Pesticide Risk Reduction Programme

Feasibility Study of the Proposed Pesticide Registration and Post-Registration Processes

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Contents

1 Introduction

1.1 Background

In 2010, the Government of Ethiopia, initiated a Pesticides Risk Reduction Project (PRRP) with technical and financial assistance from Government of the Netherlands and the Food and Agriculture Organization of the United Nations (FAO), The overall goal of the programme is to contribute to a sustainable pesticide management system in Ethiopia by regulating pesticide use by farmers. The following aspects are taken into account:

1. The whole pesticide life cycle from registration and procurement;
2. Import/local manufacture of pesticides;
3. Distribution, use and monitoring including quality control and obsolete pesticide
4. management;
5. Improvement of the environment, health of growers and the surrounding community;
6. Stimulation of the economic performance of the Ethiopian agricultural sector.

The Pesticide Risk Reduction Programme is divided into 6 Work Packages (WP):
O. General activities and Management of the project
A. Legal framework;
B. Development of a registration system for pesticides;
C. Development of a post-registration system for pesticides;
D. Sustainability of the developed registration and post-registration systems;
E. Impact assessment.

WP D focuses on the sustainability of the developed registration systems. One of the activities is to perform a feasibility study for a sustainable pesticide registration and post-registration system, which will evaluate the legal, institutional and financial aspects (e.g. levies on registration) of the pesticide registration and post-registration system.

1.2 Objective

The objective of this project is to assess the institutional and financial feasibility of the pesticide registration and post registration systems that are proposed as results of the Pesticide Risk Reduction Programme Ethiopia.

1.3 Demarcation

In this study, the assessment of the legal feasibility has not been included because the development of the legal framework is the content of a separate work package. Since the implementation of the results of the PRRP is a political decision of the Ethiopian government, the adjustment of the Ethiopian legacy is a logical consequence of that decision, and by consequence feasible.
During the execution of this project, it became apparent that the development of the post-registration processes has terminated. The only decision has been taken to develop a national reference laboratory for measuring residues of pesticides. Therefore, the assessment of the feasibility of the post-registration processes could not be executed according to the objective. Nevertheless, attention will be paid to the conditions to be fulfilled to make the integral system of registration and post-registration processes successful in terms of contribution to a sustainable system of pesticide use.

1.4 Approach

In this project the following approach has been followed:

1. Three interviews have been held with representatives of the Dutch Food Safety Authority, the Dutch Pesticide Registration Authority and the Board of pesticide producers in the Netherlands.
2. A framework has been developed which has been discussed with the local consultants of LID, which had to do the field research in Ethiopia.
3. The registration process which has been developed in work package B and described in Appendix 3 has been provided by the team of work package B.
4. A national workshop has been held, in which the proposed approach has been presented to stakeholders in the field of pesticide use.
5. Field research has been executed, mainly by the consultants of LID to collect data and information and to analyse them. Prior to the induction of the main task, an intensive document review was undertaken by the consultants. Relevant documents include Pesticide Risk Reduction Programme, government policies, guidelines and strategies on pesticide importation and use, impacts of pesticide on human health and environment. Moreover, documents related to registration and post-registration systems along with associated costs to run the system sustainably have also been referred to. Interviews with key informants at various levels have been held which helped in exploring the basic data and other important issues to get sufficient information for the evaluation. The consultants conducted interviews with key informants such as smallholder farmers, farm managers, workers in rose farms, and offices of agriculture. In addition to secondary data gathering, interviews and discussions have been undertaken with staff from the following institutions:
   - CSA (Central Statistical Agency)
   - PHRD (Plant Health Regulatory Directorate) of MOA
   - MOA (Ministry of Agriculture)
   - CLE (Crop Life Ethiopia)
   - ERCA (Ethiopian Revenue and Custom Authority)
   - RBOA (Regional Bureau of Agriculture)
   - Woreda Agriculture Office
   - Unions
   - EHPEA (Ethiopian Horticulture Producers and Exporters Association)
   - Wholesalers
   - Retailers

   Field observations were applied to obtain some qualitative data supplementing the quantitative data collected. Field observations and verifications were conducted at three rose farms (Flower farming at Joy tech, Enyi Flower Farming, Flower farming of Olejrosen, and The Tech vetch enterprise); at three chat-producing smallholder farmers (at Haramaya Woreda of East Hararghe Zone-Awaday). Moreover, wholesalers and retailers in Addis Ababa were visited.
6. A second national workshop has been held, in which the results of the study have been presented to stakeholders.

All results are described in this report.

1.5 The concept of feasibility

In this report, we analyse both the institutional and financial feasibility of the proposed system. This requires an elaboration of this concept, and how institutional and financial feasibility are related to each other. We apply the following definitions:

1. The assessment of the feasibility implies the analysis whether implementation the results of the PRRP with respect to the pesticide registration and post-registration process will contribute to sustainable plant production according to the objectives of the programme.
2. The assessment of the institutional feasibility implies the analysis whether the organisational and political conditions are present to make implementation successful.

3. The assessment of the financial feasibility implies the analysis whether the balance between costs and benefits of the proposed system will be present dependent on the paying mechanism to be applied to make implementation successful.

We distinguish between conditions which are within control and conditions which are beyond control of the authorities responsible for implementation of the results of the PRRP. All aspects contribute to the assessment of the feasibility. However, the assessment is not a static analysis whether implementation can be successful, but as far as conditions within control of the authorities are absent, recommendations will be given how to satisfy those conditions.

1.6 Reading guide

This report has been structured as follows. After this introduction, we present some background information about crop production and protection in Ethiopia (Chapter 2). In Chapter 3, we describe the results of the institutional analysis. In Chapter 4, we describe the financial feasibility. The last chapter contains conclusions and recommendations.

2 Crop production and protection in Ethiopia

2.1 General

Ethiopia's economy is based on agriculture, which is estimated in 2013 for 47% of the total Gross Domestic Product (GDP) and accounted for 85% of total employment in 2009. According to CSA, 2013 about 12.3 million hectares of area is covered by agriculture. Coffee is the main export crop, followed by hides & skins and oil crops. The agricultural sector suffers from poor cultivation practices and frequent drought, but recent joint efforts by the Government of Ethiopia and donors have strengthened Ethiopia's agricultural resilience, contributing to a reduction in the number of Ethiopians threatened with starvation. The banking, insurance, and micro-credit industries are restricted to domestic investors, but Ethiopia has attracted significant foreign investment in textiles, leather, commercial agriculture and manufacturing.

Pests (insects, plant diseases and weeds) are one of the challenges in crop production. Usually pests need attention for the following major reasons:

- Loss in quality and quantity of produce;
- Increased cost of production (pesticide and other technology application);
- Reduced market access due to lower quality (for both domestic and foreign trade) and residues;
- Aggravation of food insecurity.

If we take one of the above stated effects of pests, which are deterioration of quality and quantity of produce, we can conclude that pests are estimated (on average) to reduce production by 10-40% (MOA, 2013).

2.2 Plant production

Alleviating food security is one of the most important objectives to be attained by the agriculture system. The agriculture system in Ethiopia is dominated by rain fed agriculture, where the performance of the sector is highly dependent on the timely onset, duration, amount and distribution of rainfall that makes the sector highly vulnerable to drought and other natural calamities.

Thus, in Ethiopia, assessing total food supplies and providing timely early warning signals to the emerging difficulties due to drought and other natural calamities are and remain to be the primary objectives of the efforts to be made annually by the government and the concerned stakeholders. Towards this end, many factors need to be taken into consideration.

Improving agricultural productivity is the key for agricultural development in Ethiopia. Hence, it is widely believed that productivity growth is the most important way to increase agricultural production. Crop yields as measured by the amount of output per hectare have been increased in many crop producing areas of the country in recent production seasons. This increase in crop production has been a result of factors including the use of improved technologies and better farm management activities. As stated in different literatures related to agricultural crop production, various farm practices include application of recommended new agricultural technologies such as:

- improved seed and fertilisers;
- soil conservation practices;
- effective control of weeds, pests, diseases etc. increased agricultural production and productivity in general.

2.3 Pesticides in Ethiopia

Most of African countries lack adequate pesticide management capacities and this situation has resulted in the generation of large stocks of obsolete pesticides, empty pesticide containers, contaminated equipment, materials and heavily contaminated soil at certain sites and water bodies with a daily impact on human health and on natural enemies of pest species. Inadequate use of pesticides may have a large impact on quality of surface and ground water: the presence of residual pesticides in water reduces the availability of healthy drinking water and will reduce the ecological quality of surface water systems.

Residue problems have been reported on some export crops at different occasions. The fast growing horticulture export sector of Ethiopia faces many problems. Some pesticides with high human and mammalian toxicity and pesticides that have been restricted in developed countries are still circulating in the country due to poor regulation and lack of incentives to comply with Good Agricultural Practice (GAP). These conditions reflect a mismanagement of pesticides at different stages of the life cycle of pesticides in Ethiopia (FAO, 2013).

A basic problem in the management of pesticides is the lack of a proper registration system in Ethiopia. The registration of pesticides is still at the development stage and there is little expertise in the field of implementing internationally agreed pesticide registration procedures and guidelines and not enough capacity for conducting the required lab analysis which may lead to a situation of registering pesticides that are harmful for public health and the environment in general. Moreover the awareness on safe and judicious use of agricultural and public health pesticides is very limited. This has resulted, especially among smallholders in horticulture, in widespread misuse of pesticides, including limited variation in pesticide use creating resistance, suboptimal timing and scheduling. In addition farmers show a strong preference for cheap products with a broad spectrum with doubtful efficacy compared to the newer products (De Putter et al, 2012).

Over the last 10 years the Ethiopian government has been concerned about safe disposal of obsolete stocks. In collaboration with the government of Ethiopia, the Food and Agricultural Organization of the United Nations (FAO, 2013) secured funds from international donors and insured disposal of 2,273 tonnes during obsolete pesticide projects. Currently about 415 tonnes are also safeguarded awaiting finalisation funding arrangement from Croplife International. However, Ethiopia is still not free from obsolete pesticides (FAO, 2013).

At the same time, Ethiopia is in the process of intensifying its agriculture to meet national demands for food and to increase agricultural exports like coffee, flowers and vegetables. This implies that for sustainable growth of the agriculture sector there is an immediate need for proper regulation and management of pesticides. Pesticide management therefore receives much attention from the government in order to attain high quality agricultural produce for local consumption and export and to protect public health and natural resources.In view of this, the Government of Ethiopia has initiated a national programme to improve pesticide management along the pesticide life cycle: from the registration and import of pesticides, to use and monitoring, and including quality control and waste management (FAO, 2013). To this end, it is aimed at establishing an institutionally/organisationally and financially feasible and sustainable pesticide registration and post registration system. As a result a study is conducted and the assessment report is prepared on establishing such system with in PHRD of MOA.

3 Institutional feasibility

3.1 Principles

In the assessment of the institutional feasibility of the proposed registration system developed in work package B of the PRRP project, we focus on conditions necessary for a successful implementation of the registration and post-registration procedure. Success implies not only that it works according to the direct objectives such as that the assessment unit will apply the registration procedure correctly, but also that it contributes to the ultimate goal which is a substantial improvement of sustainable plant production. Therefore, we have applied the following principles:

a. All organisations responsible for tasks in the whole registration and post-registration procedure should be present in Ethiopia or in the neighbourhood in the case of research and testing, dependent on the sensitivity of the research for local conditions. The registration procedure includes both the composition and the assessment of the dossier.
b. The capacity of those organisations should be sufficient to execute their tasks, both in terms of sufficient manpower; skills, knowledge and technical equipment, and this capacity should not be vulnerable against disruptions.
c. Sustainable pesticide use presupposes the availability of sufficient efficacious pesticides for protecting the majority of the crops, both cash crops and commodities against present pests and diseases which have been approved in the proposed registration procedure. This requires that sufficient requests for registration will be submitted by pesticide producers. Pesticide producers will only ask for registration if they have the perspective that the revenues exceed the costs. This requires that conditions for fair competition should be present. This last principle has been added to prevent a system that is institutional feasible from a formal point of view, but that does not work in practice and by consequence does not contribute to a sustainable pesticide use in Ethiopia.

