infestation of fruit flies through the installation of handmade traps (made out of recycled plastic bottles). In order to provide significant results, it is estimated that there must be a density of 500 traps per km² on average. Since traps cannot all be installed simultaneously over large geographical areas, the most effective way to install them is to follow a “sweeping” pattern: starting on one geographical boundary of the targeted area and then cover it progressively until the opposite boundary is reached. Molasses combined with an insecticide will be used in 80% of traps. The remaining 20% will be filled using a more expensive killer bait: the Torula yeast. While the former traps will have to be refilled every two weeks, the latter will have to be refilled weekly. These traps will attract fruit flies, trap them and then kill them inside the trap. With a high density of traps, such as the one favored by the pilot, it is expected that the infestation of fruit flies will be controlled in treated areas. Just like in the case of crazy ants, the likelihood that fruit flies will move systematically from treated halves to non-treated ones is small because these flies do not really “fly” but instead live within a relatively restricted area of 4 km².[[5]](#footnote-5)

This pilot will be implemented in the two adjacent communes of Gros Morne (326 km²) and Terre Neuve (66 km²). These two communes have been selected by the Plant Health Directorate (DPV) for the following reasons:

* + Infestation rates: based on the data collected by DPV using monitoring traps, these two communes are the only two that constantly have an average infestation rate of more than two flies per trap per day (among those where farmers produce mango “Francisque” for exports).
  + High level of mango production: Gros Morne and Terre Neuve are the only two communes of the Artibonite department where farmers produce mango “Francisque” for exports, and Gros Morne is among the largest in the whole country.[[6]](#footnote-6)



**Illustration 2: Gros Morne and Terre Neuve**

The main expected impacts from this pilot are the following:

* Increase the quantity of mango exported through:
  + Reduction to the minimum of the quantity of mango infested with larvae and thus rejected because of fruit flies larvae at the USDA sorting factory (the current infestation rate for mangoes received at the factory is 7%)
  + Increase harvest period for mango francisque: if the pilot is successful at controlling the infestation of fruit flies, the harvest of mangoes can be expected to last for an extra 1 or 2 months.
* Increase gross margin of mango per hectare for mango producers in the targeted areas (mainly through larger shares of production sold to exporters)

As mentioned before, according to DPV and USDA, these impacts should materialize during the first harvest that follows the installation of traps. The impact of the pilot on the quantity of mango exported, the duration of the mango season and the infestation rate for mangoes received at the USDA sorting factory will be measured with a before-after comparison using data provided by USDA and mango exporters. On the other hand, the impact of the pilot on the gross margins of mango per hectare will be measured using a proper counterfactual.

Unlike in the crazy ant pilot, there is no commune directly adjacent to the two that have been selected for this pilot in which a RDD could be implemented in order to identify a control group. Indeed Gonaïves, Anse Rouge, Bassin Bleu and the other adjacent communes are not areas in which farmers produce mango “Francisque” for exports. As a result, the impact evaluation methodology proposed to measure the pilot’s impact on gross margins of mango per hectare can be divided in two:

1. A quasi-experimental “fuzzy” regression discontinuity design (RDD) using the geographical boundary as the random assignment criterion in order to measure the pilot’s one-year effects (same methodology as the one used for the crazy ant pilot).
2. A quasi-experimental propensity-score matching (PSM) in order to identify a control group located outside the two communes of intervention and measure the pilot’s longer term effects.

Concerning the first approach: given that the installation of fruit fly traps will also follow a “sweeping” pattern, it will be possible to compare early-beneficiaries (i.e. farmers working in the half of the commune in which traps have been installed first) with late-beneficiaries who work in the same commune but in the other half in which traps have not yet been installed. Within the two selected communes, a total of 198,000 traps will be installed between September 2015 and October 2016. These traps must be installed before mango trees bloom that is between September and February, in order to have an impact during the first harvest that follows (i.e. May). Thus the first 98,000 traps will be installed between September and October 2015 in the first half of each of these 2 communes (early-FF-treatment areas). The remaining 98,000 traps will be installed between September and October 2016 in the other half of each of these two communes (late-FF-treatment areas). The identification of the project’s causal one-year effect will thus come from comparing mango producers (the unit of analysis) working in early-FF-treatment areas to those working in late-FF-treatment areas.

