



Curriculum framework for sound pesticide management

Pesticide Risk Reduction Programme – Ethiopia

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For quality of life

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Abstract

On the bases of an extensive needs assessment exercise with key stakeholders, it became clear that graduates from agricultural universities and medical schools receive little or no knowledge on pesticides and have insufficient knowledge and capacities to manage the responsible use of pesticides in their daily work. With regards to the sustainability of the Ethiopian pesticide management system in the long-term, current curricula should be upgraded with courses covering various pesticide management topics. This report is an advice on the development of a framework for two curricula on sound pesticide management for 1) medium level education (Agricultural Technical Vocational Education and Training: ATVET) and 2) higher education (university level). These two curricula complement each other and focus mainly on agricultural education.

Keywords: pesticide, pesticide management, curriculum framework, ATVET, university, Ethiopia



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Photo front cover: Pesticide shop in Hawassa (Irene Koomen)

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List of abbreviations and acronyms

a.i.	Active ingredient
APHRD	Animal and Plant Health Regulatory Directorate
ATVET	Agricultural Technical Vocational Education and Training
BoA	Bureau of Agriculture
BSc	Bachelor of Science (BSc)
CDI	Centre for Development Innovation, Wageningen UR
DA	Development Agent
ECT	European Credit Transfer
FAO	Food and Agriculture Organisation
FTC	Farmers Training Centre
GAP	Good Agricultural Practices
HEW	Health Extension Worker
IPM	Integrated Pest Management
MoA	Ministry of Agriculture
MoE	Ministry of Education
MSc	Master of Science
OHS	Occupational Health & Safety
PAN	Pesticide Action Network
PPE	Personal Protective Equipment
PRRP-ET	Pesticide Risk Reduction Program Ethiopia
ToT	Training of Trainers
WHO	World Health Organisation

Definitions

Integrated Pest Management	The careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms (FAO/WHO, 2014)
Pest(s)	Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants and plant products, materials or environment, include vectors of parasites or pathogens of human and animal diseases and animals causing public health nuisance (FAO/WHO, 2014).
Pesticide	<p>Any substance or mixture of substance of chemical or biological ingredients intended for repelling, destroying or controlling any pest or regulating plant growth (FAO/WHO, 2014).</p> <p>Includes all of the following: Herbicide, insecticide, fungicide, nematicide, termiticide, molluscicide, piscicide, avicide, rodenticide, predacide, bactericide, insect repellent, animal repellent, antimicrobial, disinfectant (Randall et al., 2013)</p>
Pesticide life cycle	All the stages of pesticide might pass through from production to degradation in the environment after use, or its destruction as an unused product. The life cycle includes manufacture, formulation, packaging, distribution, storage, transport, use and final disposal of pesticide product and /or its container (FAO/WHO, 2014)
Pesticide management	The regulatory and technical control of all aspects of the pesticide lifecycle, including production (manufacture and formulation), authorization, import, distribution, sale supply, transport, storage, handling, application and disposal of pesticides and their containers to ensure safety and efficacy and to minimize adverse health and environmental effects and human and animal exposure. (FAO/WHO, 2014)

1 Introduction

The Pesticide Risk Reduction Programme – Ethiopia (PRRP-Ethiopia) aims to contribute to a sustainable pesticide management system in Ethiopia in order to regulate pesticide use by farmers, taking into account the whole pesticide life cycle from registration and procurement, import/local manufacture of pesticides, to distribution, use and monitoring, including quality control and waste management, and to improve the environment, health of growers and the surrounding community, and to stimulate the economic performance of the Ethiopian agricultural sector. PRRP – Ethiopia is a collaborative project between the Animal and Plant Health Regulatory Directorate (APHRD) of Ethiopia, FAO and Wageningen UR (see: <http://www.prrp-ethiopia.org>).

Within PRRP-Ethiopia five work packages were established that allowed the project management to define the steps necessary for completion of the work. As such work package D deals with 'sustainability of developed systems' in which capacity building towards development of a technical and scientific support platform is undertaken. Curriculum development on sound pesticide management is one of the sub activities.

The ever-increasing population growth will greatly increase the amount of food needed to adequately feed sub-Saharan Africa's people. As such, also in Ethiopia agricultural production will need to increase and thus the amount of pesticides used is expected to rise, either due to increased production area, but also due to more intensified production systems. In Ethiopia about 80% of the farmers are smallholders. The Ethiopian government has put the focus on increasing productivity and intensifying production of these small holders in order to ensure food security. However, especially the smallholder farmers are lacking knowledge and skills on responsible and correct application of pesticides.

