ETHANOL PROGRAM AS HOUSEHOLD FUEL

THE WORLD BANK

Green Development

PRODUCTION OF ETHANOL FOR HOUSEHOLD PROGRAM

INTEGRATED PEST AND PESTICIDES MANAGMENT PLAN

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List of abbreviations

CIRDA	Circonscription du Développement de l'Agriculture
CITES	Convention sur le commerce International des espèces de faune et de flore sauvages menacées d'extinction
CMCS	Centre Malgache de la Canne à sucre
CNA	Centre National Anti-acridien
CNRE	Centre National de Recherche sur l'Environnement
CSB	Centre de Santé de Base
DDT	Dichloro Diphényle Trichloroéthane
DPV	Direction de la Protection des Végétaux
DRDA	Direction Régionale du Développement de l'Agriculture
FAO	Organisation des Nations Unies pour l'Alimentation et l'Agriculture
FOFIFA	Centre National de Recherche Appliquée pour le Développement Rural
GPI	Gestion Phytosanitaire Intégrée
MEC	Madagascar Energy Company
MECIE	Mise en Compatibilité des Investissements sur l'Environnement
ONE	Office Nationale pour l'Environnement
ONG	Organisation non gouvernementale
OP/PO	Politique Opérationnelle
PAD	Plateforme Agrocarburant durable
PGPP/IPPM	Plan de Gestion des Pestes et Pesticides
PMEED	Projet Madagascar Ethanol pour Energie Domestique
POPs	Polluants Organiques Persistants
PPN	Produit de Première nécessité
SIRAMA	Siramamy Malagasy
SIRANALA	Siramamy d'Analaiva
SUCOCOMA	Sucrerie Complant Côte Ouest de Madagascar
SUCOMA	Sucrerie Complant de Madagascar
WWF	World Wild Fund for Nature

SUMMARY

This document, Pests and Pesticides Management Plan, is developed in the context of the preparation of environmental and social safeguard documents to guide the implementation of the Madagascar Ethanol Program as Domestic Energy, in accordance with operational policy PO 4.09 of the World Bank.

Its development is made necessary, when taking into account certain activities of the project that could result in the increase in the use of pesticides and the development of control methods and fight against pests as well as the enemies of sugar cane cultures. These could be harmful from an environmental and social point of view.

In order to better identify the problems of the management of pests and pesticides at the level of the project's intervention areas and suggest the action plan in question, the following methodological approach has been adopted in the preparation of this report:

- Field visits in some sugar cane production areas (in some areas of Brickaville, Foulpointe and Tsiroanomandidy)
- Meetings and discussions with the growers,
- Meetings with the local authorities (head of fokontany, Mayor, district chief);
- Interviews with operators (inputs sellers, bank responsible, micro-distillery units,)
- Documentary analysis.

The analysis of data collected allowed to release the following points:

- The use of pesticides by sugarcane growers remains low in the current situation but it can easily progress considering the size and the objectives of the ethanol fuel program;
- The use of pesticides is not new for producers, insofar as these products have always been used for the treatment of pests especially at the time of SIRAMA, before 2007;
- The development of the ethanol industry and ease of access to bank credit could reverse the situation in favor of an increased use of pesticides and in particular herbicides. Precautionary measures will be considered.
- The analysis of the current pesticides management mode already reveals some problems on the sector, including specifically the lack of approval for certain resellers and the lack of alternative control methods by the growers.
- The constraints that limit the development of the sector concern:
    - To failure and incompetence of technicians in pests and pesticides management;
    - To the lack of prospecting means, control and fight;
    - To the difficulty in the implementation of phytosanitary legislation (lack of application and texts follow-up);

Mitigation measures against these main problems will be oriented towards:

- The improvement of the execution conditions, of the attributions of responsible services for the management of pests and pesticides (DPV);
- The promotion of integrated pesticides management (use, storage, transport and disposal of empty packaging);
- The promotion of regional expertise and the strengthening of capacities, for the actors of the sector.
- The improvement of regional coordination by strengthening the means of communication and means of investigation as well as the establishment of a network of communication that allows a quick flow of information.

The proposed actions below result from the analysis of reports and constitute the action plan for the implementation of an effective pests and pesticides management for the growing of sugar cane, raw material for the production of ethanol:

- The promotion of pesticides management by strengthening the control of existing laboratories, support to the application of regulations and phytosanitary legislation in the program's intervention areas;
- The promotion of the integrated pest management through the development of action-research program, of alternative control methods, by training the population;
- Strengthening the capacity of technicians in pests and pesticides management by cascade training, retraining and study trips
- Support for farmer organizations through trainings, awareness and information of the population
- Monitoring and evaluation.

The implementation of this plan requires the mobilization of significant financial resources. The budget to be allocated is estimated at 99,500 million ariary for a period of three years.

1 INTRODUCTION

1.1 CONTEXT AND OBJECTIVES OF THE STUDY

According to estimates, 95% of the households in Madagascar use firewood and charcoal as energy home. This traditional practice may be harmful not only for the health of the family members, especially children, but it is mostly a factor of deforestation in Madagascar. According to WWF, more than 200,000 ha of forest are lost annually. To resolve these critical ecological and social issues, the Government of Madagascar has launched the Ethanol Program as an alternative energy to charcoal for domestic use. In addition to the reduction of pressure on wood and forest resources that project target, this is also part of the activities it generates in the REDD + mechanism (sale of carbon credits (CER) on the certified emission reductions. A prevision of 100,000 households adopting ethanol as domestic fuel will be covered by the program. It is in this framework that the program benefits financial support from the World Bank. This funding is subject to certain conditionalities such as environmental and social safeguard documents including a framework of environmental and social management (CGES), an integrated pests and pesticides management plan (PGIPP) and a resettlement policy framework (CPR) according to the included disposition in the operational policies developed by the World Bank: OP/BP4.01 (Environmental assessment) OP/4.09 (Pests control), OP/4.12 (involuntary resettlement). The funding will support: (i) the management of the project coordinated by Green Development AS, a Norwegian private company, and (ii) the two (2) pilot Ethanol micro-distilleries.

This document is part of the three regulatory frameworks (CGES, PDIPP, CPR) to serve as a guide to the implementation of the program's activities to comply with the safeguard standards required by the Bank.

1.2 PROGRAM'S ESTABLISHMENT AREAS

The program's document does not mention specific areas for the implementation of the micro-distilleries for the ethanol production, but all regions of Madagascar are concerned. However, it is stated that it is better to choose the sites, where the cost of raw materials is low (access, availability, transport…).
In this context, field studies were conducted on the pilot sites of the project: the micro-distillery managed by Madagascar Energy Company (MEC) located in the fokontany of Ampasimpotsy, rural commune of Ranomafana, District of Brickaville and the micro-distillery created by Ethanol of Madagascasr

(ETHAMAD) located in Ankadira in the rural commune of Foulpointe, Toamasina II District. Visits of the sugarcane plantation areas. As a hypothesis, a household is assumed to consume 250 l of ethanol to replace 1 ton of charcoal consumption and therefore can reduce the emission of 5 tons of greenhouse gas.
In the commune of Brickaville were also conducted as part of the program's intervention area.

1.3 OBJECTIVES OF THE PESTS AND PESTICIDES MANAGEMENT PLAN

The development of this pests and pesticides management plan follows, firstly information collected from the intervention area of a pilot sub-program through interviews and consultations in the general of the population, and sugar cane growers in particular. And secondly, this information from the field were complemented by documentary researches and analysis dealing with the same subject.

The objectives targeted by the pests and pesticides Management Plan concern:

- Evaluate the capacity of the institutional and regulatory framework to promote and implement a safe, efficient and rational management of biological-pests and pesticides and to integrate into the components of the project measures required for capacity-building;
- Set rules and standards to adopt for the sugar cane growers, indirect beneficiaries of the program in terms of management of the use of pesticides and control of biological-aggressors;
- Strengthen practices that aim to reduce dependence on chemical pesticides after the project has been implemented;
- Make sure the negative effects and potential risks for human and animal health as well as the environment pollution (water, air, soil...) are minimized.

This plan focuses on seven large chapters:

- The first chapter presents the legal and institutional framework existing in the country regarding pesticides management;
- The second chapter deals with the sugar cane production sector in Madagascar and in particular at the level of the program's intervention area;
- The third chapter describes the main biological-aggressors that act on the growing of sugar cane, the damage caused by their attacks and developed strategies to combat these scourges;

- The fourth chapter deals with the current situation regarding pesticides management (marketing and use) followed by an assessment of the environmental impact caused by the use of these pesticides;
- The fifth chapter deals with the perception of the population (including growers) on the use of pesticides;
- The sixth chapter describes the practical implementation of the management plan proposed, preceded by the monitoring-evaluation stage as well as the definition of monitoring indicators;
- The last chapter presents the financial aspects in the implementation of the plan.

2 INSTITUTIONAL AND LEGAL FRAMEWORK FOR THE MANAGEMENT OF PESTS AND PESTICIDES

2.1 INSTITUTIONAL AND LEGAL FRAMEWORK FOR THE MANAGEMENT OF PESTS AND PESTICIDES

Madagascar is well equipped with an institutional framework on the issue of pesticide products. At the central level, three technical ministries are involved: the Ministry of Agriculture, for pesticides used in agriculture; the Ministry of environment and forests, which is responsible for all chemicals products including pesticides, and also the framing of the measures on their impact on the environment; the Ministry of public health, responsible of the use of pesticides used in public health (fight against Malaria, the development of texts on the regulation of products used in intra-domiciliary processing). The Environment General Secretariat is responsible for the implementation of conventions and international protocols on chemicals products and persistent organic pollutants (POP). The General Secretariat of the Agriculture Ministry supervise the management of his ministry (DVP and CNA) in charge of insect and pest management policy control, in particular for the protection of crops and locust control. Other government departments (Department of finance and Budget, Ministry of Commerce, etc.) are involved indirectly or directly depending on their respective missions in the implementation of a rational pesticides management. A national committee for the management of chemicals (CNGPC) was created by the decree No. 98-444 of 18/06/98. It is a cross-sectoral organ, a kind of platform bringing together representatives of ministries, of NGOs, of economic operators, importing companies, etc. The CNGPC is the privileged representatives in terms of chemical security in Madagascar. They act in the resolution of inherent problems to the chemicals during their life cycle, for a preventive

protection of the environment and health. They have a power of questioning and advice. An interdepartmental approval committee is established, defined by decree No. 92-473 whose role is to decree on pesticide-related issues. The certification of products is divided into 3 phases (products to experiment, products registered with a temporary issuance of valid sale for a period of 4 years, final products after the monitoring period).

2.2 LEGAL FRAMEWORK FOR THE PESTS AND PESTICIDES MANAGEMENT

In Madagascar, the integrated phytosanitary management (GPI) has been adopted since 1993 as official strategy of crop protection by the Ministry of Agriculture. However, the environmental charter and its amendments set the general framework of the environmental policy implementation whose terms are defined by regulatory texts of application. In the context of global environmental policy, Madagascar has ratified several international conventions such as the Stockholm Convention on persistent organic pollutants, the Rotterdam Convention and the Basel Convention on the transboundary movement of dangerous wastes. These conventions and protocols will be applied if pesticides stocks became obsolete and then exported to countries where there are adequate facilities for their final disposal.

2.2.1 National Legislation

2.2.1.1 The basic environmental legislation

The Charter of the Malagasy environment (Act 90.033 amended and supplemented by laws 97.012 and 2004/015), Decree No. 99.954 amended by Decree n ° 2004/167 in compatibility of investments with the environment (commonly called MECIE Decree), and decree No. 6830/2001 on the participation of the public in the environmental assessment process which form the basis of the legal and regulatory framework of environmental legislation in Madagascar. This framework defines the national environment policy, applicable performance standards and the environmental performance level, in terms of health and safety required for a given project.

To these basic texts are added sectoral texts, including the decree 98.029 bearing the water code and decree 99.021 on the management and control of industrial pollution (with the understanding that the pesticides are industrial products).

2.2.1.2 The legislation on pesticides

The main, current, basic texts are:

- Decree No. 86.013 of 17/09/86, decree No. 86.017 of 11/03/86 and Decree No. 86.310 of 23/09/86 relating to phytosanitary legislation in Madagascar requires stakeholders to combat the enemies of crops;
- Decree No. 92-473 dated 22 April 1992 on the regulations of agro-pharmaceuticals: it specifies the measures necessary to minimize the negative consequences of the applications of agricultural pesticides on the environment. The creation of an inter-ministerial committee for approval objective is to decide on all problems relating to agricultural pesticides, from the import to the application and experimentation, approval and distribution.