As described in section **D**, **a)**, the distance from the discontinuity (i.e. the geographical boundary between early-FF-treatment and late-FF-treatment areas) will be used as an instrumental variable (IV) to predict treatment and the causal effect of the pilot will be estimated using two-stage least square. Again, it is crucial for the RDD methodology proposed here that GPS data is collected on the discontinuity borders. GPS coordinates of the house and plots of all sampled farmers must also be collected.

Concerning the PSM approach: given that the assignment of mango producers between treatments (both early and late) and controls cannot be random, there is a risk of selection bias and thus of having treatment and control groups which are not truly comparable to each other. With the PSM approach, it is possible to estimate the probability of participating in the project (*P=1*) given a vector of observed characteristics (*X*). We calculate the propensity score as follows:

*Pr* (*P*) = *Pr* (*P=1*|*X*)

Where:

*X* is the set of characteristics that determine participation

A key assumption of the PSM approach is that of conditional independence: after having controlled for the set of variables *X*, the potential outcomes for both treatment and control groups must be independent of their treatment status. Based on this, PSM matches households that have the closest propensity score and then constructs a valid counterfactual that is able to offer accurate estimates of the project’s impact.

In order to obtain the best matches, it is crucial that the pool of individuals (or potential controls) that do not participate in the intervention being tested and from which controls will be selected based on their propensity scores be much larger than the actual number of controls needed. In the fruit fly pilot baseline, we will thus survey three times more potential controls than needed and then keep only the best matches as controls for the follow up surveys.

The Plant Health Directorate has identified two communes located in the Centre department in which farmers produce mango “Francisque” for exports and which are relatively similar to Gros Morne and Terre Neuve: Saut d’Eau has a humid climate like Terre Neuve and Mirebalais is drier like Gros Morne. The pool of potential controls previously described will thus be selected from these two communes. Variables that will be used for matching will include: whether a farmer produces mango “Francisque” for exports; number of mango trees owned; quantity of mangoes harvested; farm size; age/gender/education of household head…

We will then be able to estimate the project’s impact as follows:

Impact = *E* [*Yi* (*t*=*1*, *P*=*1*) – *Yj* (*t*=*1*, *P*=*0*)]

Where :

*Yi* is the outcome for the treatment group (both early- and late-)

*Yj* is the outcome for the control group

*t=1* is after the start of the pilot

*P=1*  indicates treatment

Using PSM thus allows us to measure the causal effect of the pilot on the various outcomes of interest such as gross margins of mango per Ha.

1. **Power Calculations**

Statistical power calculations were performed to establish the number of households (HH) needed in the early-treatment, the late-treatment and the control groups. In the absence of data on mango yields and gross margins, these calculations are based on the expected increase in rural HH income taken from the Survey of Living Condition in Haiti (ECVH, 2001).

Given that rural HH income was only available at the department level and thus had a large variance, the top and lowest 5% of the data was removed in order to better reflect the fact that the area targeted by the program is smaller and thus likely to be more homogeneous. After this modification, the data indicates that the average agricultural income per HH in rural areas of the Artibonite department is 2,793 HTG, with a standard deviation of 2,446 HTG. The calculations assume an expected increase in rural HH income of 15%.

The calculations were done with a power of 0.80 and a 5% significance level, and based on the hypotheses of complete take-up up (i.e. all farmers who are offered participation to the project will accept) and no attrition (since the time lag between baseline and the second follow up is just two years and the expected benefits of the project are high).

Based on this, we estimated the following:

**Table 8**

**Power Calculations**



A sample of 1,200 farmers at baseline and the same number for each follow up will provide sufficient power to detect increases in rural HH income of 14.16% or more. As described in the previous paragraph, we will survey three times more control farmers than needed at baseline (i.e. 1,200) in order to identify the best 400 matches. The sample size of the control group will then be 400 during the first and second follow up. Thus the total sample size for the fruit fly pilot will be 4,400.

1. **Individual sampling**

MARNDR’s 2009-2010 agricultural census (RGA for its French acronym), which contains information on crops grown and residence, will be used as the sampling frame.

1. **Data Collection**

There will be three rounds of surveys: a baseline and two follow up surveys. In order to match the schedule of intervention with the agricultural calendar for mango “Francisque” (harvest starts in May), surveys should be administered in September 2015 (baseline), 2016 (first follow up) and 2017 (second follow up).