Commercialization of agriculture often leads to an increase in pesticide use¹, specifically in high-intensity production such as horticulture. However, the use of pesticides brings both benefits as well as costs to the community at large. Examples of benefits of the use of pesticides are increased production (thus increased income), less labour intensive production (e.g. use of herbicides) and less contagious diseases (e.g. malaria control). However, the costs concerned with the use of pesticides are environmental impact (e.g. pollution), occupational and public health hazards (e.g. acute and chronic diseases) and food safety issues (e.g. MRLs). In order to maximize the benefits and minimize the costs of pesticide use, pesticide should be handled responsibly. Proper knowledge of individuals who are involved in managing, using or handling pesticides is essential.

Furthermore, from the needs assessment it became clear that human health and the environment in Ethiopia are under threat due to improper use of pesticides. Specifically, the extension system that deals with the small holders put exclusive focus on enhancing and intensifying the supply of pesticides, while less emphasis is put on the safe and responsible use of these inputs.

According to interviews made with key stakeholders, currently graduates from agricultural universities and medical schools receive little or no knowledge on pesticides and have insufficient knowledge and capacities to manage the responsible use of pesticides in their daily work. With regards to the sustainability of the Ethiopian pesticide management system in the long-term current curricula should be upgraded with courses covering various pesticide management topics. This report is an advice on the development of a framework for two curricula on sound pesticide management for 1) medium level education (Agricultural Technical Vocational Education and Training: ATVET) and 2) higher education (university level). These two curricula complement each other and focus mainly on agricultural education.

¹For a timeline of pesticide use in Ethiopia, see Annex 1.

2 Approach

2.1 Objective

The objective of this study was to give advice on development of two curricula on sound pesticide management for 1) medium level education (Agricultural Technical Vocational Education and Training: ATVET) and 2) higher education (university level), which complement each other and for which the focus is mainly on agricultural education (crops). Livestock sciences, Medical Schools, Public Health, Chemistry and Business & Marketing education will also be touched upon.

Figure 2.1 below provides the full curriculum development process. This study will focus on step 1 and step 2, and will go as far as delivering the curriculum outlines for sound pesticide management. In those two steps the relevant stakeholders have been fully involved.