By applying the Decree No. 86.310 of 23/09/86 concerning phytosanitary legislation, several application orders are in effect:

- The decree No. 7450/92 of 14/12/92 on rules about sampling control of agro-pharmaceuticals: a compliance control with the standards of approval is done systematically, from import (at customs) to storage before use in order to prevent fraud;
- The decree n ° 7451/92 of 14/12/92 on normalization of the labelling of agricultural pesticides packaging. The label must indicate: the content of the container, instruction manual, safety measures;
- The decree n ° 7452/92 of 14/12/92 regulating the storage and reconditioning of agricultural pesticides by specifying the location, standards and security measures;
- The interdepartmental decree n ° 467/93 03/02/93 regulating the import, manufacture and distribution of agricultural pesticides: only entities authorized by the ministry of agriculture may import, manufacture, market, distribute and provide services in spreading the agricultural pesticides.
- Decree No. 6225/93 of 11/30/93 on suspension and restriction on the use of some pesticides with high toxicity, pursuant to the Stockholm Convention (Chlordane, dieldrin, aldrin, endrin, HCH and DDT, Camphechlor (Toxaphene), Aldicarb (carbamate) Lindane, Endosulfan, heptachlor)
- The decree No. 6242/93 of 11/30/93 relating to the request for approval, the detention authorization of selling point and the authorization of sale.
- Decree No. 95092 31/01/95 establishing sanctions relating to the offences on the marketing, distribution and use of agro-pharmaceuticals and establish the control measures
- Decree No. 99798 06/10/99 concerning registration of biological control agents and biopesticides and the regulation of their marketing and their use.
- Decision n ° 21-00/MinAgri/mid of March 24, 2000, ministerial decision of the Ministry of Agriculture (on the proposal from the DPV and the ONE). This decision deals with specific problems related to locust control.

Note that the legislation currently in effect in Madagascar in terms of pesticides management is well expanded, particularly in several aspects of the management phytosanitary products; However, it has significant deficiencies, particularly in terms of empty packaging management and transport of products as well as the responsibility in case of accident or pesticide leakage.

2.2.2 International conventions

At the Global Summit on Environment held in Rio in 1992, Madagascar, among others, adhered to the resolutions relating to the implementation of Agenda 21. This United Nation's program in six main point recommends, the use of degradable pesticides and promote the use of biological methods in order to minimize the risks from the synthesis products. The following table shows the various conventions which relate directly or indirectly to the use of pesticides to which Madagascar has ratified.

Table n ° 1: List of conventions ratified by Madagascar on the pesticide and related fields.

Conventions	Year of ratification
African Convention on the conservation of nature and natural resources	1970
Convention on international trade of endangered species of wild flora and fauna (CITES)	1975
Convention concerning the protection of the world cultural and natural heritage	1983
Convention on biological diversity	1995
Convention of the United Nations on combating desertification in those countries experiencing serious drought and/or desertification, particularly in Africa	1997
Nairobi Convention: -Protocol on the protection of the coastal marine environment biodiversity - Protocol on the control of pollution and the preservation of biodiversity	1998
RAMSAR Convention related on Wetlands of international importance, especially as waterfowl habitat	1999
Basel convention on the transboundary movement of dangerous waste	1998
Rotterdam Convention (PIC: Prior informed consent)	2004
Stockholm Convention on POPs (persistent organic polluants)	2005

Conventions	Year of ratification
International Convention for the Protection of plants (Rome)	2006

2.2.3 The safeguard policy advocated by the World Bank (OP4.09)

PO 4.09 of the World Bank for pest control (December 1998) applies to all operations of loan or bank financing that the funds granted, finance or not the purchase of pesticides.

In the farming operations funded by the World Bank, the integrated phytosanitary control as well as the prudent use of agricultural pesticides are strongly encouraged. Therefore, the following criteria are to be applied in the selection and the use of pesticides:

(i) The kept products must have insignificant effects on human health;
(ii) Their effectiveness against the target species must be established;
(iii) They must have limited effects on non-target species and the environment;
(iv) Their use must take account of the need to prevent the occurrence of resistant species.

The World Bank does not finance the acquisition of products belonging to Class IA and IB or formulations of the class II if:

(i) The country has no restrictions on their distribution and use, or
(ii) If non-specialists, farmers or other people may use or access them easily without training, equipment and infrastructure needed to manipulate them, store and use them correctly.
(iii) For the classification of pesticides or specific formulas to each of the products, the World Bank refers to the recommended classification by the WHO (OMS). The WHO recommended classification of pesticides based on the dangers they present uses originally 3 classes (in the 1960s) and then adjusted in 4 classes in 1975. The classification of pesticides by danger or risk is based on their acute toxicity expressed by value of the lethal dose LD50 Orally and intradermal (see table 2). Lethal dose 50 indicates the amount of active material expressed in mg/kg of sharp weight and that 50% of a batch of laboratory animals in which it is administered only once.

Table n ° 2: recommended WHO Classification of pesticides based on the danger they present

Class	DL_{50} for a rat (mg/kg of sharp weight)			
	Oral way		Cutaneous way	
	Solid	Liquid	Solid	Liquid

Ia	Extremely dangerous	<5	<20	<10	<40
Ib	Very dangerous	5-50	20-200	10-100	40-400
II	Moderately dangerous	50-500	200-2000	100-1000	400-4000
III	Slightly dangerous	>500	>2000	>1000	>4000
U	No danger for normal use	>2000	>3000	-	-

Source: Copplestone J.L (1988). The development of the WHO recommended Classification of Pesticides by Hazard

3 SECTOR OF SUGARCANE PRODUCTION

Sugarcane (Saccharum officinarum) is a plant from the hot and humid tropical areas but its culture is observed in all regions of Madagascar, except in the dry parts of the South. Two types of sugarcane are grown in Madagascar: (i) cane of mouth, intended for human consumption, for the manufacture of sugarcane's wine or Betsabetsa, of local alcohol or toaka gasy and manufacture of handmade sugar or Siramamy gasy (ii) the industrial sugarcane for the manufacture of alcohol and industrial sugar. Before to 2005, the area made to grow sugarcane ranged from 67,000 to 68,000 ha with 360.000 exploitations (Directory of Agricultural Statistics). Industrial growing of sugarcane represents only 1/7 of the area under cultivation in the entire island, approximately 9,500 ha (governed plantation and independent plantation).

Table n ° 3: Sugarcane production and cultivated area from 2007 to 2010

Year	2007	2008	2009	2010
Surface (ha)	25 750	23 515	23 595	23 540
Production (tons)	480 525	474 440	475 000	447 780

Source: Directory of Agricultural Statistics 2009-2010

For a good production of sugarcane, the development of industrial sugarcane is located mainly at the level of the coast (low elevation), especially around the sugar complexes that most was built at the time of colonization. The sugarcane supply of these sugar-production-complexes is ensured by governed production and growers located in the surrounding communes of these complexes.

The production of industrial sugar at the level of the sugar-production-complexes varies according to the socio-economic and political circumstances prevailing in the country. After the nationalization of sugar-producing units in 1996, two entities account for their

management: the SIRAMA for units in Ambilobe, Brickaville, Namakia, and Nosy Be and SIRANALA for the unity of Morondava. In the context of the disengagement of the State of the productive sector and surfeit to revitalize the sugar industry, lease management have been granted to Chinese group for Morondava (SUCOMA), Namakia (SUCOCOMA) and Ambilobe (SUCOCOMA) and to Vidzar Company for Brickaville and Nosy Be (see table n ° 4).

Table n ° 4: Topography of industrial units of sugar processing

Sugar producing-unit	Ambilobe	Namakia	Nosy BE	Brickaville	Morondava
Date of creation	1949	1935	1923	1930	1983
Exploitation (2015)	SUCOCOMA	SUCOCOMA	Vidzar Company	Vidzar Company	SUCOMA
Total surface (ha)	14 000	8 900	6 300	3 200	6 000
Potential surface for sugarcane (ha)	6 000	3 400	2 250	1 200	2 100
Surface for other crops (ha)	-	900	-	-	-

Source: CMCS

Over these past five years, production in industrial sugarcane is irregular. On the whole, the production trend is declining (see table n ° 5). This decline in production is attributed to the degradation of agricultural infrastructures, to the failure of the product's evacuation roads, the dilapidation of the processing machineries.

Table n ° 5: Production of industrial sugarcane in the sugar-producing units (in tons)

Campaign	2005/2006	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014
Production	188 636	64 241	72 052	44 257	69 001	78 000

Source: CMCS

From 2009 to 2015, the production of industrial sugarcane is ensured by 3 units (Namakia, Ambilobe and Morondava). The unit of Brickaville closed its doors in 2007 and in 2009 for the one in Nosy Be.

3.1 EVOLUTION OF THE SUGARCANE SECTOR IN THE PROJECT'S INTERVENTION AREAS

At the level of the intervention areas, the production of sugarcane either large or small scale, depending above all on investors, of the production mode they adopt and the relationships they establish with the producers or sugarcane growers.

The development of sugarcane production in large scale for the manufacturing of ethanol can be done at the level of the existing production sites (establishment areas of sugar-producing units, see figure 1) or potential sites.

Figure 1: Location of sugar-producing units in Madagascar (Next page)

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Source: CMCS

At the level of the existing industrial sugarcane production sites, the supply of sugarcane to the processing units is handled in three ways: by governed production, production by associations bound by contracts with the processing unit and by independent growers.

The following table outlines potential productivity of sugarcane during the growing-cycle of the plant.

Box 1, Illustrates the case of the current situation at the level of the area of a sugar-producing unit settlement.

BOX 1
Situation of sugarcane production in Brickaville

The first unit of domestic ethanol production is located in the fokontany of Ampasimpotsy, rural commune of Ranomafana by Madagascar Energy Company (MEC) whose sugarcane supply lies in the districts of Brickaville and Vatomandry.

The region of Brickaville with its agro-climatic conditions constitutes an area favorable to the cultivation of sugarcane. Observed productivity in sugarcane vary depending on the number of cuts but especially following the maintenance conducted by the growers. The involvement of Centre Malgache de Canne à Sucre CMCS (Malagasy Sugarcane Center) which ensures the promotion and monitoring of cultivation techniques could ensure a distinct increase in the productivity of sugarcane. Raw sugarcane can display a level of performance up to 70 to 80 tons per hectare.

The closing of Brickaville sugar-processing unit has caused a drastic fall in the production of sugarcane. Sugarcane fields have been replaced by other crops (rice, corn,) or have been left to pasture by the growers.

The CME initiative provoked a renewed interest in local farmers, that most attempt desperately to restart the culture.

Sites or potential area for sugarcane production exist in all regions of Madagascar. Study of phase 2 ("Definition of the potential production of sustainable agrofuel in Madagascar, a quantitative, qualitative and space point of view") conducted by MCD on behalf of PAD/WWF estimated to 11 211 876 ha exploitable areas and 17 387 895 ha exploitable areas under conditions, which is 28 599 771 ha whose largest areas are located in the regions of Menabe (11.2%) and Melaky (10.9%) for the extension of biofuels sector (PAD/WWF, 2011). However, the exploitation of these lands is subject to various conditions such as to achieve food self-sufficiency.

Outside the areas mentioned above, the production of sugarcane by the traditional farmers could contribute substantially to the supply of processing units even though their purpose is destined for domestic consumption or for the manufacture of local rum. This operation mode is found in all regions, characterized by scattered fields and small areas.

In terms of land use, the study defined 3 categories of occupation: i) exploitable areas involving land of savannas and grasslands, with no woody elements. (ii) the exploitable areas under conditions including savannas and grasslands with woody elements; (iii) the

areas to exclude including forests, protected areas, growing areas, wetlands, water bodies, built-up surfaces, mine squares with operating licenses.

exceed rarely 1 ha. These fields are often located in the shallows, in the valleys, small valley, the baiboho, along the rivers and exceptionally elevated areas or on the ridges for the oriental much more humid regions than the other regions. The dispersion of fields can cause problems of collection and transport of raw materials that could put a strain their cost.

It should be noted, that the situation of the agro-ethanol project in 2011 displays a sown surface of 236 ha of sugarcane for an objective of 305 000 ha initiated by 25 projects (WWF, 2011).

3.2 THE PRODUCTION TECHNIQUE OF SUGARCANE

In general, the production of sugarcane can be done either in extensive mode (case of farmers practice in traditional production areas), in either semi-extensive (case of growers located in areas of industrial production and national investors like MEC and ETHAMAD), or intensive and mechanized mode (case of the governed culture of sugar-processing units).

At the level of production by farmers, farming operations are exclusively manual. Farmers plant sugarcane heads and do not renew except rarely their planting. Productivity does not exceed 15 tons to per ha.

In the areas of industrial production, the technique used for the growing of sugarcane is that one spread by the CMCS whose improved production techniques are more or less mastered by the growers: as planting by cuttings (line plantation), the use of fertilizers, weeds-control products, crop pests and diseases.