The assessment of the feasibility is not limited to the evaluation of the feasibility itself, but includes also recommendations which steps have to be added in order to make it feasible.

3.2 Pesticide registration procedure

The pesticide registration process requires a unit that is able to assess the dossier according to the new procedure. According to the current procedure, the dossier is only checked on completeness, and not in relation to quality criteria and technical and scientific aspects. In the new procedure, the submitted dossier is checked if it meets the quality criteria and is evaluated on its technical and scientific aspects. This requires that the members of the assessment unit have skills and resources to do their task. With respect to the skills, the current team of the assessment unit has been trained in the PRRP project to execute their task according to the new procedure. However, on the basis of research of this project, we expect that this unit is vulnerable for the following reasons:

1. Only the current team is trained. This team consists of about 10 members, which do this task for one day per week on average, and have other main responsibilities as well. If team members have to leave the assessment unit for whatever reason, no replacement with comparable skills and knowledge is present.
2. The capacity of only 2 fulltime equivalent is very limited for the challenge to assess modern pesticides and reassess the current registered pesticides. Experts from the project team estimate that at least 3 to 4 weeks fulltime effort is necessary to assess a full registration dossier. This implies that the current capacity is limited to about 25 dossiers per year (see Chapter 4 for more details about the calculations of the necessary capacity).
3. The team is not independent in that they are not fully assigned for tasks of pesticide related activities. As part of the ministry of agriculture they lack a sufficient mandate to set priorities and

to assess the dossier independent from public and private pressure. Independency is important for the following reasons:

a. The assessment unit most have the freedom to employ sufficient assessors and other staff to be able to assess of requests for registration within a limited time horizon.
b. The assessment unit should not be responsible for other obligations competing for the same resources.
c. The assessment unit must be able to generate his own budget to cover the costs.
d. The assessment unit needs autonomy to take decisions on the registration without any interest for the unit itself neither for the assessors personally.

The submission of a dossier for registration requires results of field trials to analyse the efficacy and the environmental effects and the effects of the pesticide on the health of the sprayer and the consumer. Efficacy testing is done by independent organisations which are accredited to do these trials and tests, and which need sufficient capacity and skilled employees to do the experiments. Part of the research is not geographical specific, such as effects on human health and environmental effects. Efficacy data collection and testing need to be undertaken by Ethiopian Institute for Agriculture Research (EIAR) and universities in collaboration with PHRD: the collaboration pulls resources (human resources and laboratory equipment) together and increases efficiency.

In Appendix 3 the new registration process is described in detail. In Table 3.1 a comparison of the proposed registration system and the existing registration system presented.

Table 3.1
Comparative advantages of proposed registration and control system over the current system

S/N	Description	Former registration and control system	Proposed registration and control system	Remarks
1	Legal framework	Fragmented pesticide legislation – Registration and control by two bodies (Ethiopian Food and Medicine and Administration and Control Authority (former DACA and MoA)	Registration and control of all types of pesticides is conducted under one legislative control (Directorate) through MoA	
2	Dossier evaluation staff	Part-time	Full-time	
3	Training	No or minimal training on pesticide registration for the staff	Several dossier evaluation staff obtained training on pesticide registration and planned to work on it	
4	Registration data requirement	SEARCH based data requirement have been used	Research based data requirements have been updated	
5	Registration criteria	No acceptability criteria were used for registration decision	Acceptability criteria for human health, environment and efficacy have been developed	
6	Registration decision	Only was based on completeness check and limited data on toxicity	Would be based on completeness check, technical evaluation (human health environment and including physical and chemical properties)	

3.3 Post-registration procedure

Since no results from the work package working on post-registration processes are available, no assessment can be made about the financial and institutional feasibility of the post-registration processes as indicated in Chapter 1. However, the good functioning post-registration processes are important for the feasibility of the registration process itself. If a good functioning inspection system on import and use of illegal pesticides is absent, Incentives for farmers and growers to buy registered products lack. By consequence this is a disincentive for pesticide producers to apply for registration.

4 Financial Feasibility

4.1 Introduction

The financial feasibility is limited to the registration process. The feasibility has been calculated for the 5 representative case crops and the whole plant production sector in Ethiopia. The criterion used for the assessment of the financial feasibility is the relative change in cost price of plant products caused by the change in registration costs of a pesticide which have to be paid back by the pesticide user.

4.2 Description of Case crops

The case crops are selected on criteria based on area size, importance for export market and amount of chemical use per hectare. For the sake of general overview, a total of 16 crops are briefly discussed in Appendix 1. For this specific study, as a result of their production volume, production value, export earnings, demand they have for pesticides the study focused on the following five crops:

- maize
- bean
- tomato
- rose and
- coffee

Maize is selected for that it is planted on a relatively large area of land and its production is the highest of all crops. The cultivated land for maize (CSA, 2013) is 2.02 million hectares and the harvested yield is 6.15 million tonnes. The number of land holders of maize are estimated to be 9 million where that of teff is 6 million. In the same way the production and productivity is higher in the case of maize than that of teff where the latter crop is a bit higher in area cultivated (CSA, 2013). Beans and tomatoes are vegetables and cash crops. Beans are produced for the export market, whereas tomatoes are mainly produced for the domestic markets. Coffee is a commodity mainly produced for the export market. Floricultural crops are selected as case crops for that they are cultivated commercially on significant hectares of land, and consume relatively huge amount of pesticides. The crops are exported for more than 70% exported to the Netherlands (EHPEA, 2013).

4.3 Pesticides and pesticides use of the country

The pesticide applied area was estimated to be 2.3 million hectare; the number of holders using pesticides is more than 3.4 million, (CSA, 2013). The largest share of all pesticides used in Ethiopia are imported from abroad. A limited amount of the pesticides are produced in Ethiopia, by the Adami Tullu Pesticide Processing Share Company in the Adami Tulu Werede near Ziway. According to MOA/APHRD, a general trend of pesticide importation is found to be an increasing trend for the last 13 years (Table 4.1). This indicates that in Ethiopia, economic importance of pesticides is being recognised and utilised. Parallel with this, the production of pesticides in Ethiopia is also increasing (Table 4.2).

In 2013 a total amount of 3,182,668 (lt or kg) of pesticides is imported for commercial purpose (for more information see Appendix 2). The three major categories of pesticide chemicals arranged from the higher volume to the lower are herbicides, insecticides and fungicides respectively. Besides, there are prominent amount of pesticides imported for flower production (145,051 lt/kg) and some amount of pesticide requested by different institutions for their own use. Even though such an augment amount of chemicals imported in the year, the rate of chemicals used per crop is still low. This indicated that there is still a low amount of pesticides are used. Types of pests attacking the five case

crops and the appropriate chemicals against the pests are listed in Table 4.3. In Table 4.4 an overview of the pesticide use of the case crops in total and per ha is given.

Table 4.1

Pesticides importation into Ethiopia b/n 2000 & 2013 (tonnes of formulated product)

Year	Insecticides	Herbicides	Fungicides	Others	Total (M T)
2000	160.7	805.9	46.8	2.5	1,015.9
2001	462.6	760.7	36.0	177.5	1,436.8
2002	706.0	1136.0	71.0	171.0	2,084.0
2003	359.0	868.5	77.0	323.0	1,627.0
2004	407.0	915.7	114.0	322.8	1,759.5
2005	455.6	1197.6	146.6	423.8	2,223.7
2006	569.3	1821.1	135.7	801.6	3,327.7
2007	595.7	1687.9	153.7	594.4	3,031.7
2008	453.1	1634.9	141.7	212.7	2,442.4
2009	376.8	3105.8	223.1	12.6	4,718.3
2010	651.9	3146.8	387.3	25.4	4,211.5
2011	431.0	973.0	337.0	0	1,741.8
2012	1212.0	1992.0	355.0	52.0	3,647.7
2013	1,751.04	2,877.95	512.89	75.13	5,217.01
Average	**613.70**	**1637.42**	**195.56**	**228.17**	**2748.93**
Share in%	**22.32**	**59.57**	**7.11**	**8.30**	

Source: MoA/APHRD, 2013

Table 4.2

Pesticide Production by Adami Tulu Pesticide Processing S.C 2000-2012 (tonnes)

Year	Insecticide for		Acaricide	Fungicide	Total (tonnes)
	Agriculture (A)	Public Health (B)			
2000	106.46	-	2.50	-	108.96
2001	293.75	93.65	3.03	-	390.43
2002	319.71	60.34	2.00	-	382.05
2003	545.50	157.78	7.42	-	710.70
2004	397.17	475.25	12.42	-	884.84
2005	327.54	565.41	70.31	-	963.26
2006	792.07	764.46	22.42	-	1,578.95
2007	767.92	616.47	50.59	-	1,434.98
2008	560.93	785.23	34.79	1.84	1,382.79
2009	773.18	15,61.58	28.52	0.07	2,363.35
2010	1,110.50	19,59.84	65.28	21.50	3,157.12
2011	1,093.02	8,62.18	67.70	36.57	2,059.47
2012	1,209.51	9,56.07	71.71	8.44	2,245.73
%	**48.48**	**51.64**	**100**	**100**	
Total (A+B)	**17,662.63**				

Source: Adami Tulu Pesticide Processing Share Company, May 2013

Table 4.3

Five Case Crops, Major pests and pesticides used

Crop	Major pests	Pesticides applied
Maize	Army worm, ABW, grass weeds, weevils, termites	Chlorpyriphos-ethyle, Aluminumphosphide, Carbaryl, Metholachlor and Atrazine
Bean	Army worms, Bean flies, ABW, Bean stem maggots	Chlorpyriphos methyl
Tomato	Early blight, late blight, downy mildew	Mancozeb
Coffee	CBD	Chlorothanolin
Rose	Aphids, thrips, caterpillars, mildew and white fly	Deltametrine, Tetraconazole, Methamsodium, Boscalid

Table 4.4

Number of holders, pesticide applied and quantity of pesticide used in 2012/13 (CSA)

S/N	Crop Type	Pesticide			
		Holders	Hectare	Application Rate (Lt/kg)/ha	Amount (Lt/Kg)
1	Maize	266,911	72,884	12	874,608
2	Haricot Beans	54,002	16,249	10	162,490
3	Tomatoes	8,813	2,500	25	62,500
4	Coffee	18,040	757	5	3,785
5	Rose	85	1,315	32	42,080

Source: MoA, 2013 in tonnes in 2012

Up on the assessments on pesticides situation in the country discussions have been made/conducted with relevant expertise from MOA, BOA, Woreda Agriculture Office, CLE, importers, wholesalers, retailers, growers, EHPEA, Floriculture Industries, etc.; relevant documents/literatures were thoroughly referred: Following these and expertise judgment, it is estimated that about 25% of pesticides (volume) in the market are of illegal ones; those which came to the market through smuggling/without registration and being applied/used by growers, mainly via Kenya and Somali. Based on this estimation, about 3,915 tonnes pesticides (75% of 5,220 tonnes, total imported pesticides in year 2013) accounts for the legal ones and 1,305 tonnes pesticides, which accounts 25% of total pesticides in the market are those which are not registered, as a result their socio-economic and environmental impacts are not tested and may be risky.

4.4 Registration Costs

Currently, in Ethiopia there are 313 registered pesticides; in 2007 the number of registered pesticides was 197; on average the Ministry registers 20 or less products annually. Procedurally, the registrant comes up on application for the purpose of registration. They are requested to bring all necessary documents as stated on manuals and guide lines of the directorate. The documents supplied by the registrant are scrutinised through administrative check; if it is checked and found to be complete, it is submitted to technical/evaluation committees. Technical committees (technical team members) examine/evaluate the documents/dossiers and give recommendations. In the meantime the registrant is expected to come up with sample of the pesticide, for further references (up on disputes). Following the approval of the documents by the technical committees, the head of the directorate approves and let letter of acceptance be written for the registrant.