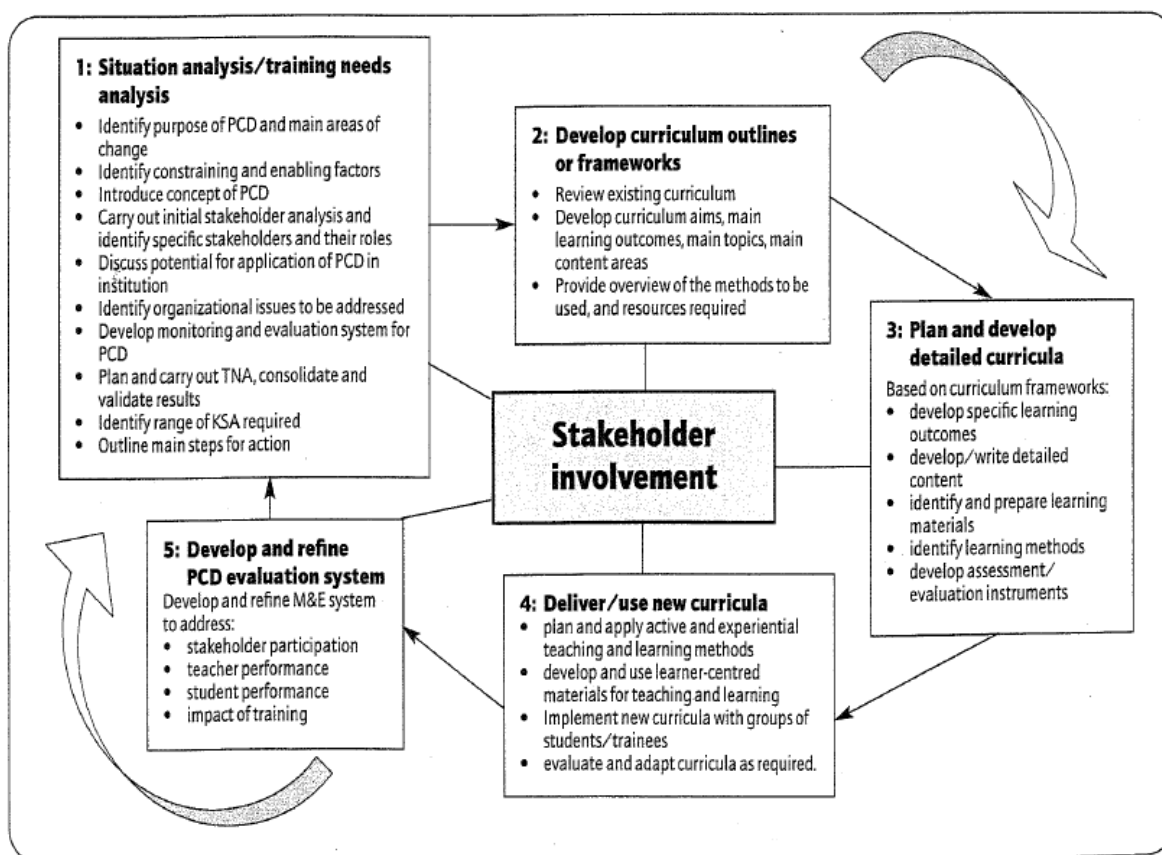


Figure 2.1: the Participatory Curriculum Development cycle (Taylor, 2003)

2.2 Needs assessment, curriculum design and validation

In order to identify within the local context what kind of competencies are needed for sustainable pesticide management, and to determine and address the discrepancy between current curricula and graduates' performance in practice, a needs assessment was carried out. Informants were selected from alumni, staff of institutes of learning, potential employers coming both from the public as well as the private sector and those active in the field of the pesticide life cycle. See chapter 3 and Annex 2 for the method used for the needs assessment.

To be able to place the scope of the proposed curricula in an international context a background study was performed assessing pesticide related curricula at various learning institutes of the Netherlands. Studying the system of spray licences both in the Netherlands as well as the UK, and a post-graduate

diploma course specifically designed for those working in the pesticide sector (see Annex 2 for an overview).

The needs assessment served as input for a planning session to design and develop the curricula. The planning session resulted in an outline of major content focus areas, learning objectives, outline of the course programme, and related teaching methods geared to expected student skills. The planning session was conducted in the Netherlands by the NL project team and in consultation with the local consultant.

A validation workshop was organised in Ethiopia (October 6th, 2014) to validate the outcomes of the planning session and draft curriculum outline, and to receive additional suggestions for improvement of the curricula (Figure 2.2).



Figure 2.2 Group discussion during the validation workshop

2.3 Curriculum outline

Based on the outcomes of planning session and the validation workshop the final curriculum outlines are composed for:

1. ATVET
2. University BSc

The main focus is on development of curricula for Agricultural Sciences (mainly crops), however to some extent advice is given for Livestock Sciences, Medical Schools, Public Health, Chemistry and Business & Marketing. Some suggestions for MSc curricula are given.

3 Needs assessment

3.1 Methodology

The needs assessment was carried out to identify within the local context what kind of competencies are needed for sustainable pesticide management, and to determine and address the discrepancy between current curricula and required graduates' performance in practice. The following specific objectives were followed:

- Identify current developments
- Identify gaps between desired and actual graduate competencies in practice
- Identify gaps between required and current curricula content in view of current developments
- Identify training needs

The assessment was done by focusing on four levels:

- Sector (agriculture, health and education)
- Organizational (management and organization, institutional)
- Operational (farm and field level)
- Individual (personal experiences)

Figure 3.1 below visualizes the needs assessment process. The information and outcomes of the needs assessment served as input for a planning session to design and develop the draft curricula.