The technical itinerary of sugarcane production is as follows:

- Clearance of plots
- Soil preparation and making of furrows
- -Plantation of cuttings
- 1st hoeing
- 2nd hoeing
- Ridging
- Removing of inferior leaves
- Harvest

The contribution of fertilizers (organic and/or mineral) is done while working the soil by incorporation with the soil. The fight against bio-aggressors can be done either preventively (in anticipation of the application of pesticides to protect crops against pest's attack) or curative (mitigating the effects of pests or by eradicating them).

Note that, the situation of the agro-ethanol project in 2011 displays a surface sown of 236 ha of sugarcane for an objective of 305 000 ha initiated by 25 projects (WWF, 2011).

3.3 THE PRODUCTION TECHNIQUE OF SUGARCANE

In general, the production of sugar cane can be done either in extensive mode (case of peasant practice in traditional production areas), in semi-extensive (case of growers located in areas of industrial production and domestic national investors like MEC and ETHAMAD), or in intensive and mechanized mode (case of governed plantation in sugar-producing units).

At the level of production by farmers, farming operations are exclusively manual. Farmers plant cane heads and don't renew except rarely their plantation. Performance does not exceed 15 tons to per ha.

In the areas of industrial production, the technique used for the plantation of sugarcane is the one broadcast by the CMCS whose techniques is more or less mastered by the growers: apart from the plantation by cuttings (line plantation), the use of fertilizers, control products against weeds, crop pests and diseases.

The technical itinerary of sugarcane production is as follows:

- Clearing of parcels
- Soil preparation and making of furrows
- Planting of cuttings
- 1st weeding
- 2nd weeding
- Ridging
- Peeling off
- Harvest

The contribution of fertilizers (organic and/or mineral) is done during the soil preparation by incorporation with the soil. The control of bio-aggressors can be done either preventively (by anticipating the application of pesticides to protect crops against pest's attack) or curative (by mitigating the effects of pests or by eradicating them).

The best season to grow sugarcane (wet and hot season) start from June to December. Harvesting can be carried out at the end of the 6th months. On the other hand, if the planting is done during the dry season and cool (from March to May), growers need to wait 12 months to be able to harvest.

The following table outlines the potential productivity of sugarcane during the crop cycle of the plant.

Table n ° 6: Productivity of sugarcane according to the age of the plant.

Year	Productivity (in T/ha)
Raw sugarcane	50
1ère regrowth	70 to 80
2ème regrowth	80 to 120
3ème regrowth	70 to 80
4ème regrowth	70
5ème regrowth	60
6ème regrowth	40

Source: MEC

3.4 The case of Ranomafana micro-distillery's sugarcane supply

The example of the pilot unit's case for ethanol processing (micro-distillery of Ranomafana of MEC company) can be served as an illustration of the mechanism and methods of operation of sugarcane supply in an industrial production zone.

The raw material (sugarcane of mouth or industrial sugarcane) necessary for the supply of Ampasimpotsy micro-distillery comes from three sources:

- Governed production by MEC company;

- The production by Brickaville growers;

- Purchases of sugarcane in Vatomandry.

3.3.1 Sugarcane production at the level of MEC

The plantation of sugarcane is located at a distance of about 5km from the site of the micro-distillery implantation. Sugarcane plantation occupy 30 hectares located in the small valleys (approximately 10 ha) and in alluvial plains (approximately 20 ha). Basins (plateau and uplands) around lowlands are covered with Ravintsara (Cinnanomum camphora) plantation, close to 1000 ha (for the production of essential oils) and paulownia plants.

Planted in June 2014, the 1st cut was made in January 2015. The cultivated varieties are varieties selected by SIRAMA (CMCS), purchased locally from growers in Brickaville region. Three varieties (B29, S26, US) are planted.

At the time of the installation of cultures, dolomite reports, chemical fertilizers and compost are used, 1 to 2 weeks after planting. Insecticide treatments based on organophosphates

(pyrifos) chlorinated as solutions or granules were also used by the company against the attacks of beetle larvae.

3.3.2 The production of sugarcane in the plantations of Brickaville

After 2017, sugarcane cultures fell heavily. Fields were converted into plots of corn, or simply left without culture for pasture. Growers that have the financial means to pay the costs of labor, continued to plant cane. Their production is intended either to the local alcohol manufacturer, or sellers of sugarcane from the Highlands. However, they were all decreasing the areas for sugarcane compared to the situation 8 years ago.

After awareness conducted by MEC, early in the year of 2015, 13 associations of growers were formally formed to meet the needs of the society. 212 growers have decided to plant sugarcane for the project or have already planted sugarcane. These growers are members of 6 formal associations divided in 5 rural communes of the Brickaville District (Brickaville, Vohitranivona, Mahatsara, Andovoranto and Anivorano).

Considering the unsuccessful steps performed by growers at the Bank to finance the 2015 campaign, MEC proceeded the funding of these growers of 470,000 ar/ha to be paid back at the delivery of the crop at a price of 44,800 ar per ton. A 5-year contract has been established between each growers and the MEC.

The areas planted in sugarcane range from 0.25 ha to 6ha following the financial resources implemented by the planters. Given that these producers are former growers from SIRAMA, the techniques conveyed by this sugar-processing unit are applied to plots. The varieties used are improved varieties of SIRAMA like S17, B49, US, M139, M555. No chemical input is used on the crops. The control against weeds (2 times per cycle but can go up to 5 times) is fully manual (the daily cost of an agricultural wage labor is 4000ar or 5000ar).

The harvest from these plantations is expected from September 2015 onwards but the majority of production could be cut from February 2016. Lack of available give on the productivity of sugarcane at the grower's level, an estimate of the production was made: for a production ranging from 25 tons/ha to 50 tons/ha on an average surface area of 1 ha by growers, it is possible to improve a production of approximately 5300 tons to 10600 tons.

Note that 248 growers from 7 remaining associations out of 13, located in the intervention area of MEC, have expressed their desire to plant cane but they face the problem of financing the campaign. They await the outcome of the dealing with the local bank to be able to realize their collaboration with MEC.

3.3.3 Purchases from Vatomandry

While waiting for the first delivery of the productions from Brickaville, the processing unit is currently supplied by sugarcanes from the town of Vatomandry at a volume of 6 tons delivered every 2 days or approximately 72 tons per month.

At the level of peasant plantations, the productivity per ha can go up to 60 tons to 80 tons if the maintenance was done well. This productivity increases up to 120 tons if fertilizers and herbicides are applied.

4. ENEMIES OF THE CULTURE AND INFERRED PROBLEMS

4.1 PESTS AND ENEMIES OF THE CULTURE

The culture of sugar cane is conducted continuously for several years following the crop cycle - cut - regrowth - cut - regrowth etc. This mode of plantation generates a large biomass that favors the development of insects. Insect borers and stalk borer caterpillars (Diatraea saccharilis, D. striatalis) that attack the stems and eat the leaves. Other pests such as cicadas, termites, white worms and nematodes attacking the roots.

The plantation in the Western part of Madagascar are the most threatened by pests including the pink borers (Sesamia calamistis), cicadas (Yanga guttulata) and white worms (heteronychus). These parasites are present on plantations of the Eastern part of Madagascar but their infestation level is tolerable. Rat attack is also reported at the level of the plantations.

There are several sugarcane diseases caused by bacterial agents, viral or fungal. Many diseases are identified in plantations of sugarcane in Madagascar. The following table summarizes their characteristics.

Diseases	Agents	Symptom	Date of the first observation in Madagascar
Fiji disease or leaf gall of Fiji (*Fiji disease)*	Virus	Deformation of the top. Yellow, white or brownish tumors on the underside of young leaves	1954
Stunting of the new growth *(Ratoon stunting dis*ease)	Bacterial (*Clavibacter xylixyli)*	None. Sometimes red discoloration in commas in the nodes	1958

Diseases	Agents	Symptom	Date of the first observation in Madagascar
Charcoal *(smut)*	Mould *(Ustilago sitamenia)*	Smoky lash, elongated and thin stems	
Fusariosis *(Pokkah Boeng)*	Mould	Rot of the top, then of the stem and the cuttings	1936
Warming up *(Leaf scald)*	Bactery *(Xanthomonas vasculorum)*	Yellow stripes on the leaves	1936
Red rot	Mould *(Physalospora tucumanensis)*	Reddening of the vein and leaves. Stems and cuttings are Reddening	1922
Chlorotic streak	Virus	Red discolorations on nodes	1952
Pineapple disease	Mould	Red rot of cuttings. Smell of pineapple	1952
Gumming disease	Bacteries *(Xanthomonas vasculorum)*	Yellow stripes on the leaves. Pathological secretion	1952
Mosaic *(Mosaic)*	Virus	Marble of young leaves	1952

Source : Mémento de l'agronome ; FOFIFA

Some diseases have marked the history of the sugarcane production in Madagascar. Indeed, in the 1950s, Fiji disease almost devastated the East Coast plantations and stunting for the West. Knowing their pathology and use of effective control resources allowed to maintain at an acceptable level the severity of this disease and the other diseases mentioned previously.

4.2 LOSSES AND DAMAGES CAUSED BY THE ENEMIES OF THE CULTURE

Damages and losses that these enemies of the culture cause on sugarcane plantations generally result by the decrease in productivity, and therefore the decline in sugar level.

Where the level of infestation is high, the total destruction of the plantation by the death of the sugarcane plants can occur.

4.3 CONTROL STRATEGY AGAINST THE ENEMIES OF CROPS

To control enemies of crops, various strategies dedicated for each agent and diseases carrier are developed within the sugarcane production areas.

4.3.1 Insects control

Various modes of control may be used:

- **Chemical control:**

It is characterized by various methods such as:

- ✓ Preventive treatment of soil against nematodes in roots;
- ✓ Insecticide spraying for roots insects (white worms, cicadas, termites)

- **Biological control**

It involves the use of predators or natural enemies of pests. For example, the island of Reunion, the use of toxic fungi against sugarcane plantation beetle pests and predators as wasps against caterpillars stem borers, is being studied.

4.3.2 Disease control

It can be done in various ways:

- Chemical control:

It consists in having preventive treatments of fungicides against rot of cuttings.

- **Agronomical control:**

This method of control is based on:

- ✓ The choice of the cuttings to grow
- ✓ The use of tolerant varieties or resistant to disease.

- **Physical control**

It can be used as a preventive measure to hold the contamination possibilities. It is based on:

- ✓ The processing of cuttings by heat treatment against certain viral and bacterial diseases;

- ✓ The processing of cuttings by cupric solution.
- ✓ The disinfection of cutting instruments.

4.3.3 Weeds control

Weeds control is part of the routine maintenance work carried out at the level of the plantation. It is a significant technical itinerary because the presence of weeds can not only compete with the growing of sugarcane plants in terms of nutrition but it can be a be a habitation favorable to the development of insects. During the crop cycle, the frequency of hoeing can go from 2 to 5 times depending on the agro-ecological conditions. Control methods are various:

- Manual weeding
- Mechanical weeding
- Agronomical processes
- Chemical weeding

5 PESTICIDES USE AND MANAGEMENT

5.1 PESTICIDES IMPORTS

Pesticides used in agriculture are wholly imported by firms or companies representing major global agro-industries. These pesticide suppliers which is in total seven (7) gather in an association called Croplife Madagascar sharpened to Croplife International. Recent statistics on the import of pesticides are not available. Approximately 6000 tons/year of all products are imported by Madagascar. The following table shows the distribution of pesticides imported by types of products.

Table No. 8: Overview of pesticide products groups imported by Madagascar (in tons)

Group of products	2007	2008	2009	2010
Mineral fertiliser	16119	15072	8147	10492
Fongicide	105	164	126	172
Herbicide	68	135	96	196
Insecticide	225	183	134	200

Source: INSTAT (quoted by registry of agricultural statistics 2009-2010)

5.2 ORGANIZATION, MARKETING AND DISTRIBUTION OF PESTICIDES IN THE PROJECT'S INTERVENTION AREAS

The distribution of pesticides is entirely private in Madagascar. Suppliers who import products are supply the market through distributors, resellers that supply stallholders.

Some distribution centers - are well maintained and comply with the rules of installation, particularly in large urban centers. However, the situations are different in rural areas where sales safety rules are not observed. Also, because of the limited financial capacity of peasants and other buyers, products are sold or offered at retail. This exercise is performed without any particular precaution with especially during the transferring by the resellers themselves.

Some resellers are versatile. In addition to sales of agrochemicals, they hold other types of commerce in the same premise including the sale of foodstuffs. The distribution is sometimes made without authorization from the competent authorities and the sales is assured by personnel who have received no training in terms of pesticides and chemical products in general. Indeed, many of these actors have no amenities or simply a provisional approval. However, resellers who are affiliated with registered vendors receive trainings by these providers.

Cane growers take their pesticide products from two channels:

-The first at the local level (head of District or head of municipality) in stores, by resellers of inputs or the market by vendors. For the case of resellers of inputs, their stores are made of small locals and they are selling at the same time other products as staple products.