Once the pesticide dossier gets approval by Plant Health Regulatory Directorate for registration through completing all requirements set by the Ministry, it will be registered. Up on registration the registrant pays ETB1,000 for the purpose of registration process. This registration is valid for only five years; as a result after five years the pesticide dossier will be evaluated, approved (if it is complete) and then renewed for five years. For every renewal of the registration ETB500 is need to be paid. For the purpose of renewal, application must be submitted at least 90 days prior to the due date for renewal of the registration/license. Assessment indicates that Ethiopian charges for registration and renewal purposes are the least, for instance as compared to Kenya. For example, the cost for the trial permit in Kenya is about KSH10,000 to cover the costs for monitoring and evaluation by the accredited public or private institute. In addition, the costs for the registration are KSH90,000. This is a permit for 3 years. After this period, a renewal is required that costs KSH20,000 and is valid for 2 years (ETB1 = KSH4 = EUR0.04).

4.5 Analysis of Feasibility of the System

4.5.1 General

The current system is not up-to-date, and requires implementing the proper requirement and criteria that have been developed by the PRRP-Ethiopia project to assess pesticides. Currently, there is no full time staff responsible for these tasks (registration and post registration), although there is a structure

being developed by Ministry of Agriculture for the system to run the works properly. The developed system intended to comprise ten basic staff members including the directorate to be properly operational. The new system of the directorate is going to use resources like office, administrative/support staff, overhead costs, vehicle etc from the Ministry.

The new system is expected to be financially and institutionally autonomous in such a way that it will sustainably provide the services. Therefore, the new system is designed in such a way that it could cover personnel costs, staff benefits, staff capacity building, office equipment and office furniture.

4.5.2 Institutional feasibility of the system and executing personnel

At the Ministry one general director for the system is recruited and works under the premises of PHRD. The General Director plans, organises and controls the work of registration and post registration aspects of the project. He supervises the work of the delegated body assigned at the pesticide import destination. He also works all dossier evaluation, efficacy work procedures, keeps the necessary documents pertaining pesticide.

At the pesticide inspection ports mentioned above the authorised personnel will be assigned. They execute the work of safety and legitimacy of the pesticides imported. The structural make up and their function along with their proposed salary will be depicted in Table 4.5.

Table 4.5
Personnel required for the proposed registration System

S/No	Duty Station	Job title	No.	Precise job description	Salary (ETB)	Modality of the work
1	At the Ministry, PHRD	General Director for the System/Directorate	1	Plan, organise and control the annual work of registration and post registration; Compile records, reports sent from technical staff; Gives relevant instructions to its subordinates Undertakes administrative checks	5,500	Contractual
2	At the Ministry, PHRD	Technical Staff like Human toxicologist, environment toxicologist, Pesticide administration officer and others as appropriate like support staff: duties and responsibilities of these staff are mainly assessment of the pesticide registration dossier	9	Undertake all necessary preliminary checks, recordings, and evaluations, Provide guidance/orientations for the registrants	4,500 (For each staff)	

4.5.3 Financial feasibility and source of fund

By maintaining the complementarity of institutional/organisational and financial feasibility of the developed system, registration and post registration tasks and activities shall be operated properly and sustainably.
The system operates in a sustainable situation if the revenue it has is greater than or equal to its expenses. To ensure its sustainability to provide the registration and post registration services in the country, two major factors need to be revised/installed. First, the revenues should be revised (financial feasibility), and, second, key staff should be assigned (institutional/organisational feasibility). Then the system shall financially and institutionally/organisationally be feasible and extend the service properly.

In order to assess whether the proposed system is financial feasible, we make the following assumptions:

1. Currently somewhat more than 300 pesticides are registered, which have a license for 5 years. We assume that in future we also need 300 pesticides to have sufficient means to protect the crops grown in Ethiopia. This implies that yearly 60 dossiers need to be approved. Given the fact that not every evaluation will be successful, about 72 dossiers need to be assessed.
2. It takes about 4 weeks to evaluate a full dossier. A fulltime employee is able to assess 12 dossiers. By consequence, 6 fulltime employees are necessary for the assessment.
3. Indirect costs (director, secretary, office equipment etc.) = 60% from direct costs.

On the basis of these assumptions, the total costs can be calculated as 6 * ETB4,500 * 12 * 1.6 = ETB518,400.00. This indicates that ETB8,640 per approved dossier and ETB1,728 per pesticide per year is expected. Given the total area of plant production of more than 10,000,000 ha, this is ETB0.05 per ha. However, only on a part of the area of plant production, pesticides are applied (2.300.000 ha). Taking this into account, the costs are ETB0.23 per ha.

In Table 4.6 we have summarised the results of the calculation of the financial feasibility, based on the estimated areas on which pesticides are applied. The increase in costs are very low and less than 0.05%.

Table 4.6
Summary of the assessment of the financial feasibility

Crop	Total area	Area pesticides applied	Total costs per ha	Registration costs per ha per pesticide	Relative share of registration costs in total costs
maize	19632000	72884	11250	0.023709	0.000%
beans	331708	16249	8800	0.106345	0.001%
tomatoes	7256	2500	17100	0.6912	0.004%
coffee	700000	757	7700	2.282695	0.030%
rose	1315	1315	1089000	1.314068	0.000%

Therefore, a system in which all registration costs are fully paid by the registrant is feasible. In this calculation, other financial sources such as import fees are not included. Currently the registration and post-registration system or the pest management system is being run by the MOA through staff of the Ministry who are employed for other tasks (duties and responsibilities). But they conduct all registration and post registration activities as additional responsibilities. Unlike that of registration, nearly none of the activities of post registration tasks are being done by the Ministry. As it is indicated above registration and post-registration systems comprises different activities to enable the system to function properly.

To enable the system to function properly, at least two main issues need to be paid attention to and implemented. Firstly, the systems need to have full-time employees; secondly the magnitude of fees and charges must be reviewed and increased, according to the above calculations. To sustain the system, its revenue must out-ways its expenses. As it is stated above, the fees and charges set by MOA is very much less than that of other countries like Kenya; this also calls for increase in revenue of the system. In another way round, in addition to expenses for employees, the systems need to have office furniture & equipment, and expected to cover its overhead costs too. Apparently, it is necessary and vital to pay attention to organise companies importing pesticides under an umbrella for the sake of efficient administration and also to generate income as levis/taxes. In Ethiopia, there are only eleven pesticides importing companies (nine foreign and two national) organised as an association under CLF. But there are by far more than eleven companies working in the industry in these regards. Kenyan experiences tell us that pesticides importing companies are organised under an association and paying levis to the government (5% of total taxes they pay). Therefore, the study recommends the Ministry to consider establishment of such a structure for administrative and income generating purposes, provided that the revenues will be applied for enhancing sustainable pesticide use.

5 Conclusions and recommendations

5.1 Conclusions

Based on the analysis in Chapter 3 and 4, we conclude as follows:

- The proposed pest registration system is feasible from an institutional point of view if the following conditions are met:
  a. The administrative registration management unit needs to have sufficient capacity, consisting of at least 6 fulltime employed staff members.
  b. The staff members need to have sufficient knowledge and skills to conduct the dossier evaluations.
  c. The registration unit need to be established as an independent unit, provided with a director and secretary, and responsible for costs and revenues of the registration process.
  d. Post-registration processes such as border and on farm inspections need to be developed and implemented to prevent disincentives to apply for registration by pesticide importers and producers and to prevent disincentives to apply illegal and counterfeit pesticides by farmers and growers.
- The proposed registration system is feasible from an financial point of view. The total costs of the registration process is estimated at ETB0.23 per ha on which pesticides are applied. Per pesticide and per crop, the registration costs do not exceed 0.05% of the total costs.

5.2 Recommendations

- It is recommended to establish a registration unit according to the conditions mentioned in Section 5.1. and to apply the proposed registration procedure for both new requests and renewals.
- It is recommended that all registration costs are fully covered by the registration fee, which has to be paid by the applicant.
- It is recommended that the Ethiopian Ministry of Agriculture develops a transition strategy to move to full application of the new pesticide registration procedure. This includes the following aspects:
  a. To set the time horizon within which the transition has to be completed. This can be the period that registration of a pesticide is not expired (5 years). An assessment how many employees are needed to complete the transition based on the time horizon, the number of currently registered pesticides which will be reassessed and an estimate of the number of new pesticides which need to be assessed in order to have a sufficiently broad and sustainable pesticide package to protect crops against pests and diseases. Reassessment of currently registered pesticides only takes place if the applicant has sufficient confidence that the pesticide will meet the requirements.
  b. An order in which currently registered pesticides have to be assessed, dependent on the expiration of the current registration and the availability of sustainable replacing pesticides.

- Successful implementation of the pesticide registration procedure can only take place if the following conditions are met:
  a. All pesticides legally applied should have been subject to the same registration procedure and criteria. This requires that the exception for the floriculture sector should be skipped. It is important that all producers are faced to the same legislation, procedures and criteria, in order to prevent legal inequality. The only exception is in case of emergency, when a new pest or disease immediately threatens important crops. However, this requires a procedure for emergency measures with a limited time horizon.
  b. It is therefore also important that reassessment of the current registered pesticides take place according to the new procedure. If farmers and growers can apply both cheap and broad working but polluting and toxic pesticides and pesticides with higher prices meeting the new criteria, they will choose the currently registered pesticide from an economic point of view. This

creates a disincentive for pesticide producers to request registration for modern products and hampers the change to sustainable pesticide use.

c. It is necessary to remove legal barriers which complicate the access of farmers and growers to buy pesticides.
d. It is recommended to remove practical barriers which complicate the access of farmers and growers to buy pesticides. Examples are labels on pesticides not available in the local language. Furthermore extension programmes are necessary especially to get smallholders familiar with modern pesticides and the way they have to be applied.
e. It is also important that the post registration process as evaluated in Section 2.3 works well. A well-functioning inspection system at the border to prevent the import of illegal and counterfeit pesticides and inspections on farm including inspection on pesticides already imported and being sold to the farmers are necessary conditions to prevent the use of illegal pesticides.

- The post-registration processes need to be developed and implemented urgently, with special attention to the prevention of import and use of illegal and counterfeit pesticides.
- It is recommended to end the exception for import of pesticides for the floriculture industry. However, attention must be paid to the availability of sufficient pesticides during the transition.
- Awareness creation and promotion works need to be worked on with regards to bringing all companies working on pesticides importation, marketing and use under an common shared strategy towards sustainable pesticide use.

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Annex 1 Overview of major crops grown in Ethiopia

Table 1 gives an overview of the main crops produced in Ethiopia. In the following paragraphs the crops are characterised in more detail.

Table 1

Area, production, production values of main Crops 2012/13

S/N	Crop Type	Crop Area	Yield (kg/ha or stems[1]/ha)	Production (tones/stems)	Unit Price (kg/stem)	Production Values (ETB)
1	Maize	19,632,000	2,500	4,908,000	10	49,080,000,000.00
2	Haricot Beans	331,708	727	151,850	20	3,037,000,000.00
3	Tomatoes	7,256	950	5,800	10	58,000,000.00
4	Coffee	700,000	650	455,000	100	45,500,000,000.00
5	Rose	1315	100000	131,500,000Stems	1	131,500,000.00
6	Tef	2,781,186	1355	37,690,984	15	565,364,760,000.00
7	Sorghum	1,685,729	2137	36,028,732	10	360,287,320,000.00
8	Wheat	1,595,724	2076	33,119,728	10	331,197,280,000.00
9	Barley	1,047,281	1706	17,867,203	7	125,070,421,000.00
10	Faba bean	583,821	1609	9,394,740	5	46,973,700,000.00
11	Finger millet	444,908	1692	7,527,339	5	37,636,695,000.00
12	Field pea	259095	1254	3,250,165	4	13,000,660,000.00
13	Chickpea	132724	1698	2,254,218	7	15,779,526,000.00
14	Sesame	271717	730	1,982,460	10	19,824,600,000.00
15	Grass pea	74923	1776	1330901	4	5,323,604,000.00
16	Cotton	165,620	1746	50,000	-	-

Source: CSA. 2013

Maize

Among cereals, maize accounts for the largest share in total production and the total number of farm holdings involved. In 2011/12, maize accounted for 28 percent of the total cereal production, compared to 20 percent for teff and 22 percent for sorghum, the second and third most cultivated crops. About 8m smallholders were involved in maize production in 2011/12, compared to 6.2m for teff and 5.1m for sorghum respectively. It should be noted that in Ethiopia, smallholder farms account for 95 percent of the total agricultural production, with large farms contributing to only 5 percent of total production and to only 2.6 percent of cereal production in particular. The average farm size is less than one hectare, with 40 percent of the farmers cultivating less than 0.52 hectares (CSA crop pre harvest estimate, 2013).