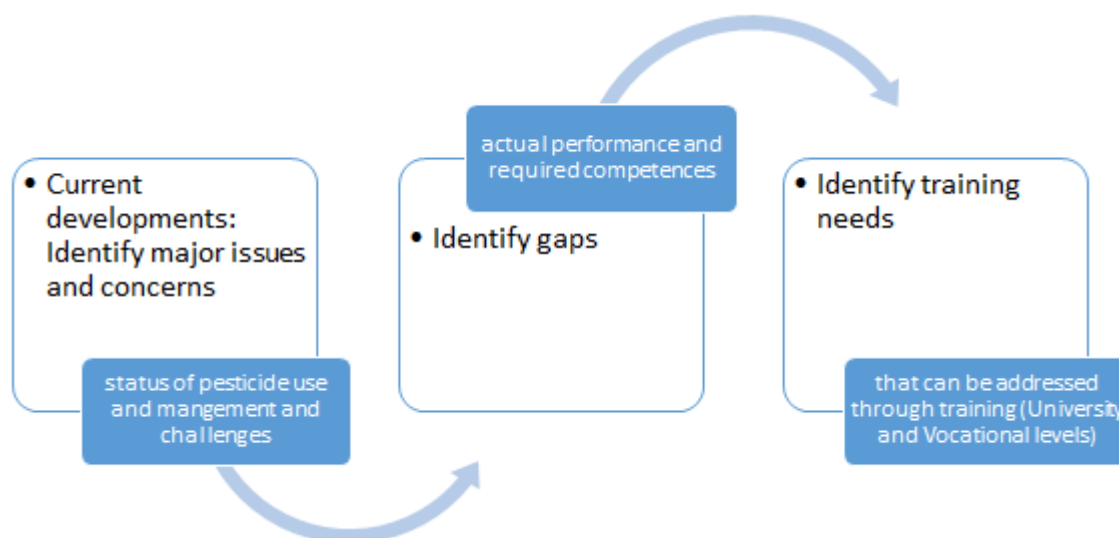


Figure 3.1 Needs assessment process

The data for the needs assessment were collected through focus group discussions, semi-structured interviews, questionnaires, observations and document analysis (see Annex 3 for the detailed methodology). The relevant stakeholders were interviewed with an open-ended interview followed by an interactive discussion about issues and concerns of sound pesticide management and related training and education topics.

Furthermore, three relevant workshops were attended by the local consultant to obtain better insights on the key concerns of pesticide management in Ethiopia and to identify which topics should be addressed through training interventions:

- IPM workshop (84 national and international participants: policy makers, researchers, educators and agro-chemical companies & traders) (July 2014)

- Pesticide stewardship workshop (professionals/researchers) (July 2014)
- Knowledge of health professionals on pesticide risks (September 2014)

For the purpose of the needs assessment the following stakeholders were identified and interviewed (numbers between brackets²):

- Educators and researchers in agriculture and environment (20)
- Educators and researchers in Health (5)
- Educators at ATVET (15)
- Agricultural experts in MoA at various levels (25)
- Development agents (15)
- Farm managers in commercial farms (15)
- Technical staff at commercial horticulture farms (BSc and above) (80)
- Other employees (Diploma and Non-graduates) in commercial horticulture farms (30)
- Chemical/pesticide supplying companies (15)

In addition to the interviews, observations of practices in the field were done at (numbers between brackets):

- Commercial horticulture farms (15)
- Farmers' cooperatives (2)
- Small holders visits at farmers' village (4)

For a complete list of those involved in the needs assessment exercise see Annex 6.

Generally, the needs assessment produced valid information for developing curricula for two levels (university and ATVET) and assisted in identifying: (1) what should be taught (2) learning experiences and approaches to be used, (3) how these experiences and approaches can be organized, and (4) how learning and programmes can be evaluated. Finally, it helped to identify and design course titles and topics, learning outcomes, outline of course content, and teaching time (credit hours/ECTs). On the basis of this teaching methods and student competence assessment can be further developed.

3.2 Findings

3.2.1 Current developments

Development agents (DAs) working with farmers in general lack the capacity and knowledge to deal with pesticides, as trial and error seems to be the dominant way of using, handling and applying pesticides (Figure 3.2). In addition, there is lack of local competence to handle and manage the introduction and use of new generation pesticides that are increasing with the rise of commercial agriculture (e.g. floriculture). Generally, the needs assessment showed that capacity on risk assessment as well as risk communication are lacking at all levels (sector, organizational and operational).

3.2.2 Current curricula

Agricultural universities and vocational education have traditionally focused on the control of pests and diseases with little attention devoted to the management and handling practices of the pesticides themselves. Likewise, environmental sciences in universities largely limit their focus on pollution topics but do not cover the full pesticide life cycle. Public health and medical education in Ethiopia are dedicated less to pesticides (in terms of time spent on the topic and content taught). Yet, cases of pesticide related health problems are common in hospitals. In general, issues related to safe handling and responsible use of pesticides are neglected in training and education at all levels, and respondents felt that the existing capacity of graduates and existing curricula are limited in addressing the current issues and concerns of pesticide management in Ethiopia. Respondents believe that many of these problems can be addressed through proper education and training.