Small growers with their purchases in small quantities take this route;

-The second, at the level of major urban centers for purchases in large quantities (tens of liters or tens of kilograms or more) by representatives of firms or stores specialized in input. In fact, these growers combine their purchasing program with other services that they should do in the city.

5.3 USE OF PESTICIDES AGAINST THE ENEMIES OF CULTURES

5.3.1 At the level of the Directorate for Plant Protection / public institution

The intervention of the DPV in its mission to promote measures to combat harmful organisms is translated by the coordination, the expertise and technical support in terms of plant protection and phytosanitary. However, it can intervene directly in the field in the case of plagues or a large infestation of culture's enemies by organizing its control (technical support) and as far as possible by applying the appropriate phytosanitary measures (search for alternative and ecological solutions).

One of the cases that we can cite is about the locust control in Madagascar where the DPV, in partnership with FAO and the CNLA, ensures that the insecticides used are part of

products registered in Madagascar. Three products are recently applied in the areas of invasion in the last quarter of the year 2014. The DPV also controls compliance with the measures of security and protection by fieldworkers in direct contact with these products. Finally, it takes all necessary measures required to preserve the environment in the application of these products.

At the instigation of public institutions for the protection of plants, phytosanitary control measures are reinforced by government decrees. Such was the case of Fiji disease which has infected the entire region of the East Coast. A Government Decree (No. 5093/87) states that it is compulsory to cultivate only varieties resistant to this viral disease. It is recommended also to not grow certain varieties highly susceptible to the following diseases:

-The "leaf scald" due to a bacterium Xanthomonas albilineans (Ash.)

-The gummosis, caused by another bacterium Xanthomonas vasculosum (Cobb)

5Chlorpyrifos 240 UL (dose 1 l/ha) ; Teflubenzuron 50 UL (dose 1 l/ha) ; 'Green muscle' (biopesticide)

-Mosaic (a viral infection).

5.3.2 At the level of producers

The pesticides degree of use varies depending on the crops level of intensification. The sugar companies use pesticides to maintain the productivity level. At the level of the growers on the other hand, the use of pesticides depends on their financial capacity and their status, or category. Growers who established a contract with sugar companies benefit from a supply of pesticides through credits granted by banks while independent growers use these products depending on the available financial resources.

The reports after interviews and consultations of growers show a difference of use of products: herbicides are weakly used as fungicides and insecticides are poorly used or even not used at all.

The table below shows both the name and type of pesticides frequently used for sugarcane and a classification test of its pesticides by dangerousness while following the guideline recommended by the OMS (WHO). It is worth noting that these products are those that have been used over the past five years by the growers.

Table No. 9: list of products frequently used on sugarcane and their classification according to the OMS (WHO)

Name of pesticide	Active ingredient	Use	Classification by OMS (WHO)	Remarks
Gesaprim 500	Atrazine	Herbicide	III	

Name of pesticide	Active ingredient	Use	Classification by OMS (WHO)	Remarks
Harness	Acetochlor	Herbicide	III	
Ipress Lombi	Unknown	Herbicide	Not classified	
Servian75	Halosulfuron-methyl	Herbicide	Not listed	
Amigan 65	Terbutryne Ametryne	Herbicide	III	
Gesatop	Simazine	Herbicide	III	
Glyphosate	Glyphosate	Herbicide	III	
Glyphader	Glyphosate	Herbicide	III	
Alvagine	Unknown	Herbicide	Non classé	
Diuron	Diuron	Herbicide	III	
2,4-D	2,4 D amine salt	Herbicide	II	Selective post-emergence herbicide against weeds of rice
Marshal	Carbosulfan (family of carbonates)	Insecticide	II	
Pyrifos	Chlorpyrifos (family of Organophosphates)	Insecticide	II	
Cypermethrine	Cypermethrine	Insecticide	II	
Sumithion	Fenitrothion (family of Organophosphates)	Insecticide	II	
Rayletus Parster	Unknown	Fungicide	Not classified	
Bordeaux mixture	Copper sulfate	Fungicide	III	Toxic for human in case of inhalation

Source: PIC, Biodev

From the table above, we can see that the pesticides used in sugarcane belong to class II of the WHO, i.e. "moderately hazardous", especially those for use against insects and to class III (slightly hazardous) those used as an herbicide. Although the treated pesticides here are not

classified in "dangerous pesticides", WHO's directive indicates the necessity of precautions when handling and using them so that they do not constitute a source of harm to human health and the environment.

Pesticide whose active ingredients are based on pyrethroids (Cypermethrin), carbamates and aryloxyacid (2, 4 - D) are to be monitored closely because of the negative impacts that they cause to human health and the environment.

5.4 PESTICIDES MANAGEMANT IN THE PROJECT'S AREAS OF INTERVENTION

5.4.1 General case

For the sake of productivity, an agricultural development project if he opts for the intensification and mechanization has recourse to pesticides that are essential. In this situation, environmentally harmful spillovers are feared.

Similarly, as being said above, the use of agricultural inputs in general and pesticides in particular depend on the level of performance to be achieved but especially on the financial capacity of the growers. At the level of the two major channels of sugarcane supply for the sugarcane processing into alcohol, the pesticide management mode can show a difference, although cultivation techniques, inherited from the SIRAMA, cause no noticeable difference.

Registered pesticides in Madagascar, for all types of use and purpose and without specification of cultures to be treated, are listed in the annex. Note that this list is evolving in time and that a periodic update is produced by the responsible (DPV). 129 materials (substance) are certified dated from August 29, 2014.

5.4.2 Case of the area of Brickaville

5.4.2.1 Operating mode at the level of "governed plantation"

Interviews with the heads of micro-distilleries of Ampasimpotsy and some workers of the plantation said that pesticide use confined solely to treatment against soil insects (white worms of Heteronychus) during the 1st planting. It's the workers themselves who conducted the treatment without any technical support.

The observation of a decline in performance and the delay in the execution of the maintenance work (weeding) constrain the personnel of the plantation to consider the use of herbicides from the next campaign (2nd regrowth of sugarcane). No information on the product or on the treatment mode was provided.

5.4.2.2 Operating at the level of sugarcane growers (Fokontany of Brickaville)

At the level of sugarcane growers in the concerned district, the use of pesticides or other chemical inputs is almost nil value. First of all, the plantation lies in an alluvial area where fertility is good and therefore, requires no input of nutrients surplus. From the use of

sugarcane varieties of SIRAMA keep growers away from the attacks of culture's enemies (fungal origin, bacterial and viral) through varietal resistance and avoid chemical treatments. The manual method (weeding) is mostly preferred in the control against weeds.

However, the development of sugarcane culture (extension of areas to grow, growers increase) could take during a short period of time the availability issue in labor and can force growers to orientate themselves towards the use of herbicides. Demonstrations of this kind were reported by a few growers when meetings with them.

5.5 ENVIRONMENTAL ASSESSMENTS OF THE MANAGEMENT METHODS

An environmental assessment of the effects of the use of pesticides was conducted at two locations at the level of the pilot-unit that was the object of visit in this study:

- The first is located at the level of the Ampasimpotsy ethanol unity of transformation, specifically within the plantation of sugarcane of the society where soil and water samples were taken (watercourses located downstream of the plantation) have been performed for chemical analyses. The objective is to determine and evaluate residues in the samples that may come from the pesticides used.
- The second level consists of interviews and public consultations organized at the level of growers on a few fokontany of Brickaville district

5.5.1 Results of soil and water analysis

It is important to make an assessment of the potential impacts on soil, specifically from the ground located at the planting area, given that a watercourse is used downstream by two Fokontany, including the Fokontany of Ambodibonara and Ampasimazava. This stream passes along the planting of sugar cane. In this sense, an analysis of the soil of the planting was conducted to assess its infiltration capacity and chemical contaminants transportation in case of use of plant protection products, which, for the time being, is not part of the practices of the society for the maintenance of the plantations.

The lateritic type soil has a Silt-Sandy-clayed texture of 15% silt, 21% clay, and 64% of sand. It has a high level of porosity ranging between 40% and 50% (porous soil) with a good fragmentary structure. The soil is relatively acidic with a pH of 4.88 and an average speed of infiltration of (K = 3, 5 cm/h). Residues of chemicals will not be retained in the soil substrate but infiltrate due to its intrinsic property towards the watercourse downstream of the plantation.

With the exception of a single use of Pyrifos insecticide, early in the planting campaign by 2014, the current agricultural practice of the company at the level of sugarcane plantations has no significant impacts on soil or water. However, the use of organic compost moderately acidic (pH = 5. 85) on an acidic soil merits attention when there is extensive use of organic

compost. In this case, even the stream will also be impacted in terms of concentration of undesirable elements (nitrate and nitrite) and acidity due to the phenomenon of infiltration.

Table 10: result of water analysis collected at the level of the plantation

Parameters	PO_4^{3-} (in mg/l)	NO_3^- (in mg/l)	NO_2^- (in mg/l)	DBO_5 (in mg/LO_2)	DCO (in mg/LO_2)	pH	Conductivité (in µS/cm)	T (in °C)
Values	0,08	< LMD	8,26	-	-	6,66	252	26,3°

Source : BIODEV (2015)

The results showed that the analyzed water is suitable for human use. For the moment, the watercourse along the planting of sugar cane is not affected by agricultural activities. For example, biological fertilizer intake can increase the content of nitrite and nitrate, undesirable in the water for consumption. Similarly, no toxic residue is detected in the soil.

Overall, the pesticides management practices at the level of the plantation for the production of sugarcane generate no negative impact, according to the analysis carried out, that can bring harm to the health of the surrounding population. But a certain reserve deserves to be considered to the extent that the company intends to opt for an intensive mode of production in the future.

5.5.2 Impacts

The negative impacts that may emerge in the use of pesticides at the level of the district of Brickaville plantations are currently close to zero, given that none of the consulted growers use these products (see §6).
However, it may be that in the future, increased productivity in sugarcane requires the intensive use of chemical inputs (pesticides) on crops and which can result in negative impacts. These impacts concern the following points.

5.5.2.1 Impacts on the environment

The use of pesticides by farmers are likely to generate significant negative impacts, both on the physical environment (pollution of certain water resources due derivatives during operations of pesticide spraying or flushing...) and biological communities (impacts on certain non-target species, impacts on the phenology of some plants,)

Negative impacts also exist at the level of farmers and some operators, such as the producers of biological products, beekeepers and sericulture, cold water shrimp supplier, artisanal fishermen and others.

The use of pesticides may cause the death of many insects, spiders, some arthropods and, sometimes, secondary mortality of insectivorous birds that eat contaminated insects (example: case of Fenitrothion)
Below are a few groups of non-target arthropods that could be subjected to the treatment:

- Free insects and spiders: they are often decimated by the broad spectrum insecticides and those who escape the effects of the insecticides will be destroyed by the next Bush fire (very frequent especially in the South)

- Social insects such as ants, termites, bees: these insects store their foods that are collected around their nests, and when food has been treated with a residual insecticide, it contains slow degradation residues. If then, this food is consumed little by little, the whole society can be destroyed.
- Crustaceans are also very threatened by persistent insecticides and others such as pyrethroids, as well as other aquatic insects (beetle's larva, dragonflies, etc.)
- We cannot say that the consequences of treatments on non-target organisms are reversible, but there must be a recolonization from untreated locations, even though this may last for years (case of termites).
  For aquatic organisms, it should be avoided specially to treat their biotopes or at least proceed by treatment with bio pesticides.

For reptiles and birds, the principle of recolonization is also valid, and perhaps you should schedule treatment so as to provide special untreated areas for a reserve of animals for the future recolonization of treated surfaces, especially in the case of large surfaces treatment with broad spectrum insecticides. Treatments repeated on the same surface during the same year should be studied closely.

5.5.2.2 Impacts on the human health

It is well known that all issues related to pesticides are linked both to active materials as well as to their residues of decomposition (function of their chemical structures which govern their remanence in nature or on a given substrate).

Identically in the domain of biophysical, the use of pesticides by investors or by micro-distillery sub-projects and/or grower's partners of sub-project are likely to generate significant negative impacts on human communities (handling of pesticides), contamination of certain foodstuffs or food chains by pesticide residues.)

In a short and medium term period, the following clinical toxicologist's signs appear:

- At the level of ORL (Burns and eye irritation, sneezing, pharyngitis, laryngitis, etc.);
- At the level of breathing organs (chest Burns, dyspnea, cough, chest tightness, etc.);
- At the level of neural systems (Headache, Coma, hemiplegia, convulsion, paresthesia, neuropsychiatric disorders, etc.);
- At the level of digestive organs (constipation, diarrhea, abdominal pain, nausea, vomiting, etc.);
- At the level of the skin and scalp skin (itching, burning,)
- At the level of the human body in general (anorexia, asthenia, fever, insomnia, etc.).