Figure 1 *Maize plant not attacked by pests (but insignificant weeds)*

Bean

Haricot bean is considered as the main cash crop and protein source of farmers in many low lands and mid altitude zones of Ethiopia. The country's export earnings from haricot bean exceeds that of other pulses such as lentils, horse bean and chickpea. For example, out of ETB44m export earnings from pulses and oil seeds during the 2009/2010 fiscal year, the share of haricot bean was ETB37m or 85.5% (EIAR, 2010). Although beans are largely grown in Ethiopia, the national average yield amounts to 0.8-0.9 t/ha under peasants farming condition (CSA, 2010). Aphids, thrips and bean flies are dominant pests for beans.

Based on statistical data from Food and Agriculture Organization of the United Nations (FAO) and Government of Ethiopia (GoE) 2010, haricot bean production ranges from 100–200 thousand tonnes per year, with yields highly dependent upon rainfall. Average national production is approximately 150 thousand tonnes per annum. The level of production in 2010 was approximately 195 thousand tonnes with a domestic market value of USD45m.

Approximately 35–40 thousand tonnes of beans were sold through the international export markets via Djibouti and it is estimated that 10 thousand tonnes were sold through the Kenyan border at Moyale. This suggests that 145 thousand tonnes or 75% of the bean harvest was consumed locally.

Tomato

The introduction of cultivated tomato (Solanum lycopersicum Mill.) into Ethiopian agriculture dates back to the period between 1935 and 1940 (Samuel *et al.*, 2010). The Ethiopian Institute of Agricultural Research (EIAR) was established in 1966 (Setotaw, 2006; cf. Roseboom *et al.*, 1994:2) during which tomato was recognised as a commodity crop. Since 1969, 300 varieties were tested (Shushay, 2011). However, among varieties tested most showed susceptibility to late blight, powdery mildew and mosaic virus (Tindall, 1970).

The first record of commercial tomato cultivation is from 1980 with a production area of 80 ha (Lemma, 2006) in the upper Awash by Merti Agroindustry for both domestic as well as export markets. The total area increased to 833 ha by the year 1993 and later on the cultivation spread towards other parts of the country. Since 1994 up to present, tomato acreage increased to 5338 ha with a total production of 55,635 Mg (CSA, 2011). Currently tomato is one of the regional export crops of the country (Wiersinga and de Jager, 2009; Joosten *et al.*, 2011), to countries like Djibouti, India and Israel.

Tomato is a popular and widely grown vegeTable crop in Ethiopia, ranking 8th in terms of annual national production. It is consumed in every household in different modes, but in certain areas, such as Walo, Hararge, Shawa, Jimma and Wallaga, it is also an important co-staple food.

Figure 2 *Tomato Plant*

Rose

Ethiopia has geographical advantages for a floriculture industry, e.g. the high altitude (flowers grow well above 1100m ASL), the vast unexploited arable land and the conducive climate for flowers. Also, the plentiful low-cost labor market is very attractive for the industry, since it is a labor-intensive one. The strong initiative of the Government of Ethiopia to encourage the industry and the safe environment of the country compared to other African countries, such as Kenya, is also a big advantage for Ethiopia. These advantages, especially the geographical ones, are the reason why Ethiopia has been attracting many flori-farms even from Kenya where the industry has already been developed.

The history of the Ethiopian floriculture industry dates back to 1980, about thirty years ago, when state farms started to export flowers to Europe. The first private farm that started trading flowers was the Ethioflora. It cultivated summer flowers but not roses and exported only to the Netherlands. Recently it has been producing mainly roses and exporting them to several countries. Another company which entered the industry in the early phase is Golden Rose Agrofarms L.T.D, which started growing roses in 2000.

Currently there are total of 85 farms in Ethiopia. Out which 76 active, 5 changed in to vegetables and 4 not functioning at the moment and under bank. A total of about 1315 ha is covered by the flower industry in the country; with minimum rose firm size, 3ha (ASK flowers) and that of maximum 250ha (Sher Ethiopia). Only commercial farms are involved in Ethiopian Floriculture Sector, out growers/small holder farms are not involved in the sector.

Figure 3 *Rose Plant*

Coffee

Coffee production in Ethiopia is a longstanding tradition. Ethiopia is where Coffea arabica, the coffee plant, originates. The plant is now grown in various parts of the world; Ethiopia itself accounts for around 3% of the global coffee market. Coffee is important to the economy of Ethiopia; around 60% of foreign income comes from coffee, with an estimated 15 million of the population relying on some aspect of coffee production for their livelihood. Coffee exports equivalent to 34% of that year's total exports.

Ethiopia is the world's seventh largest producer of coffee, and Africa's top producer, with 260,000 metric tonnes in 2010. Half of the coffee is consumed by Ethiopians, and the country leads the continent in domestic consumption. The major markets for Ethiopian coffee are the EU (about half of exports), East Asia (about a quarter) and North America. The total area used for coffee cultivation is estimated to be about 4,000 km^2 (1,500 sq mi), the size is unknown due to the fragmented nature of the coffee farms. The way of production has not changed much since the 10th century, with nearly all work, cultivating and drying, still done by hand.

The revenues from coffee exports account for 10% of the annual government revenue, because of the large share the industry is given very high priority, but there are conscious efforts by the government to reduce the coffee industry's share of the GDP by increasing the manufacturing sector. In Ethiopia coffee has four production systems, where small scale farming covers more than 95%.

- Forest (8-10%)
- Semi-forest (30-35%)
- Garden (50-55%)
- Plantation (5-8%)

Teff

Teff is a crop indigenous to Ethiopia and be produced on a large area of land in all the regions of the country. For the crop year 2012/13 2.78 ha of land has been cultivated and the productivity of the crop was 13.55 qtls/ha. From 2011 to 2013 land allotted to teff accommodates 28.4%, 28.5% and 28.4% respectively and covers a large area of land among cereals. Teff is primarily utilised for Injera and also used for cattle forages and also mixed with mud to use it for construction as a plastering material.

Teff in its nature is a gluten free crop and desired by the people which are allergic to the gluten amino acids. As a result, the demand of the crop is increasing from time to time and the price of the crop is prominently increasing. Additionally there are investors which are eager to participate on its production and supply on the world market. A prominent amount of Herbicides are used on teff production. Formerly there was a large amount of 2.4-D amine chemical were used to control broad leaved weeds in teff field. However due to the development of genetic resistance of broadleaved weeds to the chemical incorporated with succession of grass weeds the chemical is becoming inefficient. Due to this reason farmers have started to use PALACE herbicide chemicals at some places of teff growing Woredas.

Sorghum

It is endogenous to Ethiopia. One of the major cereals crops and is the dietary staple of the farming community in Ethiopia; Amhara, Oromia and Tigray regions are the major producers. It is very important crop in the lowland arid and semi-arid areas. Only second to *teff* for *Injera* making Utilization: food, beverage, fuel, construction, and fodder and other value added products such as bio-ethanol. Because of its relatively better performance and higher biological yield under marginal conditions, sorghum would highly contribute to national food security.

Barley

Barley is an indigenous crop to Ethiopia. It is grown on a large area of land preceded by wheat and accommodating an area of land 1, 047,284 ha (CSA, 2013). It is utilised primarily for Injera and also used for Kolo, Ethiopian confectionary diet. There are two types of barley grown in the country, food barley and malt barely. At large food barley is produced followed by malt barley.

Wheat

Currently there are at least seven bread wheat varieties grown by farmers and certified seed is available. However, most of them were released over 10 years ago and have become susceptible to rust diseases. Weeds can cause heavy grain yield loses due to competition with the crop for light, moisture and soil nutrients, or by allelopathy (suppressing of growth by one plant by another plant through the release of toxic chemicals, usually through the root system). Weeds can be detrimental in several ways in addition of yield reduction. Grain contaminated with weeds brings lower market price. Some weeds and their seeds such as *Allium vineale* L. or wild garlic which is widespread in Ethiopia, produce an off-flavor to the flour during milling and thus low quality flour which is rejected by the milling industry.

In spring wheat such as those grown in Ethiopia, the most severe competition from weeds, occurs during the early part of the crop cycle. Thus early weed control is required. Ideally, the crop should be free from weed competition from the time of seedling emergence until the beginning of stem elongation. That is, during the first 40-50 days.

Weed infestation can be kept low through common sense farming practices. In fact, before the advent of chemical herbicides, farmers had to rely almost entirely on cultural practices to keep the weeds to a minimum. The first piece of advice and most economical is to use weed-free seed. Purchasing or using weed contaminated seed, can result in a poor economic investment, especially if new (not known) weed species are introduce into new farmers' fields.

Reduction in weed infestation can also be accomplished by, for example; destroying all the weeds that appear on the field during fallow, before they set any seed. Also, sowing the crop may be delayed to allow as many weeds as possible to germinate and be destroyed by tillage before sowing the crop.

However, one has to be careful not to recommend sowing the crop beyond the optimum planting date because of reduction on the yield potential of the crop.

The reduction on the build-up and the control of weeds can also be accomplished by crop rotation. Weeds that have the same cycle as wheat tend to create the most severe problem. For example, wild oats *(Avena spp)* are amongst the world's most noxious weeds in cereals. When crop rotation is practiced, the new crop should have different life cycle or different cultural practices to allow for the destruction of the weed population. For example, wheat can be grown in rotation with faba beans, chickpeas, maize, even sorghum, etc. all of them can be planted in rows to allow for mechanical or hand weeding.

a. On broad leaves weeds, the continued use of 2-4D herbicide by the farmers has selected out the prevalence of 2-4D tolerant weeds which are not killed by the herbicide even when using higher dosages.
b. Narrow leaves or grass weeds such as wild oats *(Avena spp)*, *Agropyron spp*, fox tail weed *(Phalaris spp)* and other grasses have become a real challenge threatening wheat yields, since on some farmers' fields these weeds are more prevalent that the wheat crop proper. Due to high cost of selective herbicides for narrow leaves control, farmers have restrained on the use of chemical control and prefer to do hand weeding instead. However, during the early stage of crop development, farmers are unable to differentiate the grass weed from the wheat crop proper and they often delay the weeding operation until too late when weeds are distinguishable, but the damage is already done to the crop.

There are many micro-organisms that can attack both the roots and the lower part of the wheat plant that is closest to the soil. The unique feature of all these micro-organisms is that they spend at least part of their life cycle in intimate contact with the soil. These pathogens can be divided further into two groups, namely; 1) those that can persist in the soil for many years, in the absence of the wheat plant, and 2) those that cannot and are introduced into wheat field from elsewhere. They may come from other crops, or from nearby wheat fields and are usually dispersed by wind, farm machinery, or living organisms such as cattle and man himself.

Faba bean

Faba bean (*Vicia faba L.*) is one of the major pulse crops grown in the highlands (1800 – 3000 masl) of Ethiopia, where the need for chilling temperature is satisfied. It is believed that the crop was probably brought to Ethiopia from the Middle East through Egypt (Yohannes, 2000) around the 5th millennium B.C, immediately after domestication. Ethiopia is now considered as one of the centers of secondary diversity for faba bean (Asfaw *et al.*,1994;Yohannes, 2000). Faba bean is grown in many regions of Ethiopia including Tigrai, Gonder, Gojam, Wellega, Wello, Gamu Gofa and Showa .
Pulses are essential part of the dietary requirement of most Ethiopians. Of the total area and production of these crops in Ethiopia, Amhara region accounts for about 48% of the area and production in country followed by Oromiya region, which accounts for 36% of area and 37% of production. The major types of pulse crops in terms of area and production are, faba bean, chick pea, field pea and haricot bean. In recent years, the grain yields of faba bean and chick pea in the longer rainy (maher) season have shown increasing trends. On the contrary, the grain yields in the shorter rain (belg) season are very low compared to that of the meher season. In the longer rainy season, the grain yield of faba bean has increased from 0.97 t/ha in 2008/09 to 1.21 t/ha in 2011/122 crop season, which reflects a 24% increase in five years (CSA, 2013).