1. **Questionnaire**

The main data collection instrument for this evaluation will be a household survey with detailed information on mango production (**Table 9**).

**Table 9**

**Survey Instrument**

|  |
| --- |
| **SECTION** |
| **Section 1: HH information** |
|  |
| Section 1.1: Identification of HH members |
| Section 1.2: Information on education, health and work |
| **Section 2: Plots information** |
|  |
| Section 2.1: List of plots |
| Section 2.2: Information about plots owned |
| Section 2.3: Information about plots rented |
| Section 2.4: Information about leased plots |
| Section 2.5: Information about purchase and sale of land |
| Section 2.6: Information about the use of agricultural technologies on plots |
| **Section 3: Crop information** |
|  |
| Section 3.1: List of annual crops |
| Section 3.2: Seeding of annual crops |
| Section 3.3: Use of agricultural inputs on annual crops |
| Section 3.4: Labor used for annual crops |
| Section 3.5: Annual crops production |
| Section 3.6: Annual crops storage and commercialization |
| Section 3.7: Production of perennial crops and fruits |
| Section 3.8: Labor used for perennial crops |
| Section 3.9: Perennial crops storage and commercialization  Section 3.10: Crop losses (including losses from fruit fly) |
| **Section 4: Livestock information** |
|  |
| Section 4.1: Livestock inventory |
| Section 4.2: Livestock production |
| **Section 5: Farmers organization membership** |
| **Section 6: Housing:** |
|  |
| Section 6.1: Status of housing occupancy |
| Section 6.2: Physical characteristics of the house |
| Section 6.3: Water and sanitation |
| Section 6.4: Electricity |
| **Section 7: Assets, Income and expenditures** |
|  |
| Section 7.1: HH assets |
| Section 7.2: HH incomes |
| Section 7.3: HH expenditures |
| Section 7.4: Food expenditure and consumption |
| **Section 8: Access to finance** |
|  |
| Section 8.1: Informal savings |
| Section 8.2: Bank accounts |
| Section 8.3: Credit |
| **Section 9: Food security** |
|  |
| Section 9.1: Dietary diversity |
| Section 9.2: HH hunger scale |
|  |

**E. Evaluation Work Plan and Budget**

**Table 10**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **2015** | | | | **2016** | | | | **2017** | | | | **2018** | | | | **2019** | | | | **Responsible** | **Cost (currency)** | **Source of Funding** |
| **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| Questionnaire design and pilot survey |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 10,000 | HA-L1094 Project budget |
| Data collection for fruit fly baseline survey (2,000 surveys at 70 USD each) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 140,000 | HA-L1094 Project budget |
| Data collection for crazy ant baseline survey (700 surveys at 70 USD each) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 49,000 | HA-L1094 Project budget |
| Baseline report for both pilots |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant; BID; MARNDR | US$ 25,000 | HA-L1094 Project budget |
| Data collection for fruit fly follow up survey #1 (1,200 surveys) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 84,000 | HA-L1094 Project budget |
| Data collection for crazy ant follow up survey #1 (700 surveys) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 49,000 | HA-L1094 Project budget |
| Intermediate evaluation report with analysis of follow up #1 for both pilots |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant; BID; MARNDR | US$25,000 | HA-L1094 Project budget |
| Data collection for fruit fly follow up survey #2 (1,200 surveys) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 84,000 | HA-L1094 Project budget |
| Data collection for crazy ant follow up survey #2 (700 surveys) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant | US$ 49,000 | HA-L1094 Project budget |
| Final evaluation report with analysis of follow up #2 for both pilots |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Consultant; BID; MARNDR | US$ 25,000 | HA-L1094 Project budget |

**Total Cost of the Evaluation Plan: US$ 540,000**

**REFERENCES**

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1. Plant Health Directorate [↑](#footnote-ref-1)
2. Winters, Salazar and Maffioli (2010) [↑](#footnote-ref-2)
3. Plant Health Directorate [↑](#footnote-ref-3)
4. Plant Health Directorate [↑](#footnote-ref-4)
5. Plant Health Directorate [↑](#footnote-ref-5)
6. Plant Health Directorate [↑](#footnote-ref-6)