5.5.2.3 Impacts on the regional or local economy

It is obvious that if the health of the stakeholders is deteriorated, this will have negative impacts on both local and regional economies as well as national. Indeed, not only working days will decrease but expenses related to care will increase too, putting at risk the lives of impacted families.

5.5.2.4 Transboundary environmental problems

Transboundary problems that can be treated in this study include:

- Atmospheric distillation related to an unscheduled use of pesticides that can cause pollution in areas of use where the effects of the products persist after the products are no longer used for the period exceeding their half-lives;
- The management of obsolete products (Basel convention) which are likely to deteriorate during storage considering the change of texts, the addition of the prohibited products. Poor conditions of storage that can cause leakage of products by contaminating the environment or causing intoxications of personnel working around or in storage spaces.

5.5.3 Mitigation measures

Measures to mitigate the listed impacts above are enunciated on 3 points:

1. Choosing good healthy cuttings;
2. Improvement of control methods against enemies (integrated methods);
3. Elaboration and application of the PGPP.

These measures aim primarily to reduce the use of pesticides on the cultivation of sugarcane. Where the use of pesticides is imperative for good reason, measurements give instructions and ways to minimize the effects on the environment and human health.

5.5.3.1 Choice of healthy cuttings

The planting of sugarcane is made by cuttings. However, this mode is favorable to the transmission of diseases. The use of healthy plants is a crucial action and various practices, measures and methods can be implemented to have this plant health warranty.
They relate to:

- Disinfection of cutting material
- The treatment of cuttings by thermotherapy techniques;
- The selection of resistant or tolerant varieties
- The requirement to use varietal resistance by application of governmental decrees;
- The practice of successive tree nurseries method;
- The practice of successive plant nurseries method;
- The introduction of new varieties must be through quarantine;
- The application of texts on transport and circulation of production plants.

5.5.3.2 The use of integrated control methods against enemies.

Although the current use of pesticides is still limited in the sugarcane sector as it was found in the case of the sub-project pilot site, it is time to launch and develop alternative programs to chemical products. These alternative control concern biological control, agronomic control, the use of bio-pesticides and especially the valorization of traditional control methods or "ady gasy".

Indeed, alternative methods are rarely used to overcome the enemies of crops or insect vectors of disease. Regarding the pests, the shock of pesticides effect litigates to their favor in intensive cultivation. Most farmers are unaware of proper and relevant pesticide use and different alternative methods, particularly in the context of integrated pest management.

In this context, the NGO Voarisoa has developed a collection of methods «ady gasy» in 1996, but most indications relate to vegetable growing and food crops of the highlands. Their application on sugarcane remains to be demonstrated and even to be experimented.

Another case concerning invasion of weeds on crops, the integrated control against weeds goes first through the reduction of infection by preventive methods; then several non-chemical control methods are involved as curative control.

Table n ° 11: non-chemical weed control methods

Preventive control methods	Curative non-chemical control methods
- Make sure to prepare the soil very well at the 1st (deep plowing) planting; - Reduce the spacing of the lines when planting sugarcane; - Make a fake seedlings before planting - Manage residues (soil mulching on the regrowth soils); - Join the culture of sugarcane to vegetable plantations; - Practice crop rotation (case of a diversification practice) - Make a good varietal choice (more covering variety)	- Multiply the frequency of manual and/or mechanical weeding (3 to 5 times during the 1st planting, 2 to 3 times for regrowth)

5.5.3.3 The development of a management plan for pests and pesticides (PGPP)

The existence of a PGPP which development is proposed in this present document, serves as a framework for legal and regulatory dispositions on pesticides. It highlights the duties and responsibilities of the stakeholders involved in the management of pesticides.

6 INFORMATION AND PERCEPTION OF THE POPULATION

Interviews and public consultations has been conducted with the growers and grower's associations in some ethanol manufacturing unit areas (existing or under construction) as the intervention area of the micro-distilleries of Ranomafana, Foulpointe and Tsiroanomandidy. The objectives of these consultations includes: to know and determine sugarcane growers level of ability in the management of pesticides (use, manipulation and safety control in the use of these products) and collect evidence of poisoning existence case, real dangers or the grower's state of health or one of their family members.

6.1 PUBLIC CONSULTATION

The public consultation or interviews took place in 5 fokontany, respectively in the rural commune of Brickaville (MEC's sub-project intervention zone), in the fokontany of Ankadira of the rural commune of Foulpointe (region of Analanjirofo) and the rural district of Tsiroanomandidy (region of Bongolava). The debate/exchange focused on the following points: perception on the use of pesticides; control of the use of pesticides; the handling of products and processing equipment; the types of training received on pesticides and their use; the risks involved and the physical harm or consequences on the health of the users; environmental threats and existing biotic elements (see PV in annex 3).

The results of the organized discussions can be summarized as follows:

- None of the growers who were able to start plantations use agricultural chemical inputs and nor pesticides;
- Threats of pests at the level of the plantations are tolerable and do not cause performance decrease;
- At the time when SIRAMA (cases of Brickaville) still operated, growers have used chemical fertilizers and pesticides.
- The supervision of growers was ensured by SIRAMA, technicians who also had taught technical training on the phytosanitary treatment;
- Growers buy pesticides from inputs dealers located in the District capital (big city).
- Resellers provide products according to the demands of growers and brief instructions on their use;
- Resellers provide products according to grower's demands and give brief instructions on their use;
- Products used previously (before 2007) no longer exist on current market.

- Job opportunity in labor supply is so much lower than the demand of the growers that they would resort to the use of herbicides but are faced with the lack of financial means.
- No accident or contracted disease due to the use of pesticides were observed by the growers.

6.2 GRIEVANCE AND COMPLAINTS HANDLING

The issue of major grievances which were raised by growers, they converge on two points:

1. The access problem to pesticides which results in the impossibility for growers to acquire these goods which price continues to increase;
2. The unavailability of the products that the SIRAMA former growers used to use and whose performances and effectiveness gave satisfaction to users.
3. The needs of growers in technical guidance and training on the use of pesticides and the phytosanitary treatment.

Discussions were then converged towards this main question: by what approach can we finance these needs from growers in pesticides?

In fact, the wishes of growers are not only the acquisition of pesticides in easy ways but on the financing of the entire campaign, including performances of the necessary work during the sugarcane crop cycle. The following alternatives were mentioned:

- Requests from growers are rather towards a direct help from the State under the economic and social development program. In fact, according to advanced comments by the growers, the shutting down of SIRAMA caused a change in the standard of living of the general population of Brickaville and growers in particular. Indeed, the culture of sugarcane is the only source of sustainable income for most farmers.
- A financial support of investors/traders in the project is also sought by the growers. In the case of MEC for example, the company has already made a loan of 470,000 ar/ha for growers who have started the culture (labor, furrow work) or who have already planted. This loan is considered by the growers as inadequate compared to the total needs of 1 700 000 ar/ha. Growers ask that the company renews its support.
- Joint surety loans from local banks (BOA of Brickaville for growers in this area) have been made by growers, consolidated in associations were unsuccessful.
- Some growers have chosen to make bank loans on an individual basis but they clashed with the Bank's requirements, requirements deemed too difficult for borrowers.

7 ACTION PLAN

7.1 IDENTIFIED PRIORITY PROBLEMS

The following problems and restrictions have been identified in terms of pest's management and pesticides, in anticipation of pest and pesticide management activities, at the level of Madagascar Ethanol as domestic energy project's areas of actions (PMEED).

1 In terms of the institutional framework

- Lack of agents of the DPV at the decentralized level;
- Lack of ownership of the sectoral initiatives by stakeholders and the population;
- Lack of materials at the level of the two control and analysis of pesticides laboratories.

2 In terms of legislative and regulatory aspects

- Lack of the application of texts related to pesticides management: import, storage, distribution, use;
- The existence of shortcomings at the level of texts on the transportation and disposal of pesticides.

3 In terms of the capacity building - training - awareness of stakeholders

- Lack of trainers, managers specialized in the protection of plants
- Inadequate training of dealers and pesticides users;
- Lack of information for producers on the products handled;
- Lack of information on potential dangers related to the use of pesticides;
-

1.4 INADEQUTE TRAINING OF THE HEALTH PERSONEL FOR PREVENTION AND SUPPORT FOR POISONING CASES RELATED TO PESTICIDES, PARTICULARLY AT THE LEVEL OF THE CSB

- Lack of control of the pesticide's quality and the searching of residues in water, soil and food by the laboratory of the DPV and the CNRE.

4 In terms of technical management of pesticides

- Introduction of fraudulent, toxic pesticides with doubtful quality;
- Lack of control, by the competent agents, of the pesticides sold by resellers and those used by producers;
- Unsafe application of pesticides;
- Lack of collection and treatment of pesticide's bottles or empty containers;
- Absence or inadequacy of waste disposal systems;
- Difficulties in removing pesticides which are approved and being sold on the market;
- Absence of clinical toxicovigilance.

5 Public health action plan

- Lack of health monitoring plan for producers
- Absence of specific measures and devices to support people poisoned by pesticides
- Lack of kits for the determination of cholinesterase dose with atropine staffing as well as supplies of first necessities and equipment adapted for the CSB
- Inadequacy of products storage infrastructure in the health centers and impregnation centers.

6 In terms of monitoring and control

- Lack of analysis of pesticides residues in soils and waters;
- Lack of structure and collection system as well as the management of empty packaging;
- Absence of specific protection for secondary and tertiary ditches that cross the fields;
- Lack of technicians specialized in environmental assessment, monitoring and evaluation.

7 In terms of integrated control methods

- Lack of experiments / demonstrations, at the farmer level, on alternative control methods to pesticides;
- Lack of officers trained in GPI of cultures;
- Lack of implementation of alternative methods to control pests.

The following table summarizes and compares international recommendations according to the principles and standards defined by the current international policy and the existing current situation at the level of pesticides management in the agricultural sector in general and sugarcane sector in particular.

Table n ° 12: Adequation between the existing and the international rules on pesticide management

PESTICIDES MANAGEMENT REGARDING THE INTERNATIONAL POLICY	MANAGEMENT OF PESTICIDES AT THE LEVEL OF MALAGASY AGRICULTURAL SECTOR
CHOICE OF PRODUCT	
Identification of the enemy to control. Opportunity to apply a plant protection product or if a biological or cultural solution is sufficient	Less information on the enemy to control. Use of the available products.
	Less information on the enemy to control. Use of the available products.
	Cultural or remains at the research stage without any value
-Advance information on the recommended product: dose and method of application, time of treatment, frequency, precautions, etc.	- Product information: scattered, not documented in a paper, sheets and manuals written in foreign languages
- Prior technical training of pesticides users	- Non-organized training
ACQUISITION OF PESTICIDES	
-Take into account the phytosanitary legislation in the country, of the effectiveness of the products in the field	- Existence of laws but not yet effective.
	Pesticides are used in an empirical way without prior comparative testing or effectiveness evaluation.
- Safe products delivery to the areas of use	- Uncontrolled purchases without prior consultation with specialists.
- Alternate products to avoid pest resistance	- Generally the same products are used
- Supply of equipment for processing and protection	- Deficit of treatment equipment. No adequate protection equipment.
- Training on the safe use of pesticides	- Non- organized training or diffuse
FORMULATION AND RECONDITIONING	
-If necessary, negotiate with the provider that provide packaging and labels	Suppliers repackage and sometimes deliver pesticides in plastic bags without labels.
-Reconditioning operation is regulated	- No applicable regulation

PESTICIDES TRANSPORTATION	
- To comply with the laws and regulations of the country.	- The decree does not exist or is not accurate.
-Do not transport damaged packaging, without labels	- The packaging without labels are transported.
- Keep products away from passengers, livestock and food. Load and unload products with care	- Security measures are generally not respected
-Inform the driver of the presence of pesticides in the vehicle	- Information not given
STORAGE OF PESTICIDES	
- To comply with the laws and regulations of the country.	- The law exists, but its application is not effective.
-Never store pesticides with foodstuffs intended for human or animal consumption	-Pesticides are stored in the same warehouses where all other assets of the farm and the harvest are.
-Store separately herbicides insecticides and fungicides	- All pesticides are stored together
-The warehouse must be lit, ventilated and dry, always closed and inaccessible to the public, with visible pictograms and space to store empty containers, protection equipment. Presence of extinguisher, adsorbent material, a dosing equipment, a sink and SOAP, etc.	-Warehouses not in accordance with international standards. Offices are sometimes used as warehouses
DISTRIBUTION	
- Regulated	-Unregulated. Any merchant interested in this business start operating even without infrastructure and prior knowledge of the products.
-Inform users of the toxicity and the dangerousness of the product being distributed	- Not made by resellers

ETIQUETAGE	
-Must contain information about the product and its use, on precautions to be taken, etc.	Presence of products without labels or labels written in unknown language unknown by the user
HANDLING OF PESTICIDES	
-Professional competence required at each organizational level guaranteed by a training at each start of season	-Limited technical knowledge. Non-organized training or limited to a few insiders.
-Make sure that all safety measures have been taken	-Safety measures are not taken or badly applied
-Establish an evaluation system of the campaign	- Limited evaluation
MANAGEMENT OF EMPTY CONTAINERS	
Never re-use empty containers or ex-pesticides. Return them to the manufacturer or decontaminate and destroy them according to the standards of the FAO	-Empty containers are typically re-used or discarded in nature, either burnt or buried in the ground without prior decontamination.
ELIMINATION OF OUT OUTDATED PESTICIDES	
-Obsolete pesticides must be disposed according to the standards of the FAO	All available products are used. Farmers rarely pay attention to the expiration date of the products which is also often not mentioned on the label.