Faba bean is a crop of manifold merits in the economic lives of the farming communities in Ethiopia. It serves as a source of food and feed with a valuable and cheap source of protein. It plays a significant role in soil fertility restoration as a suiTable rotation crop that fixes atmospheric nitrogen. It is also a good source of cash to the farmers, and generates foreign currency to the country.

Chick Pea

Chickpea (*Cicer arietinum*), which takes the 2nd share of the area and the production of pulses next to faba bean (vicia faba L.), is among the most important cool season food legumes in Ethiopia. There are two types of chickpea in the world: the Desi type, with small angular brownish colored seeds,

widely cultivated in Ethiopia; and the Kabuli type, with large, ram-shaped, white or pale cream or yellow colored seeds. They have also differences in yield and market preferences. The crop grows in several regions of the country mainly in Showa, Gojam, Tigray, West Wollo, Gonder, East Bale and West Hararge with altitude range of 1400-2300 m.a.s.l. and annual rain fall of 700-2000mm (Geletu *et.al.* 1996). It grows on stored soil moisture after the end of rainy season on clay soil. The major cereal crops such as tef (Erograstic tef), Barely (Horduem Vulgare), and wheat (Triticum sp.) are commonly rotated with chickpea in Northern and Central Highland of the country where it grows as a sole crop (Million, 1994).

Chickpea is a good source of dietary protein, fertility restorer through symbiotic nitrogen fixation, drought tolerant and break crop. It can be processed and used in form of dehulled (split seed or kik), and soaked and roasted (kolo or snacks). Geletu *et al.* 1996 stated that this crop can be used in mixture with cereals and root crops in the preparation of childhood food such as faffa, of which 10% is chickpea, as a protein supplements.

Cotton

Cotton is grown throughout Ethiopia at elevations above 1000 meters and below 1400 meters. Because most of the lowlands lack adequate rainfall, cotton cultivation depends largely on irrigation. Cotton is one of the growing crops in Ethiopia at large .The ecological adaptability of the crop is at low land areas of the great African rift valley. The holder of the farm is at commercial level and the production level is increasing from time to time. For example, the Production volume for the crop year 2013 (2005) the cultivated land is 165,620 hectare and the production was 2,892,798.57 qts.
The produce yield is supplied either to the ginning factory or exported. In the same way, the textile industries in the contry is increasing from time to time. Regarding the pesticide use in the country, 1,583,691 kg/lt for the production year 2011/12 (MOA) and a large amount of pests are attacking cotton both at commercial and small holder framings. Given its excellent growing conditions, abundance of raw materials and availability of land, Ethiopia has the potential to become a major global cotton producer but the cotton industry in Ethiopia as of 2011 is far behind that of the coffee industry and cereal production.

There are however, significant obstacles to the development of the industry in Ethiopia due to a distinct lack of administrative bodies to monitor and certify agricultural practices in the country and to process cotton in factories on a wide-scale commercial level. However, the development of the textile industry is a priority of the Ethiopian government in their economic growth strategy and in 2006 implemented an important privatisation initiative to attract foreign and private enterprises to develop the sector. Despite its lack of governance, the Ethiopian cotton industry is self-sufficient and as of 2002 provides some 50,000 tonnes annually to the textile industry of Ethiopia.

Annex 2 Overview of major pests and diseases

Generally the recurrent pests include stalk borers, African boll worms, and barley shoot fly. The migratory pests are pre dominantly army worms, locusts and quelia birds. Army worms are occurring annually or biannually depending up on the weather condition. When the weather condition is rainy alternated with sunny condition, the incidence and severity is high while in the weather condition is dry or rainy condition the existence is lowered. Regarding migratory locust, the desert locust, its occurrence is conditional and it is seen once every four to five years.
Major specific pests and diseases for the five case crops are as indicated below:

- Maize pests are Stem borer, Shoot fly, cut worms, Grasshoppers, Wollo bush cricket, African ball worm, and aphids
- Haricot bean pests are aphids, bean stem maggot, and bean bruchids
- Major pests for tomatoes include late blight, early blight, powdery mildew and mosaic virus coffee. Major insect are Anthestia bug, blotch leaf minor, Brown tortrix, berry butterfly, coffee leaf minor coffee thrips. Also the Tuta Absoluta infected area is rapidly increasing, however in 2013 no effective (bio) pesticides have been introduced in Ethiopia.

Rose major pests are aphids, thrips, caterpillars, mildew and white fly.

Recurrent pests are occurred predominantly on pulses particularly on Haricot beans and vegetables like tomatoes. The total amount of herbicide imported for the year 2013 production year is amounting for 1,643,788 in which the total volume is next to insecticide. The major weeds of the country are categorised in to two components. These includes broad leaved weeds and grass weeds. Conventionally farmers used to control them by hand weeding by the use of sickles and machetes.

However, now days, farmers have started using a sound amount of herbicides to control both types of herbs. At the eve of herbicide use the small holder farmers have started to use chemicals for broadleaved weeds chemicals like 2-4D. In the meantime due to the repeated application of broad leaf killers the prevalence of grass weeds has been manifested due to the succession of monocot family herbs. As a result, farmers started to use chemicals which control grass weeds.

Herb killers of grass family which currently used in effect are TOPIC (CLODINOFOP +PROPARGYL) and PUMASUPER (FENOXYPROP), where both are applied in wheat. These chemicals are sometimes blended with broad leaf killers. There is a difficulty in mixing the conventional broad leaved herbicide like 2-4D amine. Instead the mixture is becoming effective with a chemical designed to kill broad leaved weeds called SETARINE. However the farmers are using the conventional herbicide by alternating the application modality instead of mixing.

The newly arrived herbicide PALACE (PYROXSULAM) gave the final resolution to control weeds in in the farm for that it kills both broad leaved and grass families. The drawback of the former herbicide is that it is costly and seldom afforded by the small holder farmers. Additionally whole killer herbicides are used to kill herbs in discriminatively and farmers have already started to use it for pre plantation on annual crops and in permanent orchards like coffee, fruit crops and noxious weeds.

The whole killer chemical Glyphosphate has been introduced at vast state farms since 50 years back to control taller grass weeds which were growing fast and now a days started to be used by the small holders to eradicate weeds invading their farms and creating difficulties to cultivate their land. Glyphosphates are becoming very popular in that it is useful to carry out the minimum tillage and no tillage for their crop establishment. Round up (in its current price) is relatively affordable than palace despite its use is limited to eradicate weeds emerging before land preparation.

The uses of fungicide chemicals are also hold paramount importance currently due to the intensification of farms and innovation of new the technologies. This is particularly true to wheat where it is cultivated in more advanced practices. In here crop diseases of different forms like rusts

(yellow rust, stem rust and leaf rust) and smut are becoming very challenging. Arsi and Bale Zones where wheat is cultivated at large they are facing these fungal problems. The use of pesticide chemicals to control rusts is becoming familiar and expanded to a large area of land. The farmers are using Tilt (Propiconazole) and Bylaton (triadimefon) chemicals to control the disease whenever the incidence is appearing. Chemicals like copper compounds are also used at small holders and at small scale commercial farms.

Fungicide chemicals are also applied among horticulture and coffee cultivators. For horticultural crops, they are applying mancozeb chemicals. The importance of this chemical is at large at rose farmers in the country and they use it intensively to control diseases occurring on their flowers. They are doing so because once the disease is seen on their plant it will be devastating to their business in that production and market outlet will be lowered.

Eastern parts of the country major crops grown are maize, sorghum, chat and vegetables. For maize and sorghum farmers do not apply pesticides but there are army worms (once every two years, usually in May); on that occasion, they apply Malathion and durasban (Chlorpyriphos). They apply 1 liter/hectare at a price of ETB200. For chat and vegetables, rarely do they apply DDT (its use is illegal and not recommended), Malathion, endosulphur, Mancozeb. They apply DDT, a totally outdated pesticide, with the intention of obtaining a better colour for chat (deep green and shiny). Culturally, farmers apply compost to control or minimise risks of rust.

Annex 3 Overview of new registration process

Dossier evaluation
Dossier evaluation focuses on developing guidelines and procedures for the pesticide registration in Ethiopia in a scientifically underpinned way and as specific as possible for Ethiopian conditions. It covers the aspects of efficacy assessment, human health risk assessment (including occupational and consumer health) as well as environmental risk assessment. It aims to develop the capacity at the APHRD to apply these guidelines and procedures. The Work package will result in an evaluation manual plus software tool for the Animal and Plant Health Regulatory Directorate (APHRD) of the Ministry of Agriculture of Ethiopia. The user-friendly software tool operationalises the guidelines and procedures for human health risk assessment and environmental risk assessment; all basic pesticide data can be entered in it and these will be used for the risk estimates. The registration process entails the following:

Preparation and submission of the dossier by the applicant
The applicant, if necessary, should consult the MOA on the legal and other requirements prior to the submission of the application for registration. Certain registration schemes may permit applicants to submit a pre-application, a limited dossier that indicates the major issues that are relevant for the specific product, in order to obtain more specific guidance on whether the product could be registered. The Ministry may at that stage inform the applicant that the product for which the registration is sought may not fulfil the criteria for registration, based on experience or based on certain set criteria (e.g. pesticides of certain class of toxicity would not be permitted for a specific group of users in the country).

The applicant should submit the application for registration according to the format and conditions as specified by the Ministry of Agriculture. The Ministry of Agriculture may consider requesting an electronic dossier to facilitate storage and retrieval of the data. The application for registration should include a full and objective summary of all data as well as the conclusions from the applicant. The relevant general requirements for the dossier should be made publicly available and any specific requirement should be made available from the responsible authority upon written request. The applicant should fulfil all technical and financial requirements as specified in the registration regulations of the country.

Initial administrative actions by the responsible authority (group of experts destined for dossier evaluation)
Upon receipt of the application for registration, the responsible authority creates a unique file for this application and ensures that all correspondence is properly filed and can be easily retrieved. The responsible authority, upon receipt of the application for registration, sends an acknowledgement of receipt to the applicant within a reasonable time frame. In case a fee is required for submission of the application for registration, verification of receipt of the fee should also be carried out as part of the completeness check.

Confidential data on pesticide products will be handled by authorised staff only. Such documents are held in a secure location at all times. Measures against loss (fire, theft, damage by water, etc.) should be taken. A duplicate dossier should be stored safely in a physically different location.

Completeness check
The PHRD administrative expertise checks, in a timely manner, whether the dossier is complete with respect to the requirements and specified criteria. The check also included consideration of any request for waivers from the applicant.
Based on the completeness check, the responsible authority should request the applicant to supply any missing or incomplete information in the dossier. If the gaps in data submitted are considered essential for their evaluation, the technical team members inform the applicant that further processing

of the application is postponed, pending the submission of these additional data. After the check of completeness the committee and the applicant discuss a work plan that includes expected timelines for the regulatory decisions.

Technical and scientific evaluation
The registration dossier, including any data generated at the request of the responsible authority, need to be submitted to qualified experts in relevant fields including efficacy, human health and environmental effects for technical evaluation of the data. These experts could either be part of the office of the responsible authority or experts from academia or research institutions. They perform the evaluation, whenever possible, making use of internationally agreed methodologies and criteria. Care should be taken to ensure that these experts are indeed independent, that no conflict of interest is declared with respect to the data they are evaluating and that the dossier is treated confidentially.

After receipt of the evaluation of the data in the relevant fields, the technical team members of PHRD, if necessary, request the applicant to submit any additional data that are deemed essential by the evaluators. Any requests by the applicant for a data submission waiver should be treated at this stage. The technical committee also specifies a time period within which these data should be submitted and also indicates that further processing of the application for registration is postponed until receipt of these data. If and when appropriate, the technical experts may also take note of expert opinion from other competent regulatory authorities when evaluating data.