² Indicates number of people interviewed

Except from the void in pesticide teaching within several education programs, when pesticide subjects are being covered most of it is incoherent and scattered across different disciplines, education levels and educational topics. For example, if we consider the ATVET Crops Production Occupational Standards (Occupational Standards for Field Crops, 2011), pesticide topics are scattered among different crop production topics. There are no separate subjects that cover all elements of pesticide management and provide a complete picture. As such there is the need for development of a stand-alone program on pesticide management, which may be part of different discipline teaching programs.



Figure 3.2 Pesticide shop (L) and spraying activities in green house (R)

3.2.3 Current competencies

In Ethiopia there is a clear ambition to shift towards more commercial agriculture, industry and knowledge based agri-business. Skilled labourers and managers are crucial to attract investors and to develop new business and to comply with the international market requirements, including responsible and minimum use of pesticides. Specifically, employees' capabilities to handle and use pesticides are crucial, not only with regard the export sector in the context of global competition, but also with regard to food safety and occupational health. The required competencies are mainly characterized by the higher level quality and safety requirements associated with certification schemes.

Nevertheless, in Ethiopian context, capabilities of young employed graduates have been among the critical issues of concern in the emerging sector such as horticulture. Employers are concerned that new graduates of universities joining the workforce are poorly prepared and lack the suitable capacities to manage pesticides.

In particular, as became clear from the needs assessment, practitioners lack competences in 1) understanding the safety and precautionary language commonly found on product labels, 2) how to communicate pesticide benefits and risks to the public and 3) how to transmit information on how to select pesticides and protect the professionals handling the pesticides.

From discussions and interviews with experienced respondents being employed university graduates, it was shown that adverse events related to pesticide problems are common in practice (e.g. instances of seriously injured employed graduates in the MoA were mentioned as a lack of competence in pesticide handling and safety).

Generally, all respondents felt that the existing capacity of graduates and existing curricula are limited to address the issues and concerns of the pesticide management in Ethiopia.

The information and data collected through the interviews, observations, questionnaires and document analysis allowed the curriculum development team to:

- Confirm the need for curricula adjustment. Typically, the interviews with the educators and researchers in universities and the existing document analysis provided valuable insights about the limitation of the already-established learning approaches and experiences and the changes required or to be introduced;
- Provide input for recommendations how these limitations can be overcome through including specific courses.

Reflecting the above mentioned gap, two options are suggested: (1) those already employed should receive additional training, (2) the existing agricultural universities and vocational education institutes should design a curriculum that integrates pesticide management and IPM in their education system.

Furthermore, two major areas of training interventions were recommended: (1) Pesticide management with courses addressing fundamental knowledge, skills and practices for the effective and safe use of pesticides while having the least impact on human and the environment and (2) IPM with courses addressing the knowledge, skill and practices of IPM & knowledge to prevent and control pests while having the least impact on public and occupational health and the environment.

Quotes from respondents

"The health aspect of pesticides and how to integrate with agriculture and environment is less addressed..."

"Pesticides will continue to be used and what we can do is to know how to use them in a responsible and safe way"

3.2.4 The health sector & pesticide knowledge & competences

Although not directly addressed in this needs assessment, another project (Mebrate et al., 2014) under the PRRP-Ethiopia carried out an extensive survey amongst health extension workers and medical staff. In short the major conclusions of this survey were:

The survey shows that Physicians, Nurses and community health extension workers (HEW's) lack sufficient:

- **Knowledge on pesticide health issues (type of pesticides, diagnosis, treatment)**
- **Skills/competences to deal with pesticide health issues (gastric lavation, cathartics, intubation, etc.)**
- Pre-service and especially in-service training
- Resources to manage pesticide poisoning (guidelines, routine reporting mechanisms)

General recommendations from the survey included:

- Sensitization on all levels of health facilities
- **Incorporation of pesticide health in academic curricula**
- **In-service knowledge and skill training on prevention, diagnosis and treatment of pesticide poisoning**
- Development of guidelines for diagnosing and treating pesticide poisoning cases (flow charts)
- Incorporation of pesticides toxicity indicators in the health management information system and separate recording and reporting of poisoning cases

The items indicated in bold give a clear indication for revision of the health curriculum at university as well as for vocational training.