7.2 INTERVENTION STRATEGY AND ACTION PLAN FOR PESTICIDES MANAGEMENT

To change the above negative trends regarding the limits of rational management of pests and pesticides, the proposed action plan will initiate a process, and to support the national response in this domain. It will focus on preventive measures (institutional and technical capacity-building; formulation of policy and regulatory training of stakeholders; information campaigns, education and awareness campaigns, focused on communication for behavior

change; establishment of storage and disposal infrastructure of the packaging) and curative measures that can contribute to the improvement of the current pesticides management system (training of staff in prevention and support for poisoning related to pesticides; strengthening the capacities of laboratories etc.).

7.2.1 Intervention strategies

In the context of the project's intervention in the field of plant protection and pesticide management, the following principles should be observed:

- Attention and precautionary principle,
- Strengthening of inter-ministerial collaboration (Agriculture, environment, research, Commerce...);
- Building the capacity of stakeholders involved in the management of pesticides;
- Transparency and traceability of the products used;
- Sustainable management of products and approach to public health;
- Coordination and cross-sectoral cooperation (public, private, producer);
- Development and reinforcement of the norms and technical standards;
- Information and management of data related to the management of pesticides;
- Rationalization and strengthening of structures for monitoring and risks prevention;
- Monitoring and evaluation - control on health and environmental impact;

In terms of implementation plan, the PGPP must ensure the following measures:

- Strengthen synergies with the programs, activities and ongoing initiatives;
- Clarify the expectations and responsibilities of the different actors;
- Ensure the effectiveness of the participation of all relevant actors

7.2.2 Action plan for pesticides management

The management plan is divided into 4 steps:

Step1. Strengthen the institutional and regulatory framework for pesticide management

Step 2. Strengthen the capacity of institutional actors and producers

Step 3. Improve the use and pesticides management systems

Step 4. Ensure the monitoring and evaluation of the implementation

1) **Step1. Strengthen the institutional and regulatory framework for pesticide management**

- Popularization of laws on plant protection and the general safety rules in the management of pesticides to raise effective ignorance that may exist at the level of all stakeholders in the sector;
- Revision of the texts on the transportation and disposal of pesticides;
- Strengthening capacities of pesticides control laboratories of DPV and NWRC (renewal of equipment, reagents supply, solvents and spare parts, recruitment of qualified people…)
- Strengthening of procedures for registration of pesticides.
- Strengthening of procedures for the registration of pesticides.

2) **Step 2: strengthen the capacity of institutional actors and producers**

- Training officers of the DRDA, technicians of ON, etc. to be trainers on pesticides management;
- Training commune technicians, farmer leaders;
- Growers trainings;
- Training of inputs resellers;
- Strengthening of customs controls at the level of ports and international airports.

3) **Step 3. Improve the use and pesticides management systems**

- Involvement of civil society in information/education/communication in terms of pesticides management.

4) **Step 4. Ensure the monitoring and evaluation of the implementation**

- This step concerns the practical side at the level of growers or resellers.

It is about the following points:

- *Equipment acquisition*

The acquisition of pesticides in advance involves in the identification of the problems to solve, the choice of product and the quantification of pesticide's needs. Information needs are required such as the location of the production area to be protected, the type of pests (pests, enemies) to control, the surface to be sown. Having knowledge on these elements

will guide inputs resellers in choosing the appropriate pesticides, determining the quantity to purchase and the processing techniques to adopt. This step involves the acquisition by the dealer of a warehouse built for pesticides. The quantities of pesticides to buy depends on the program and needs of the crop and the level of performance to be achieved. It is recommended that the inputs reseller uses dosing materials (graduated test tubes or graduated containers, dosing spoons, etc.) for the provision of pesticide to growers.

- *Acquisition of processing equipment*

The second stage of the plan concerns the acquisition of material for processing in connection with the processing techniques adopted. Returns of selected technology equipment will help the project to determine the number to be acquired. A bad choice of material or an underestimation of the actual needs in technology equipment will block the normal flow of the phytosanitary campaign with as a result a stock of non-used pesticides during the campaign. The materials needed are sprayers backpack, towed or carried.

- *Acquisition of protection equipment*

The use of pesticides, even on a reduced scale, is not without risk to the health of the population and the environment. Also, the acquisition of protection equipment as the overalls made from waterproof fabrics, neoprene gloves or PVC, with refill filters gas masks, plastic glasses or visors, rubber boots is essential to avoid the risk of contamination and poisoning of the producers. It is necessary, in addition, - to ensure the body hygiene of the operators and the cleaning with water and soap after each treatment equipment and - provide pictograms from different places where the products will be handled.

- *Repackaging of pesticides*

Pesticides are available in many solid or liquid forms and can be provided in large packaging difficult to manage at the level of the project. Repackaging in small packages can be requested by the project to a subcontractor notified to suit its needs. Packaging for small doses of 0.5 liters and 50 grams are suitable for the project.

- *Dispatching of products and equipment*

Dispatching of products and equipment for treatment and protection must be done on time before the treatment campaign. Measures must be taken by the sponsor of each agricultural production unit to inform carriers of damages that can be causes by an improper loading of pesticides. A distribution plan of products and equipment will be prepared in advance according to the campaign program. Spaces to accommodate these products and materials will be prepared in advance. These premises will be locked away from foodstuffs for humans and animals, water sources and other assets of the operation. The products will be stored in order not to be mixed up with other things. Herbicides will be separated from insecticides and fungicides with visible labels.

- *Handling of pesticides*

The handling of pesticides is the most delicate phase because it requires direct involvement of stakeholders in agricultural production. It determines the success of a campaign of plant protection of cultures and stored stocks in terms of agronomy. The production manager or a qualified technician will establish a phytosanitary treatment program. This step requires more supervision from the program responsible.

- *Collection and destruction of empty and obsolete pesticide packaging*

Empty or open packaging and obsolete pesticides will be collected by resellers of inputs and destroyed under the supervision of the DPV officers according to FAO standards. A report will be prepared for this purpose.

- *The result of phytosanitary campaign*

At the end of each marketing year of treatment, a review of the campaign will be drawn up by the promoter of each sugarcane production unit and synthesized by the project manager. The remains of undiluted products will be reconditioned and stored by the exploitation until the next planting season. Empty containers will be inventoried, decontaminated and destroyed by the exploitation under the supervision of DPV agents. The remains of porridge and equipment rinsing water will be dumped away in fields from water courses. Contaminated materials, in warehouses, will be buried away from the villages and water points.

7.3 MONITORING AND EVALUATION PLAN

7.3.1 Monitoring

To measure the effectiveness of pests and pesticides management plan on the level of the reduction of diseases and poisoning of concerned persons, including workplace treatment safety (on the ground), recommended actions should be the subject of a monitoring-evaluation.

The monitoring plan shall be subject to the activities planned by the project. Monitoring is supported by the collection and analysis of data, to check if the implementation of the activities takes place as planned and make immediate adaptations if necessary. It is therefore about an assessment-based activity in short term, in order to act in real time. The frequency of monitoring will depend on the type of information needed, however it will be continuous throughout the implementation of the action plan.

The follow-up will be arranged through periodic field visits and will be assured at two levels:

1. At the level of the intervention areas (areas of sugarcane production) by:

- The promoter of the project (strategic supervision)
- The DPV/MinAgri (operational supervision)
- The CMCS

2. At the level of the ethanol manufacturing unit (in the project's area), by:
- The technicians of the CIRA in the districts (proximity monitoring)
- The decentralized health services of the district

Proximity monitoring will be done by local agents of the DIRA (decentralized service of the Ministry of Agriculture), the Health Services and community health Structures. The frequency of the use of alternative methods of the pest control will also be evaluated. Finally, particular emphasis must be focused on the monitoring and evaluation of the following points: the control of non-targeted groups to find out if the treatment against pests and harmful operations do not harm other non-targeted living-beings in this fight; Entomological surveys to control the vector population and the effectiveness of treatment program; health monitoring of manipulators; and the choice of pesticides regarding risks to the environment.

With the control and environmental pesticide monitoring, the Direction of the Protection of plants from the Ministry of Agriculture with the agents of the "Direction régionale de la Santé Publique (Regional Public Health Board) , "Direction régionale du Commerce" (Regional Commerce Board) at the level of the intervention areas, the ONE, will be responsible for the control of stakeholders in the distribution and marketing of pesticides to ensure that only qualified products are sold and used. There will be verification of the tenors of the components and pesticide residues and their adequacies to the international standards.

7.3.2 Evaluation

Two evaluations will be carried out, an internal mid-term and an external one at the end of the last implementation of PGPP in order to maintain the objectives of the action plan. The mid-term evaluation will be performed by the project promoter. The object will be to determine the correct evolution of the management plan and the results recorded at mid-term. Financial partners (World Bank, Green development), the beneficiaries of the project (micro-distilleries, growers and local communities) as well as the other involved partners (resellers of inputs and other stakeholders) will fully participate in this assessment. The final evaluation of the pesticide management plan will be focused on measuring the effectiveness of its implementation and its performance as well as to identify the lessons learned. It will be conducted by an external organization.

7.3.3 Monitoring indicator

To ensure the follow-up, it is necessary to have indicators that are predesignated signals expressing the changes under certain conditions or outcomes related to specific interventions. These are settings which use provides quantitative or qualitative information on the impacts and the environmental and social benefits of the PGPP. Monitoring indicators will help in the implementation of the mitigation measures, monitoring and assessment of the entire project to assess the effectiveness of these activities.

Monitoring indicators of risks/hazards evaluation in toxic products are:

1 In terms of health and the environment

- Toxicity level of the products used,
- Available quantity of personal protection equipment,
- Level of knowledge of good management practices (pesticides, empty packaging, etc.),
- Level of safety for those who are handling and using the products,
- Percentage of manipulative staff having undergone medical check
- Level of residues concentration on non-targets,
- Level of impact on domestic animals, aquatic organisms and wildlife,
- Toxicity level of the decomposed substances,
- Level of contamination of water resources (water points, rivers...).

2 In terms of storage conditions / pesticides and empty packaging management

- Percentage of available and adequate storage facilities,
- Level of risk associated with transport and storage,
- Available quantity of appropriate spraying or treatment materials
- Spraying process control level

3 In terms of staff training - Information/awareness-raising of the population (growers, resellers of inputs, public)

- Number of modules and developed training guides;
- Number of training sessions carried out;
- Number of IEC tools developed;
- Number of officers trained by category;
- Percentage of the population affected by awareness-raising campaigns;
- Level of knowledge from users on products and associated risks;
- Level of knowledge of the traders/distributors on the products.

The following table summarizes previous defined monitoring indicators and relevant monitoring authorities.

Table 13: Summary of the monitoring Plan

Component	Monitoring element	Indicators and items to collect	Periodicity	Monitoring responsible
Water	Pollution state / contamination of surface water and underground resources (wells)	Physicochemical and bacteriological of water bodies (pesticide residues, etc.)	Once a year	PP DPV CNRE
Soils	Pollution state of the pesticide storage sites	Type and quantity of waste (solid and liquid)	Once a year	PP DPV CNRE
Vegetation and wildlife	Evolution of wildlife and fauna; and the state of the flora, animal and plant biodiversity	- Toxic residues at the level of plants and crops - Levels of destruction of non-target (animals, aquatic, wildlife and vegetation)	Once a year	PP DPV CNRE
Human environment	Hygiene and health Pollution and nuisances Protection and safety during operations	- Types and quality of the pesticides used - Number of accident/intoxication - Waste management (Residues of pesticides and empty packaging) - Respect of the wearing of personal protective equipment - Compliance for storage and use of pesticides - Number of producers aware on the use of pesticides - Level of monitoring by the DPV officers	Once per semester	PP DPV CNRE CMCS

7.3.4 Responsibilities in the coordination and monitoring of the implementation

The implementation of the strategy for pests and pesticides management is a concern for many speakers and it requires the participation of a wide range of organizations as well as public and private institutions. The safe and proper use of pesticides, including quality control and resistance management, requires inter-sectoral collaboration.