Preparation of summaries and conclusions
The technical committees submit their conclusions to the PHRD within a reasonable and agreed time frame and provide a summary listing of the data and assessments that formed the basis of their conclusions. Based on the evaluations and recommendations of the experts, the directorate prepares a comprehensive summary of all relevant data and the conclusions from the experts for consideration by the Ministry if it is of the view that review of the data is complete and ready for a decision.

Risk management and registration decision
The Ministry takes the final decision on the registration of the pesticide, taking into account the review prepared by the responsible authority, and possibly the outcome of the public review procedure. The decision of the Ministry may be provisional or full registration, with or without restrictions and/or conditions, or refusal. The Ministry may also decide to suspend a decision, and request further data or assessments to be provided.

Use of a pesticide is generally approved only for specific applications, e.g. for control of specific pest(s) on certain crops or specific applications for control of nuisance pests or vectors of diseases. These approved purposes should be incorporated in the registration decision. Effectiveness of the product to control specific pests, and risk of residues on the crop concerned, are among the factors that play a role in decisions to limit approval to certain crop-pest combinations.

In cases of elevated human health or environmental risk, the use of certain pesticides may be severely restricted. Such severe restrictions may, for instance, specify that the product can be used only by licensed applicators for very specific purposes. However, restricting the use of pesticides as a form of risk management is only effective if the restrictions are actually adhered to and are being enforced. The Code of Conduct therefore stipulates that prohibition of the importation, sale and purchase of highly toxic and hazardous products may be desirable if other control measures or good marketing practices are insufficient to ensure that the product can be handled with accepTable risk to the user.

In case the Ministry concludes that a registration may be granted, the administrative body assigns a unique registration number linked to the specific registration from the specific applicant. If the registration of a pesticide is refused, or if the use of pesticide is severely restricted, specific additional post-registration actions may need to be taken in order to protect human health or the environment.

Publication and dissemination of registration decision
In cases where registration is granted, the PHRD informs the applicant of all relevant conditions linked to the registration, including the labelling and marketing conditions and the registration number. The

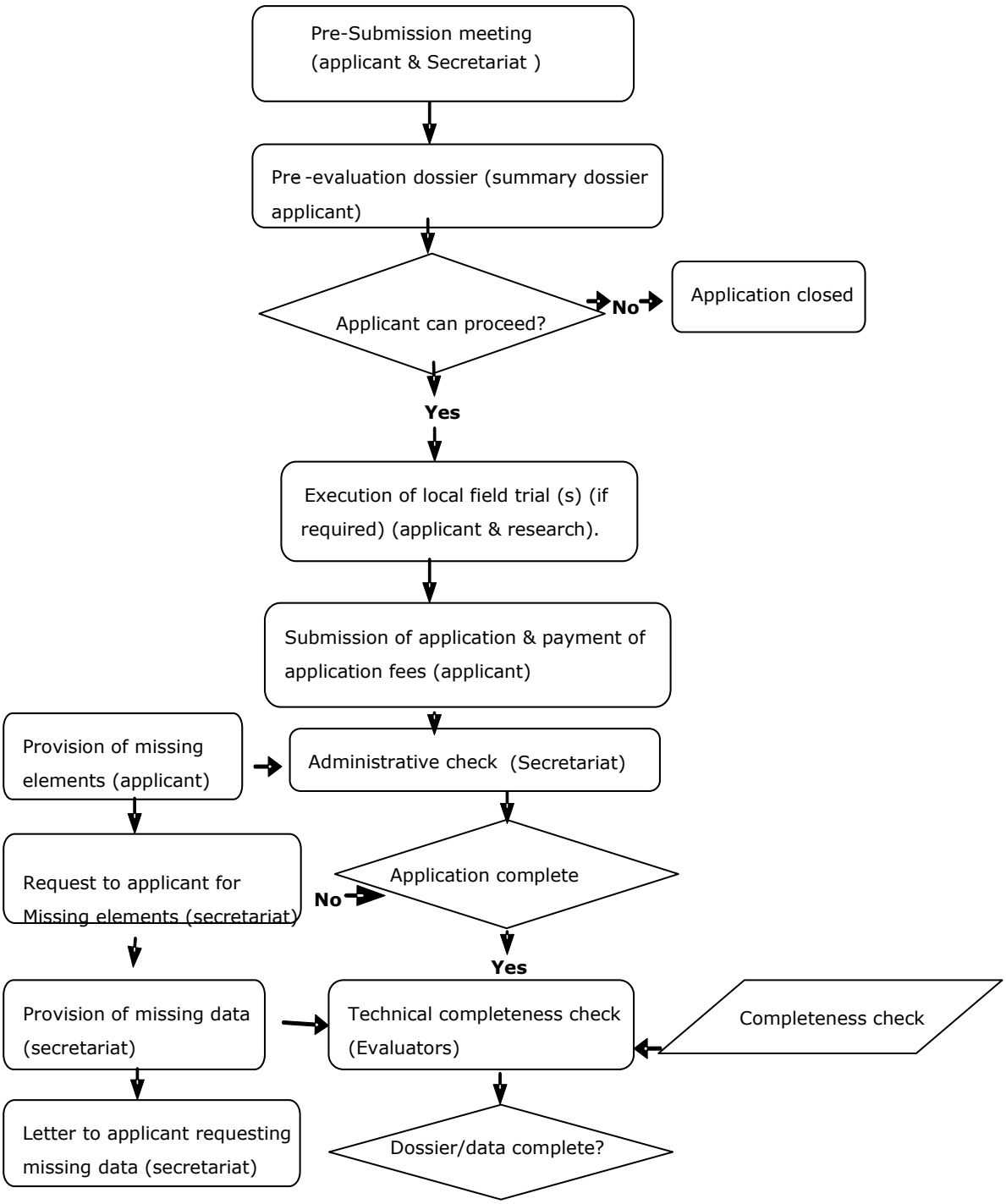
Ministry then takes the necessary actions to release the decision in the website destined for these purposes on the product to be legally registered. The information contained in the website includes: name of registrant, registration number, trade name of product, active ingredient(s) as well as its concentration(s), formulation and usage. Only registrants of registered products should be allowed to import and/or manufacture the products for sale. The responsible authority may also make this information available on the Internet.

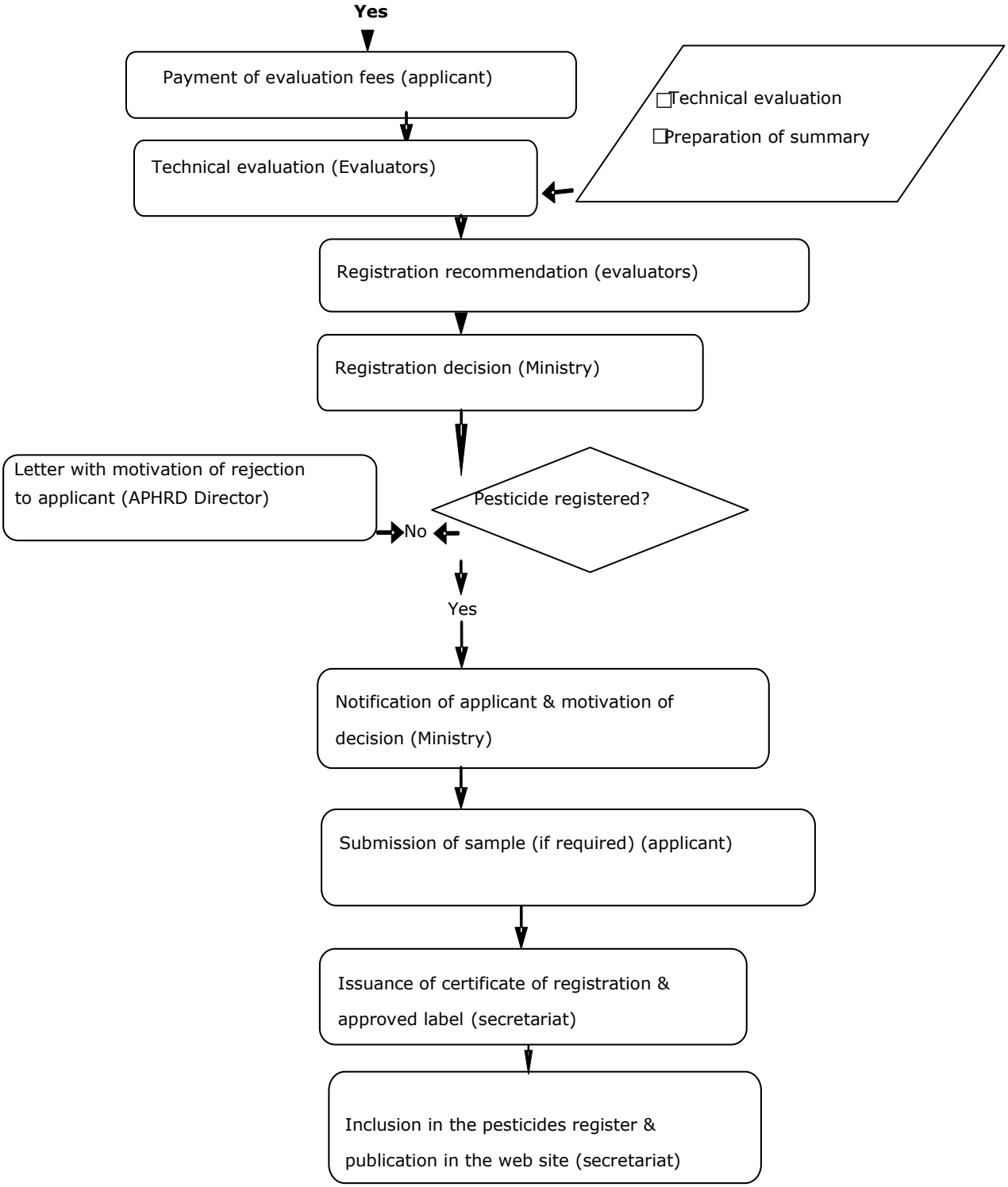
The Ministry also informs all key representatives/stakeholders of relevant governmental agencies and institutions, including enforcement agencies, customs departments, plant protection services or public health services as well as experts who participated in the evaluation of a positive decision. Enforcement agencies and experts may also receive information regarding refused applications.

Label extension

The Ministry of Trade and Industry from its part, provides additional data to the responsible authority to support new uses (label extension). If these additional label claims are approved by the authorities, they would then be included on the label. Mainly pesticide registration process passes through request and submission of necessary documents by the registrant/applicant, administrative check, evaluation team and approval by representative from MOA. Specifically the registration system of the country comprises the following flow charts:

Figure 1 *Flow Chart of Pesticide Registration Procedure*





To come up with a final decision to establish a complete dossier for the registrant by the Ministry, is estimated to take 120-170 days - provided that all processes go smoothly from both parties. Usually this is not maintained due to the following drawbacks from both parties: first, the MOA Directorate has no fulltime staff to run all the tasks and, second, the registrants themselves do not meet the time requirements accordingly. For instance, the registrant is expected to come with correct documents as required by the Ministry for an administrative check within eight weeks, but usually registrants take more like three or four months.