Several stakeholders are involved either individually or in partnership in the implementation of the actions foreseen. Managing pests and pesticides requires open and close collaboration between the directorates and services central and/or regional ministry of agriculture, the ministry of public health, with other sectors such as the environment (ONE), the CMCS and local communities, but also the private sector involved in the import and distribution of pesticides and of producer organizations to develop harmonized approaches that deal with the development in a healthy environment.

It is necessary to establish communication and close collaboration between the institutions responsible for health, environment and agriculture, to provide the necessary support for good implementation of policies and strategies.

The entities responsible for health and environmental monitoring regarding the predefined levels and their respective constituencies are formed by:

- The PP, the VPD for the coordination of the supervisions,
- Regional services, laboratories of CNRE and the DPV, the CMCS for the 'internal' environmental monitoring: "of proximity" at the level of sugarcane processing units and plantations in the project's intervention areas;
- The ONE for 'external' environmental monitoring in places other than the implantation sites of transformation units and plantations in the intervention area of the PP;
- Decentralized services of the Ministry of Public Health for the 'external' health monitoring in the intervention areas of PP.

The monitoring will be periodic according to the levels and data, including those relating to the indicators evolution which will be incorporated into the reports to provide to the project. An evaluation will be planned mid-term (end of the 2nd year) and another at the end of the project.

7.4 INSTITUTIONAL ARRANGEMENTS FOR MONITORING

In fact, the monitoring of the PGPP implementation calls out several public, private entities and organizations of producers whose intervention and responsibility complement each other.

- The **PGPP** will be implemented by the project Madagascar Ethanol as domestic energy (promoter of the project or PP) with its executive bodies, in close collaboration and in permanent connection with the two key ministries: The Ministry of Agriculture and the Ministry of Public Health.
- **PP** will ensure the coordination of the PGPP implementation and will use as interface with other relevant actors. It will coordinate the capacity-building and training of officers, growers or associations of growers as well as some other technical structures involved in the implementation of PGPP.
- The **DPV**: will provide the supervision of the PGPP implementation and support the capacity-strengthening of the agents/technicians in the field.
- The **MinAgri** Regional Services: will participate in the monitoring of the PGPP implementation and the capacity-strengthening the of its agents/technicians on the ground. These structures will be the "proximity monitoring" of the PGPP establishment and will set up regular reports to this effect to the PP;
- the **MSP** Regional Services: ensure the "external monitoring" on the implementation of the section "Health" of PGPP and will regularly prepare reports to that effect to the PP.

- The **ONE:** ensure the external monitoring of the implementation of the section "'environment'" in the implementation of PGPP;
- The **CMCS**: will participate in the monitoring of the implementation of PGPP and the capacity-strengthening of the growers and disseminates good agricultural practices in accordance with the guidelines in the PGPP;
- **Institutes and laboratories for research and analysis (laboratories of DPV and CNRE)** will help in the analysis of environmental components (analysis of pesticides residues in waters, soils, plants, culture, fish, food, etc.) to determine the parameters of pollution, of contamination and toxic pesticides;
- **The grower's organizations**: they must have and apply environmental procedures and practices in terms of ecological management and safe use of pesticides;
- **Local communities**: they will participate in the populations awareness-raising and social mobilization activities. They will also participate in the supervision and the external monitoring of the implementation of measures advocated at PGPP's level;
- Environmental NGOs also participate in informing, educating and awareness-raising of agricultural producers and populations on the environmental and social aspects related to the implementation of PGPP, but also the monitoring of the environment implementation and monitoring.

7.5 TRAINING OF THE ACTORS INVOLVED IN THE MANAGEMENT OF PESTICIDES

To ensure the effective integration of environmental concerns? in the implementation of the project, it is suggested to implement a program training and awareness-raising of all actors that should be articulated around the following axes: operationalize the strategy of pesticides management; promote the emergence of expertise and professionals on pesticide management; raise the level of awareness and responsibility of users and employees on pesticides management; protect the health and safety of populations.

Training should be targeted and tailored to the different groups of actors (researchers, Plant Protection Services agents, technical staff (rural development), health workers, growers and associations of agricultural producers and other NGOs, active in combating pests and vectors, resellers and inputs stallholders.)

The objectives of the training allow stakeholders to assimilate knowledge on the content and methods of prevention, to be able to assess their work environment and their environment in order to improve them by decreasing risk factors, to adopt precautionary measures to reduce the risk of poisoning, to promote the use of protective equipment and to properly apply the procedures to be followed in case of accidents or poisoning.

The training modules are oriented on the risks associated with the handling of pesticides, methods of integrated management (collection, disposal, storage, transport, treatment), proper behavior and sound environmental practices, maintenance of facilities and equipment for the processing, protection measures and measures to be adopted in case of poisoning, etc) A particular emphasis will be put on the conditions of security in secure storage, to avoid mixing with other products in routine domestic use, but also on the re-use of empty packaging. It is recommended to train the trainers bringing them to produce themselves a guide of good practice/management of pesticides, a guide from the reality and the existing conditions.

Indicatively, a training module can contain the following elements:

- Knowledge of the pests;
- Alternative methods of pest control;
- Phytosanitary legislation in effect;
- Information on the risks as well as health and safety advice;
- Basic knowledge about handling and risk management procedures;
- Wearing of protection and security equipment;
- Risks related to the transportation of pesticides;
- Procedures for handling, loading and unloading;
- Outline of treatment and operation process;
- Health and safety in relation to processing operations;
- Emergency and relief procedures;
- Technical procedures;
- Maintenance of equipment;
- Control of emissions;
- Monitoring of processes and residues;
- Biological monitoring of exposure to pesticides

7.6 INFORMATION AND AWARENESS-RAISING OF THE POPULATION AND DECISION MAKERS

Within the information and awareness-raising program of users on the management of pesticides, actions will have to be extended to the whole population and will also target policy makers and local authorities. These awareness-raising aims to reduce the risks of affection and intoxication by pesticides, to bring to an awareness all the issues, to induce a real change in behavior. These programs must be multifaceted in nature and rely on multiple materials.

In this regard, it is to establish active programs not only timely but should be of a permanent nature. In this case, it is indicated to develop a communication with the integration plan in awareness-raising of all social and professional structures existing in the society. The use of

local or national media services is important. The subject and/or conveyed themes in messages to transmit must include, in addition to the program on the management of agricultural pesticides, on the use of insecticides for sanitation and household.

8 PROPOSED BUDGET FOR THE IMPLEMENTATION OF PESTS AND PESTICIDES MANAGEMENT PLAN

Given that some of the suggested activities go beyond the execution framework of the project, only activities that could be supported by the project are budgeted here.

Table n ° 14: Implementation cost of the measures of PGPP

Objectives	Suggested mesures	Period	Coast (in 10^3 ariary)
Step 1: Strengthen the institutional and regulatory framework for pesticides management	- Popularization of plant protection laws	1st and 2nd year	NA
	- Revision of texts on the transport and disposal of pesticides	Start of the project	NA
	- Diagnostic laboratories on existing pesticides control and the strengthening of their capacities	Start of the project	NA
Step 2: Capacity-strengthening of the institutional actors and producers	- Training of trainers (Ministry officers, technicians DPV, NGOs, etc.)	1st year	5 000
	- Training of technicians (growers coaching)	1st and 2nd year	7 000
	- Training of growers (growers of the processing unit)	1st, 2nd et 3rd year	22 000
Step 3: Training of growers (partners or not of the processing unit)	- Training of resellers and distributors of inputs	1st year	500
	- Develop a practical guide for the use of pesticides (good practice guide)	1st ,2nd year	10 000
	- Organize awareness-raising sessions on pesticides management.	1st, 2nd et 3rd year	5 000
Step 4: Ensure the monitoring and evaluation of the	- Analysis and control	Annual	10 000
	- Permanent monitoring	Annual	5 000
	- Supervision	semestrial	5 000

Objectives	Suggested mesures	Period	Coast (in 10^3 ariary)
implementation plan	- Evaluation (Mid-term)	Once	15 000
	- Final evaluation (End of project)	Once	15 000
TOTAL			**99 500**

9 CONCLUSION

Assessments of the use of pesticides on sugarcane in the project's intervention area showed a low level of use of these products and which don't have notable damage on the environment or on human health yet. But it may be that a change in this situation is to fear where growers are moving towards an intensive production mode.

However, pesticides, when used appropriately, can be important for the production of sugarcane as well as for the protection of the environment and human health. In order for the control of pests and vectors to be successful, it is important to rely on effective, acceptable quality pesticide products that cause no adverse effects. We must also adopt a more integrated management of pesticides by ensuring the application of safety requirements.

The effectiveness of the implementation of PGPP relies, first, on the existence of a will to invest in capacity-strengthening of all actors involved in the management of pesticides, and secondly the commitment of stakeholders from different business sectors (public, private and growers) complementary and essential actions.

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ANNEXES

1 SYNTHETIC, BANNED PESTICIDES OR STRICTLY REGULATED IN MADAGASCAR

Name of product	Observations
- 2,4,5-T - Captafol - Chlordiméform - Chlorobenziate - Dinoseb and Dinoseb salts - Dibromo-1,2 ethane (EDB) - Fluoroacetamide - Heptachlor - Hexachlorobenzene - Lindane - Composed of mercury - Methamidophos (for formulations containing more than 600g of actifve principle / l only) - Parathion (ethyl and methyl) regardless of their concentration - Pentachlorophenol - Phosphamidon (for formulations containing 1000g of aactive principle / l only)	Decree 4196/06 23/03/06 on the ban of import, sales and use of some active ingredients of pesticides in agriculture
Aldrin	**Legislative or administrative measures:** decree No. 6225/93 of November 30 1993. Use suspended for any product containing aldrin
Chlordane	**Legislative or administrative measures:** decree No. 6225/93 of November 30 1993. Almost non-existent use.

Name of product	Observations
Chlordimeform	The product was never used, at least on a large scale in the country. It requires more time to make a final decision.
Mercury compounds, including inorganic compounds alkylmercury, alkyloxyalkyl and arylmercury.	Requires more time to make a final decision. Use abandoned in the 1980s.
Dieldrin	Decree No. 6225/93 of November 30 1993. The product was withdrawn in 1993.
Fluoroacetamide	Requires more time to make a final decision.
HCH (set of stereoisomers)	Decree No. 6225/93 of November 30 1993. Use abandoned in the 1980s.
Hexachlorobenzene	Unrecognized use. Requires more time to make a final decision.
Pentachlorophenol and its salts and esters	Unrecognized use. Requires more time to make a final decision.
DDT	**Import conditions:** use only permitted for combating malaria and under control of the Ministry of health services. **Legislative or administrative measures:** Decree No. 6225/93 of November 30 1993. Any use in agriculture is suspended for DDT-based products.
Heptachlore	**Import conditions:** General conditions. Use of the product limited to treatment of seeds. **Legislative or administrative measures:** decree No. 6225/93 of November 30 1993.
Lindane	**Import conditions**: within the conditions of general use of the product which is limited to the seed treatment. **Notes:** decree No. 6225/93 of November 30 1993
Dursban	Mandatory wearing of protective suit
Decis EC	Mandatory wearing of protective suit during the preparation and processing
Undene	Wearing of protective suit
Alsytin	Wearing of protective suit
Toxaphene	Products with high toxicity are prohibited for sale and use
Endrine	Products with high toxicity are prohibited for sale and use
Carbamate	Products with high toxicity are prohibited for sale and use

2 LIST OF ACTIVE HOMOLOGATED MATERIALS IN MADAGASCAR (August 07, 2014)

N°	Active ingredient
1	1-DECANOL
2	2,4 D ALAMINE SALT
3	2,4 DIMETHYALINE SALT
4	ABAMECTINE
5	ACETAMIPRIDE
6	ACETOCHLOR
7	ALPHA-CYPERMETHRINE
8	ALPHAMETHRINE
9	AMITRAZE
10	ANILOFOS
11	ATRAZINE
12	AZADIRACHTINE
13	AZADIRACHTINE
14	AZOXYSTROBINE
15	BACILLUS THURINGIENSIS SP KURSTAKI
16	BASILIC, GIROFLE
17	B-CYFLUTHRINE
18	B-CYPERMETHRINE
19	BENFURACARBE
20	BENSULFURON-METHYL
21	BROMADIOLONE
22	BUTRALINE
23	CARBARYL
24	CARBENDAZIME
25	CARBOSULFAN
26	CHLOROPHACINONE
27	CHLOROTHALONIL
28	CHLORPYRIPHOS-ETHYL
29	CHLORPYRIPHOS-METHYL
30	CINEOLE+ALFA-TERPINEOL
31	CYANOPHOS
32	CYFLUTHRINE
33	CYHALOTHRINE
34	CYPERMETHRINE
35	CYROMAZINE
36	DELTAMETHRINE
37	DIAFENTHIURON
38	DIAZINON
39	DICHLORVOS
40	DIFENACOUM
41	DIFETHIALONE
42	DIFETHIALONE