Annex 4 Major crop type and costs of inputs

Crop Type	Input	Costs	Application Rate				Man Day Total
Maize	Fertiliser	3,000.00					
	Seed	500.00	25kg/ha				
	Pesticides	500.00	1lit/ha				
	Labour	2,850.00	Ploughing + Weeding		12MD/ha	45MD/ha	57MD/ha
	Draught animals	900.00					
	Land/rent	300.00					
	Harvesting	1,200.00					
	Threshing	2,000.00					
	Total Costs	11,250.00					
				Yield: 40qtls/ha			
				Price: ETB400/Quintals		ETB16,000/Ha	
Teff	Fertiliser	3,000.00					
	Seed	500.00	25kg/ha				
	Pesticides	500.00	1lit/ha				
	Labour	2,800.00	Ploughing + Weeding		16MD/ha	40MD/ha	56MD/ha
	Draught animals	1,200.00					
	Land/rent	300.00					
	Harvesting	800.00					
	Threshing	4,000.00					
	Total Costs	13,100.00					
				Yield: 20qtls/ha			
				Price: ETB1,700/Qtl		ETB34,000/ha	
Haricot bean	Fertiliser (DAP)	1,500.00					
(Boloqqe)	Seed	1,000.00	100kg/ha				
	Pesticides	200.00	1lit/ha	Insecticides			
	Labour	2,800.00	Ploughing + Weeding		8MD/ha	20MD/ha	28MD/ha
	Draught animals	600.00					
	Land/rent	300.00					
	Harvesting	400.00					
	Threshing	2,000.00					
	Total Costs	8,800.00					
				Yield: 15qtls/ha			
				Price: ETB900/Qtl		ETB13,500/qtl	
Tomatoes	Fertiliser (DAP)	4,500.00					
	Seed	200.00	100g/ha				
	Pesticides	1,200.00	2lit/ha	Insecticides	Fungicides		
	Labour	5,200.00	Ploughing +	hoeing	12MD/ha	80MD/ha	28MD/ha
	Draught animals	1,200.00					
	Land/rent	300.00					
	Harvesting	4,500.00					
	Total Costs	17,100.00					
				Yield: 30qtls/ha			
				Price: ETB1,000/Qtl		ETB30,000/qtl	
Coffee	Fertiliser (DAP)	1,500.00					
	Seed						
	Pesticides	2,400.00	4lit/ha		Fungicides		
	Labour	1,500.00		hoeing	30MD/ha		
	Draught animals						
	Land/rent	300.00					
	Harvesting	2,000.00		40MD/ha			
	Total Costs	7,700.00					
				Yield: 4qtls/ha			
				Price: ETB8,000/Qtl		ETB32,000/qtl	
Rose	Fertiliser (DAP)	1,500.00					

Crop Type	Input	Costs	Application Rate			
	Cuttings/Vegetative parts	50.00/Stem		This plant material is often used for 3-4 years (3-4 years life span)		
	Pesticides	24,000.00	20lit/ha	Insecticides	Fungicides	
	Labour	3,000.00	Seedling	Transplanting		60MD/ha
	Draught animals	5,000.00				
	Land/rent	1,000.00				
	Harvesting	3,500.00		70MD/ha		
	Others	1,000.00				
	Green house	1,000,000.00	1m investment costs and life span is 10 years			
	Machineries	15,000.00				
	Total Costs	34,500.00				
		1,089,000.00		Yield: 100,000stems/ha (3-4 year life span)		
				Price: ETB1/stem	ETB100,000/ha	

Annex 5 Estimation of costs of registration for the last 15 years (2000-2014)

15 Years Age	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Fee/registration cost	1,000	1,160	1,361	1,561	1,811	2,100	2,436	2,826	3,278	3,803	4,411	5,117	5,936	6,886	7,988	9,266

Source: Own Estimation/Calculation

N.B. According to this interest rate based projection, the 1000.00 Registration fee of 1999 will be more than 10,000.00 (10,748.00) by 2015. This is the base for our 10,000.00 registration fee, in addition to other African countries experiences.

Annex 6 Volume and prices of pesticides imported to Ethiopia (2013)

Common name	Use Category	UNIT PRICE	TOTAL PRICE (EUR)	Volume (L/Kg)	DATE /Code
CHLOROPYRIPHOS	INSECTICIDE	5.40	59,400.00	11,000.00	1/1/2013
2,4-D AMINE	HERBICIDE	3.25	187,200	57,600.00	1/1/2013
MANCOZEB 80% WP	FUNGICIDE	3.4	34,340	10,100.00	1/1/2013
MYCLOBUTANIL		39.78	28,641.6	720.00	1/3/2013
ZINC PHOSPHIDE 57%	INSECTICIDE	5.5	8,250	1,500.00	26/12/2013
ALUMINIUM PHOSPHIDE	INSECTICIDE	7	52,255	7,465.00	
SPINOSAD	INSECTICIDE	234.17	25,290.36	108.00	3/1/2013
DELTAMETHRIN	INSECTICIDE	10	128,000	12,800.00	9/1/2013
FENOXYPROP-P-ETHYL	HERBICIDE	1	12	12.00	2/01.2013
ALUMINIUM PHOSPHIDE	INSECTICIDE	6.18	62,418.99	10,100.16	9/1/2013
2,4-D AMINE	HERBICIDE	3	288,000	96,000.00	16/01/2013
LAMDA-CYHALOTHRIN	INSECTICIDE	12.8	122,880	9,600.00	18/01/2013
LAMDA-CYHALOTHRIN	INSECTICIDE	7.15	66,066	9,240.00	14/12/2012
THIRAM	INSECTICIDE	6.35	69,850	11,000.00	31/01/2013
MANCOZEB 80% WP	FUNGICIDE	3.75	93,750	25,000.00	29/01/2013
CHLORPYRIFOS ETHYL 480ML/LT	INSECTICIDE	8.6	82,560	9,600.00	29/01/2013
TETRAMERHRIN PERMETRIN	INSECTICIDE	0.53	93,492	176,400.00	29/01/2013
2,4-D AMINE	HERBICIDE	3	144,000	48,000.00	11/2/2013
IMIDACLOPRID 250	INSECTICIDE	12.55	125,500	10,000.00	4/2/2013
ZINC PHOSPHIDE 57%	INSECTICIDE	4.8	52,800	11,000.00	6/2/2013
MACOZEB	FUNGICIDE	3.1	25,110	8,100.00	4/2/2013
LAMDA-CYHALOTHRIN	INSECTICIDE	6.2	98,208	15,840.00	12/2/2013
METALAXYL 8% MANCOZEB 64%WP	FUNGICIDE	7.8	70,278	9,010.00	14/02/2013
GLYPHOSATE 48%SL	HERBICIDE	3.3	168,616.8	51,096.00	18/02/2013
LAMDA-CYHALOTHRIN	INSECTICIDE	6.2	74,400	12,000.00	18/02/2013
THIRAM	INSECTICIDE	6.1	67,100	11,000.00	15/02/2013
PROFENOFOS	INSECTICIDE	9.2	164,036	17,830.00	22/02/2013
2,4-D AMINE	HERBICIDE	3	144,000	48,000.00	21/02/2013
TETRAMERHRIN PERMETRIN	INSECTICIDE	0.53	93,492	176,400.00	5/3/2013
CHLOROPYRIPHOS	INSECTICIDE	5.4	59,400	11,000.00	5/3/2013
GLYPHOSATE 48%SL	HERBICIDE	2.9	1450,000	500,000.00	07/03/1013
CELPHOSE	INSECTICIDE	5.6	67,200	12000.00	11/3/2013
GLYPHOSATE 48%SL	HERBICIDE	2.9	145,000	50,000.00	12/3/2013
GLYPHOSATE 48%SL	HERBICIDE	3.75	66,150	17,640.00	11/3/2013
MALATHION	INSECTICIDE	3.35	160,800	48,000.00	13/03/2013
ALUMINIUM PHOSPHIDE	INSECTICIDE	15	52,488	3,499.20	8/3/2013
PYROXSULAM	HERBICIDE	80.91	116,510.40	1,440.00	25/03/2013
CLODINAEX 10%	HERBICIDE	7.5	37,869.6	5,049.28	25/03/2013
GYLPHOS 48% SL	HERBICIDE	3.1	5,580	1,800.00	25/03/2013
GYLPHOS 48% SL	HERBICIDE	3.1	120,528.00	38,880.00	25/03/2013
MANCOZEB 80% WP	FUNGICIDE	4.03	101,556	25,200.00	29/03/2013
THIRAM	FUNGICIDE	8.35	86,840	10,400.00	29/03/2013
S-METOLACHLOR + ATR	HERBICIDE	12	100,800	8,400.00	2/4/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.053	149,584.8	48,996.00	2/4/2013
GLYPHOSATE 48%SL	HERBICIDE	3.75	66,150	17,640.00	2/4/2013
2,4-D 720 G/L	HERBICIDE	2.65	244,244	92,167.55	2/4/2013
METOLACHLOR+ATRAZINE	HERBICIDE	7.25	278,400	38,400.00	2/4/2013
GLYPHOSATE 48%SL	HERBICIDE	3	155,520	51,840.00	5/4/2013
PYROXSULAM	HERBICIDE	80.78	174,484.8	2,160.00	12/4/2013
SPINOSAD	INSECTICIDE	259.17	27,990.36	108.00	11/4/2013
GLYPHOSATE 48%SL	HERBICIDE	3.4	31,960	9,400.00	12/4/2013
CYMOXANIL+COPPER OXYCHLORITE	FUNGICIDE	12.7	45,720	3,600.00	11/4/2013
ALUMINIUM PHOSPHIDE	INSECTICIDE	7.5	82,944	11,059.20	16/04/2013
GLYPHOSATE 48%SL	HERBICIDE	2.9	50,338.2	17,358.00	23/04/2013
GLYPHOSATE 48%SL	HERBICIDE	2.9	150,336	51,840.00	
GLYPHOSATE 48%SL	HERBICIDE	2.9	99,997.8	34,482.00	23/04/2013
PYROXSULAM	HERBICIDE	80.91	116,510.4	1,440.00	23/04/2013
GLYPHOSATE 48%SL	HERBICIDE	3.75	66,150	17,640.00	15/04/2013
		8.18	57,260	7,000.00	30/04/2013
DIMETHOATE	INSECTICIDE	4.25	102,000	24,000.00	30/04/2013
GLYPHOSATE 48%SL	HERBICIDE	4.5	40,770	9,060.00	29/04/2013
GLYPHOSATE 48%SL	HERBICIDE	3.5	42,000	12,000.00	14/05/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	187,200	72,000.00	13/05/2013

Common name	Use Category	UNIT PRICE	TOTAL PRICE (EUR)	Volume (L/Kg)	DATE /Code
GLYPHOSATE 48%SL	HERBICIDE	3.4	171,360	50,400.00	25/04/2013
GLYPHOSATE 48%SL	HERBICIDE	3.75	66,150	17,640.00	13/05/2013
GLYPHOSATE 48%SL	HERBICIDE	3.75	66,150	17,640.00	13/05/2013
GLYPHOSATE 48%SL	HERBICIDE	3.053	149,621.42	49,008.00	6/5/2013
PYROXSULAM	HERBICIDE	82.54	89,143.2	1,080.00	10/5/2013
CLODINAFROP + PROPARGYL	HERBICIDE	19	364,800	19,200.00	30/04/2013
S-METOLACHLOR + ATR	HERBICIDE	8	76,800	9,600.00	2/5/2013
THIAMETHOXAM+METALAXYL+DIFENOCONAZOLE	FUNGICIDE	97	31,525	325.00	6/5/2013
LAMDA-CYHALOTHRIN	INSECTICIDE	12.8	122,880.00	9,600.00	26/04/2013
FENOXYPROP-P-ETHYL	HERBICIDE	13.95	178,448.4	12,792.00	18/04/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.55	235,008	92,160.00	23/05/2013
S-METOLACHLOR + ATR	HERBICIDE	7.25	152,250	21,000.00	24/05/2013
ATRAZINE 250GL+ AMETRYN 250GL		5	100,000	20,000.00	18/04/2013
S-METOLACHLOR + ATR	HERBICIDE	8	153,600	19,200.00	2/5/2013
THIOMETHOXAN	FUNGICIDE	97	315,25	325.00	6/5/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	93,600	36,000.00	6/5/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.8	239,400	63,000.00	10/5/2013
PYROXSULAM	HERBICIDE	82.45	118,728	1,440.00	15/05/2013
GLYPHOSATE 48%SL	HERBICIDE	6	100,800	16,800.00	15/05/2013
PYROXSULAM	HERBICIDE	82.45	118,728	1,440.00	14/05/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3	288,000	96,000.00	17/05/2013
PYROXSULAM	HERBICIDE	82.45	89,143.2	1,081.18	21/05/2013
GLYPHOSATE 48%SL	HERBICIDE	3.5	42,000	12,000.00	17/05/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.25	187,200	57,600.00	29/05/2013
PENDIMETHALIN 455%	HERBICIDE	6.57	84,096	12,800.00	12/4/2013
PENDIMETHALIN 455%	HERBICIDE	2.75	165,000	60,000.00	11/4/2013
GLYPHOS 48% SL	HERBICIDE	2.9	187,920	64,800.00	21/05/2013
GLYPHOSATE 48%SL	HERBICIDE	3.85	179,027.5	46,500.65	18/06/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.9	290,000	100,000.00	17/10/2005
2,4-D AMINE 720 G/L SL	HERBICIDE	3.8	213,750	56,250.00	17/06/2013
CHLOROPYRIPHOS	INSECTICIDE	0.53	128,900	243,207.55	24/06/2013
CHLOROPYRIPHOS	INSECTICIDE	UNKNOWN	UNKNOWN		24/06/2013
CHLORPYRIPHOS	INSECTICIDE	5	35,000	7,000.00	25/06/2013
PYROXSULAM	HERBICIDE	82.54	89,143.2	1,080.00	24/06/2013
PYROXSULAM	HERBICIDE	82.45	118,728	1,440.00	24/06/2013
PYROXSYLAN	HERBICIDE	82.54	89,143.2	1,080.00	24/06/2013
GLYPHOSATE 36%	HERBICIDE	3.3	24,000	7,272.73	10/6/2013
CLODINAFROP + PROPARGYL	HERBICIDE	19	364,800	19,200.00	8/6/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.8	79,800	21,000.00	30/05/2013
DIAMETHOATE	HERBICIDE	4.25	102,000	24,000.00	30/05/2013
PYROXSULAM	HERBICIDE	82.54	89,143.2	1,080.00	30/05/2013
CHLOROPYRIFOS	UNKNOWN	5.05	15,453	3,060.00	29/065/2013
**********	**********	2.45	2,145.22	875.60	12/6/2013
SPINOSAD	INSECTICIDE	27548.64		-	13/06/2013
SPINOSAD	INSECTICIDE	255.08	27,548.64	108.00	13/06/2013
GLYPHOSATE 48%SL	HERBICIDE	4.05	71,442	17,640.00	3/6/2013
GLYPHOSATE 48%SL	HERBICIDE	3.75	66,150	17,640.00	3/6/2013
CLODINAFROP + PROPARGYL	HERBICIDE	19	364,800	19,200.00	31/05/2013
MANCOZEB 40%	FUNGICIDE	3.3	23,100	7,000.00	26/09/2013
MANCOZEB 40%	FUNGICIDE	5.25	10,500	2,000.00	26/09/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	124,800	48,000.00	26/09/2013
COLDINAFOP + PROPARGYL	HERBICIDE	19	19,200	1,010.53	10/10/2005
GLYPHOSATE 48%SL	HERBICIDE	2.9	187,920	64,800.00	14/06/2013
GLYPHOSATE	HERBICIDE	3.5	142,940	40,840.00	10/6/2013
COLDINAFOP + PROPARGYL	HERBICIDE	7	90,720	12,960.00	17/06/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.8	384,750	101,250.00	10/6/2013
PROFENOFOS	INSECTICIDE	7	84,000	12,000.00	10/6/2013
CHLORANTRANILIPROLE	INSECTICIDE	165	105,600	640.00	11/6/2013
GLYPHOSATE 48%SL	HERBICIDE	3.5	42,000	12,000.00	5/7/2013
GLYPHOSET	HERBICIDE	3.4	122,400	36,000.00	5/7/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.25	187,200	57,600.00	8/7/2013
PYROXSULAM	HERBICIDE	80.94	116,553.6	1,440.00	1.7.2013
FENITROTHION+CYPERMETHRIN+BIOALLETHRIN	INSECTICIDE	0.86	282,520.32	328,512.00	21.10.2013
PENDIMETHALIN	HERBICIDE	6.4	12,288	1,920.00	1.7.2013
GLYPHOSET 36SL	HERBICIDE	3.4	122,400	36,000.00	3.7.2013
GLYPHOSATE 48%SL	HERBICIDE	4.05	71,442	17,640.00	27/06/2013
CARBAMETE	INSECTICIDE	83.5	3,636,327.10	43,548.83	17.6.2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	124,800	48,000.00	9.7.2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	187,200.00	72,000.00	9.7.2013
LAMDA-CYHALOTHRIN	INSECTICIDE	12.8	122,880	9,600.00	11/7/2013

Common name	Use Category	UNIT PRICE	TOTAL PRICE (EUR)	Volume (L/Kg)	DATE /Code
GLYPHOSATE	HERBICIDE	4.98	19,530	3,921.69	10/7/2013
DICOFOL	HERBICIDE	5.97	27,581	4,619.93	10/7/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	187,200	72,000.00	22/07/2013
2,4-D AMINE 720 G/L SL	HERBICIDE	3.8	427,500	112,500.00	11/7/2013
CHLORANTRANILIPROLE	INSECTICIDE	325	2,600	8.00	12/7/2013
MENDIPROPAMID	FUNGICIDE	63	60,480	960.00	12/11/2013
METHOXYFENOZIDE	INSECTICIDE	36.55	19,737	540.00	12/11/2013
SPINOSAD	INSECTICIDE	255.08	27,548.64	108.00	12/11/2013
LAMDA-CYHALOTHRIN	INSECTICIDE	5	125,400	25,080.00	05.08.2013
TRIADIMETON	FUNGICIDE	13	41,600	3,200.00	12.08.2013
PROFENOFOS	INSECTICIDE	9.2	165,600	18,000.00	12.08.2013
CLODINAFOP 808/E, SAFENES 208/E	HERBICIDE	22	396,000	18,000.00	06.08.2013
ZINC PHOSPHIDE 57%	RODENTICIDE	8.4	8,400	1,000.00	16.08.2013
2,4- D	HERBICIDE	2.55	352,512	138,240.00	16.08.2013
2,4-D	HERBICIDE	3.25	187,200	57,600.00	12.8.2013
PYROXSULAM	HERBICIDE	82.54	89,143.2	1,080.00	5.8.2013
PYROXSULAM	HERBICIDE	82.54	89,143.2	1,080.00	5.8.2013
PYROXSULAM	HERBICIDE	82.54	89,143.2	1,080.00	5.8.2013
CYMOXANIL+COPPER OXYCHLORITE	FUNGICIDE	13.3	47,880	3,600.00	6.8.2013
SUSPO-EMULSION	HERBICIDE	10.7	46,224	4,320.00	6.8.2013
ALUMINIUM PHOSPHIDE	INSECTICIDE	15	37,584	2,505.60	6.8.2013
2,4-D AMINE 720 G/L SL	HERBICIDE	2.6	249,600	96,000.00	7.8.2013
CHLORANTRANILIPROLE	INSECTICIDE	165	105,600	640.00	2.8.2013
SPINOSAD	INSECTICIDE	255	137,700	540.00	4.9.2013
CAROSULFAN	INSECTICIDE	8.13	365,850	45,000.00	10.9.2013
BIFENTHRIN	INSECTICIDE	4.47	111,750	25,000.00	10.9.2013
DELTAMETHRIN	INSECTICIDE	10	68,000	6,800.00	20/08/2013
CHLORPYRIFOS ETHYL 480ML/LT	INSECTICIDE	6.54	62,784	9,600.00	19/08/2013
DELTHAMETHRIN	INSECTICIDE	10	55,800	5,580.00	20/08/2013
DELTHAMETHRIN	INSECTICIDE	50	9,000	180.00	20/08/2013
0	PERMANENT	3.16	105,228	33,300.00	16/08/2013
PROFENFOS	INSECTICIDE	7	21,000	3,000.00	21/08/2013
IMIDACLOPRID 250	INSECTICIDE	22	66,000	3,000.00	21/08/2103
CLADINAFOB PROPARGYL	HERBICIDE	9.45	181,440	19,200.00	27/08/2013
2.4D	HERBICIDE	3.25	187,200	57,600.00	3/9/2013
2.4-D	HERBICIDE	2.6	59,904	23,040.00	6/9/2013
ATRAZINE	HERBICIDE	5	100,000	20,000.00	27/6/2013
GLYPHOSATE	HERBICIDE	4.05	71,442	17,640.00	27/06/2013
0		1	1	1.00	30.07.2013
0		30	300	10.00	8/8/2013
MALTHAIN	INSECTICIDE	3.65	131,400	36,000.00	12/8/2013
ORGANIC CHEMICAL	ANTI-STREES	4.6	92,000	20,000.00	13/08/2013
AZADIRACHTIN	INSECTICIDE	4.25	21,250	5,000.00	13/08/2013
CYMOXANIL+COPPER OXYCHLORITE	FUNGICIDE	13.3	95,760	7,200.00	14.01.2006
METALAXYL 8% MANCOZEB 64%WP	FUNGICIDE	9.2	119,600	13,000.00	16.9.2013
PROFENOFOS	INSECTICIDE	7	7,000	1,000.00	16.9.2013
SPINOSAD	INSECTICIDE	255	137,700	540.00	25.10.2013
ALPHACYGERMETHRIN 100G/LT	INSECTICIDE	18.3	54,090	2,955.74	21.10.2013
CHLORPYRIPHOS ETHYL 48% EC.	INSECTICIDE	5.4	59,400	11,000.00	12.10.2013
2-4D	HERBICIDE	3.25	187,200	57,600.00	02.10.2013
CHLORPYPHOS 480A.I	INSECTICIDE	4.9	73,500	15,000.00	14.10.2013
THIOPHONATE-METHYL 310 G/L	FUNGICIDE	3.2	73,600	23,000.00	17.10.2013
PROFENOS	INSECTICIDE	9.2	165,600	18,000.00	30.10.2013
MANCOZEB	FUNGICIDE	3.25	72,358	22,264.00	13.11.2013
2-4D	HERBICIDE	3.25	187,200	57,600.00	7.11.2013
FENITROTHION+CYPERMETHRIN+BIOALLETHRIN	INSECTICIDE	0.86	282,520.32	328,512.00	29.2.2013
TROFLURALIN	HERBICIDE	13.35	8,010	600.00	9.10.2013
GLAYPHOSET	HERBICIDE	3.8	45,600	12,000.00	22.11.2013
GLYPHOSET	HERBICIDE	4.5	79,380	17,640.00	13.11.2013
HALOXYFOP R	HERBICIDE	22	118,800	5,400.00	10.12.2013
TETRAMETHION	INSECTICIDE	0.53	186,984	352,800.00	30.12.2013
LAMBDA-CYHALOTHRIN 5%	INSECTICIDE	5.31	67,543.20	12,720.00	30.12.2013
PROFENOFOS	INSECTICIDE	9.2	1,656,000	180,000.00	13.12.2013
MYCLOBUTANIL	FUNGICITD	18.03	25,963.2	1,440.00	2.12.2013
DELTAMETHRIN	INSECTICIDE	10.5	71,400	6,800.00	13.12.2013
THIRAM	FUNGICITD				18.12.2013
CHLORPYRIPHOS 48%EC	INSECTICIDE	5.6	67,200	12,000.00	2.1.2014
CHLORIPYRIPHS	INSECTICIDE	5.4	56,700	10,500.00	17.1.2014
CHLORPYRIFOS	INSECTICIDE	4.83	125,193.6	25,920.00	2.1.2014
SPINETORAM	INSECTICIDE	163.75	88,425	540.00	23.1.2014
ENDOSULFAN	INSECTICIDE	5.1	47,124	9,240.00	27.12.2013

Common name	Use Category	UNIT PRICE	TOTAL PRICE (EUR)	Volume (L/Kg)	DATE /Code
LAMBDA-CYHALOTHRIN 5%	INSECTICIDE	6.95	64,218	9,240.00	27.12.2013
METHOXYFENOZIDE	INSECTICIDE	46.4	25,056	540.00	31.12.2013
METHOXYFENOZIDE	INSECTICIDE	46.4	25,056	540.00	31.12.2013
		32,737.62	28,552,056.87	6,539,513.40	

Annex 7 Pictures

Kick-off meeting

Final workshop

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The mission of Wageningen UR (University & Research centre) is 'To explore the potential of nature to improve the quality of life'. Within Wageningen UR, nine specialised research institutes of the DLO Foundation have joined forces with Wageningen University to help answer the most important questions in the domain of healthy food and living environment. With approximately 30 locations, 6,000 members of staff and 9,000 students, Wageningen UR is one of the leading organisations in its domain worldwide. The integral approach to problems and the cooperation between the various disciplines are at the heart of the unique Wageningen Approach.