N°	Active ingredient
66	FLUOMETURON
67	FOSETYL-AL
68	FURATHIOCARBE
69	GLUFOSINATE-AMMONIUM
70	GLYPHOSATE
71	HALOSULFURON-METHYL
72	HALOXYFOP-ETOTYL-ESTER
73	HALOXYFOP-R-METHYL
74	HEXACONAZOLE
75	HEXAZINONE
76	HYDROXYDE DE CU
77	HYDROXYDE DE CU
78	IMIDACHLOPRIDE
79	LAMBDA-CYHALOTHRINE
80	MALATHION
81	MANCOZEBE
82	METALAXYL
83	METALDEHYDE
84	METALDEHYDE
85	METARHIZIUM ANISOPLIAE VAR ACRIDUM (IMI 330189)
86	METARHIZIUM ANISOPLIAE VAR. ACRIDUM
87	METHAMIDOPHOS
88	METHIDATHION
89	METOLACHLORE
90	METRIBUZINE
91	MONOCROTOPHOS
92	MYCLOBUTANIL
93	OXADIAZON
94	OXYCHLORURE DE CU
95	OXYTETRA-CHLORURE DE CU
96	PARAQUAT
97	PENDIMETHALINE
98	PHOSPHAMIDON
99	PHOSPHURE D'AL
100	PHTHALIDE
101	PRETILACHLORE
102	PROFENOPHOS
103	PROPAMOCARBE
104	PROPANIL
105	PROPICONAZOLE
106	PROPINEBE
107	PROPOXUR

N°	Active ingredient
43	DIFLUBENZURON
44	DIFLUBENZURON
45	DIFLUBENZURON
46	DIFLUBENZURON
47	DIMETHAMETRYNE
48	DIMETHOATE
49	DINICONAZOLE
50	DIPHACINONE
51	DIURON
52	EMAMECTINE BENZOATE
53	ESFENVALERATE
54	ETHEPHON
55	ETHOPROPHOS
56	ETHOXYSULFURON
57	ETOFENPROX
58	EUGENOL+CITRONELLA+SABINENE
59	FENARIMOL
60	FENITROTHION
61	FENPROPATHRINE
62	FENTHION
63	FENVALERATE
64	FIPRONIL
65	FLUBENDIAMIDE

N°	Active ingredient
108	PYPERONYL BUTOXIDE
109	PYPRIMIPHOS-METHYL
110	PYRIMICARBE
111	PYRIMIPHOS-METHYL
112	PYROQUILON
113	SOUFRE
114	SPINOSAD
115	SULFATE DE CU
116	SULFENTRAZONE
117	TAGETES
118	TEFLUBENZURON
119	TERBUTRYNE
120	THIACLOPRIDE
121	THIDIAZURON
122	THIOBENCARBE
123	THIODICARBE
124	THIRAME
125	TOLCLOFOS-METHYL
126	TRIADIMEFON
127	TRICLOPYR
128	TRICYCLAZOLE
129	TRIFLUMURON

3 REPORT FROM CONSULTATIONS WITH SUGARCANE GROWERS (Next page)

FITANANA AN-TSORATRA – MPAMBOLY FARY - PGIPP

Toerana: AMBODIFAHO

Daty:/ 3 / 0 // 0 / 9 // 1 / 5 /

Fokontany: AMBODIFAHO

Kaominina: BRICKAVILLE

Distrika: BRICKAVILLE

Faritra: ANTSINANANA

Antony: Famolavolana drafi-mpitantanana ny mpanimba ny voly sy ny fanafody enti-miady amin'izany ho an'ny fambolena fary hahodina ho alikaola fandrehitra (ethanol domestique).

Ny solontenan'ny BODEV no nanomboka ny lahateny rehefa avy niarahaba sy nisaotra ireo mpivory. Nazavainy tamin'izany fa sty fivoriana sty dia natao mba hakana ny hevitry ny mponina mba ahafahana mandrafitra ny drafi-mpitantanana ny mpanimba ny voly sy ny fanafody enti-miady amin'izany ho an'ny fambolena fary hahodina ho alikaola fandrehitra. Avy eo dia nosoratana tamin'ny dinika ireo ireto avy ny fanamarihan'ny mpivory:

- Ny mpamboly dia misoratra sy mava. Ny ahi-dratsy. Misy koa mpamboly fary mampiasa fanafody famonoana ny ahi-dratsy. Amin'izao fotoana izao dia tsy mampiasa fanafody miadiana amin'ny aretina sy bibikely ny mpamboly fary.
- Ny fanafody entin'ny tantsaha hamonoana ny ahitra dia: « Glifadare, Gezatope, Sakosto, DHD. Misy ihany ireo tantsaha mampiasa ny DG mba hamonoana ny bibikely amin'ny fambolena
- Nomarihan'ny tantsaha fa ny mpamboly fary eto Brickaville dia efa nahazo fiofanana mikasika ny fepetra tokony horaisin'ny mpamboly rehefa mikirakira fanafody, nandrafitra ny fotoana niasan'ny SIRAMA. Izy ireo dia nampiasa fitaovana toy: « tuberculostune, masque, gants, combinaison, bottes ».
- Ireo mpamboly fary dia nanipika fa rehefa hampiasa fanafody dia ireto avy ny fepetra tokony horaisina:
  - Fampandrenesana ny mpiara-monina mikasika ny toerana sy ny fotoana hanatanterahana ny fanaparitahana ny « pesticide » mba hiarovana ny fahasalaman'ny olona sy ny biby fiompy.
  - Fanangana tsipika « marquage » ny toerana nanaparitahana ny « pesticide »
  - Kobanina ery amin'ny toerana nambolena ny fitaovana avy nampiasaina.
  - Mandrafitra ny fanaparitahana fanafody dia tsy tokony hisakafo avy mila mandro amin'ny savony rehefa vita ny asa.

- Ny fanisian'ny mpamboly diaghisian'ny toeram-pivarotana fanafody manara-penitra, ary azo antoka.

- Tsy misy mpivarotra ireo aron'akanjo sy fiarovana ny vatana eto Brickaville. Ny fanirianay dia tokony hisy magazay mpivarotra ireo kojakoja ireo eto an-toerana.

- Tsy manohitra ny toro-drivotra ny mpamboly satria manomboka amin'ny 8 ora maraina ny fanafazana ny ranom-panafody (fifanarana azony avy amin'ny SICAMA)

- Mbola tsy tsara ny mitahiry ny fanafody ao an-tokantrano satria misy fofona ny fanafody. Ny vata olana narosoin'ny tantsaha dia tokony hisarona tsara ny fitoeran'ny fitahirizana ny fanafody. (bouteille, bidons ...),

Ny fanafody mifono sachet dia alevina rehefa avy nampiasaina satria hatahorana ho ampiasain'ny ankizy.

Ireto avy ny hetahetan'ny mpamboly mikasika ny fampiasana fanafody:

- Tokony tsy fanafody (tsy) lany daty, arahana toromarika fampiasana azy ary fampitandremana.

- Tokony hisy fivana tahirim-panafody ao amin'ireo mpivarotra fanafody.

- Manara-penitra ireo fanafody varotany "Cacheté"

- Tokony hisy ny fanofanana amin'ny fampiasana ireo fanafody avy amin'ny mpivarotra ho an'ireo tantsaha, indrindra fa ho an'ireo tsy mahay mamaky teny.

Rehefa tsy misy intsony ny fanamarihana dia nofaranan' ny Presidant ny fikambanana MAVITRA ny fivoriana

Ny mpanoratra

NY BIROSY

Ny filoha Fokontany AMBODIRAFIA

CHEF DE FOKONTANY

MAHASAHY MARCEL

FITANANA AN-TSORATRA – MPAMBOLY FARY - PGIPP

Toerana: ANKADIRANO | Daty:/01/ //10/ // 1 / 5 /

Fokontany : ANKADIRANO | Kaominina : Foulpointe

Distrika: TOAMASINA II | Faritra: ANTSINANANA

Antony: Famolavolana drafi-mpitantanana ny mpanimba ny voly sy ny fanafody enti-miady amin'izany ho an'ny fambolena fary hahodina ho alikaola fandrehitra (ethanol domestique).

Ny solontenan'ny BIODEV no nanomboka ny lahateny tamin'ny alalan'ny fifampiarahabana sy nanamafy tamin'ireo mponina ny anton'ny fivoriana. Toy izao manaraka izao ny dinika natao sy ny fanehoan-kevitry ny mpivory:

- Amin'izao fotoana izao dia tsy mampiasa fanafody ny mpamboly fary eto an-toerana. Misy aretina ny fary fa tsy mampiasa fanafody. Ny mponina dia miasa ny ahidratsy amin'ny tanim-fary.
- Tsy ampy vola ny mpamboly hividianana ireo fanafody hamonoana ny bibikely mihinana ny fary
- Mila fanofanana amin'ny fampiasana ny fanafody, fanadiovana ny fitaovana aorian'ny nampiasaina;
- Mila fanofanana mikasika ny fitehirizana ny fanafody,
- Mila toro-hevitra amin'ny fanariana ireo fonosan'ny fanafody aorian'ny nampiasaina.

Rehefa tsy misy ny fanamarihana dia nofaranan'ny Filoham-pokontany ny fivoriana.

NY MPONINA — [signature]

NY FILOHAM-POKONTANY — [stamp: COMMUNE RURALE FOULPOINTE • FOKONTANY ANKADIRANO] [signature]

VANONA TSIVERIMODY Justin

BIODEV — [signature]

FITANANA AN-TSORATRA – MPAMBOLY FARY - PGIPP

Toerana: Tsiroanomandidy

Daty: /0/3//1/0//_1_/_5_/

Fokontany :

Kaominina : Tsiroanomandidy

Distrika: Tsiroanomandidy

Faritra: BONGOLAVA.

Antony: Famolavolana drafi-mpitantanana ny mpanimba ny voly sy ny fanafody enti-miady amin'izany ho an'ny fambolena fary hahodina ho alikaola fandrehitra (ethanol domestique).

Ny solontenan'ny BIODEV no nanomboka ny lahateny rehefa avy niarahaba sy nisaotra ireo mpivory. Nazavainy taminizany fa ity fivoriana ity dia natao mba hakana ny hevitry ny mponina mba afahana mandrafitra ny drafi-mpitantanana ny mpanimba ny voly sy ny fanafody enti-miady amin'izany ho an'ny fambolena fary hahodina ho alikaola fandrehitra. Ary eo dia nisoso tamin'ny dinika ka ireto avy ny fanamarihan'ny mpivory:

- Mikasika ny bibikely mpitunina ny fary dia ny fano. Ny fano ireay dia mety hanimba 150 fototra fary. Tsy mampiasa fanafody hamonoana bibikely ny mpamboly fary. Misy ny fanafody fa ny tantsaha no tsy mampiasa.
- Ny mpamboly fary dia mampiseho ny fahavononany hampiasa ireo fanafody mikarakarana sy hamonoana ny bibikely mety hanimba ny fary.
- Ny mpamboly fary dia maniry ny fanampian'ny orinasa eo amin'ny lafiny toro-hevitra ara-teknika ary fampianarana mikasika ny fampiasana ny fanafodim-biby. Tokony ny orin'asa no manatoy fanafody ho an'ny tantsaha, averin'ny tantsaha rehefa miakatra ny vokatra fary.
- Eo amin'ny lafin'ny fampitaovana, dia maniry ny tantsaha mba hanampy azy ny orinasa, toy ny fitaovana ilaina amin'ny famonoana bibikely (aron'alanjo, kiraro, pulverisateur ---)
- Ny orin'asa dia tokony hanana teknisiana mahafehy ny voly fary, izy io dia hiandraikitra ny fahasalaman'ny fary, ary hanaramaso ny voly fary.
- Ny orin'asa dia miandraikitra amin'ny ady famonoana bibikely sy ny aretina mety hitranga amin'ny voly fary. Ny sarA-pitsaboana dia aloan'ny mpamboly amin'ny fiakaran'ny vokatra

Rehefa tsy nisy intsony ny fanehoan-kevitra dia novakiana ampahibemaso teo anatrehan'ny mpiosy ny fitanana an-tsoratra ka nanaiky ny votoatiny ny rehetra, amin'ny alalan'ny fanaovana sonia etsy ambany.

NY MPONINA

Rojonirina

Le DDR

RANAIVONANAHA Francis

BIODEV

COMMUNE RURALE FIHAONANA TSIROANOMANDIDY

LE VICE PRESIDENT DE LA DELEGATION SPECIALE

RAKOTONDRANOA André Félix

- Manana fahatokisana ny mpamboly amin'ny orin'asa amin'ny fitandrovana ny fiarovana ny fahasalaman'ny voliny.