4 Occupational profiles

4.1 Introduction

Competencies are capabilities of people that they can develop. People will be enabled to become process and results oriented, act in an adequate, goal oriented, and motivated way within their job situations (Mulder, 2012). Competencies are the possession of certain attributes such as knowledge, skills and attitude. Occupational profiles, which address the skill, knowledge and attitude levels required for an occupation, have been formulated based on three elements: 1) needs assessment, 2) the professions of alumni of both ATVETs and universities, and 3) the relevance of pesticide management to their professional lives. It should be noted that more than only aspects of the profiles relevant to pesticide management have been included because an occupational profile is a holistic view of the competences needed for a specific occupation.

4.2 Agricultural Technical and Vocational Education Training (ATVET)

In total 4 different groups of occupational profiles were identified:

1. Extension officer
2. Research assistant
3. Field assistant
4. Section head

For each group the core learning tasks, tasks and core competencies are described³. Those with relevance with regards to pesticide management are indicated in **bold**.

Group I: Extension officer	
Core learning tasks: working with people, deal with complex technical situations, holistic thinking, problem solving and empathy skills.	
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application, storage, waste disposal), identification of pests, occupational & public health hazards & mitigation of risks, environmental impact, cost benefit, legislation & regulation, IPM principles (IPM crop protection plan, biological control, GAP), dissemination strategies	
Tasks <ul style="list-style-type: none">- Assists farmers in undertaking crop and livestock production and natural resource management;- Carry out performance surveys for data collection on planting dates, pesticides records, harvesting, yield expectations, weather conditions etc.- Assist in planning and construction of produce collection sheds- Supervise dissemination of input supplies and marketing- Disseminate technical information	Competencies <ul style="list-style-type: none">- Market intelligence- Group dynamics- Ability to train farmers- Demonstrate ability in work performance and results- Demonstrate leadership and professional competence- Demonstrate excellent people skills- Demonstrate confidence- Ability to empower others in the community to lead- Ability to adopt to change

³The presented occupational profiles are a modification of those developed for the Niche project on 'Development and improvement of demand-driven horticulture training' (Niche Kenya 126/140). Input from the project partners in this project are greatly acknowledged.

<ul style="list-style-type: none"> - Enforce good agricultural practices (GAP) - Provide linkages to farmers - Develop training programmes for farmers and officers working under him / her - Carry out applied research - Provide specialist services including transfer of knowledge on pesticide application - Empower farmers and their groups 	<ul style="list-style-type: none"> - Skills in oral and written communication - Ability to act in principled and in an ethical manner - Interpersonal and team skills - Demonstrate personal responsibility and dependability
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Group II: Research assistant	
Core learning tasks: Assist in research related activities	
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application), efficacy trials, identification of pests, occupational & public health hazards & mitigation of risks, environmental impact, IPM principles (IPM crop protection plan, biological control, GAP)	
Tasks <ul style="list-style-type: none"> - Collect data for research team - Prepare for trials - Supervise field activities - Supervise implementation of trials - Supervise application of pesticides (if part of the trial) - Data collection - Present data for analysis 	Competencies <ul style="list-style-type: none"> - Research methods skills - Report writing skills - Good communication ability - Ability to make accurate observation and recording

Group III: Field assistant (at a farm or agricultural company)	
Core learning tasks: Implement field related technical activities	
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application, storage, waste disposal), identification of pests, occupational health hazards & mitigation of risks, environmental impact, IPM principles (IPM crop protection plan, biological control, GAP)	
Tasks <ul style="list-style-type: none"> - Carry out field and farm activities - Apply pesticides including mixing - Maintain farm equipment - Implement standard operating procedures and good agricultural practices - Assist in planning of farm activities 	Competencies <ul style="list-style-type: none"> - Demonstrate ability to follow instructions independently - Demonstrate ability in work performance and results - Demonstrate personal responsibility and dependability

Group IV: Section head (at a farm or agricultural company)	
Core learning tasks: Planning, manage, supervise a unit or business, take care of human resources and handle technical issues	
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application, storage, waste disposal), identification of pests, occupational & public health hazards and mitigation of risks, environmental impact, cost benefit, legislation & regulation, IPM principles (IPM crop protection plan, biological control, GAP) and dissemination strategies	
Tasks <ul style="list-style-type: none"> - Consolidate and monitor production data - Coordinate farm activities - Prepare spray programs - Carry out labour allocation to units and management - Ensures standard operating procedures - Supervise workers in the farm - Allocate tools (including PPEs) for field activities - Supervise produce management at collection 	Competencies <ul style="list-style-type: none"> - Demonstrate leadership and professional competence - Market intelligence - Group dynamics - Ability to train other employees - Ability in work performance and results - Be creative and original thinker - Ability to network across sectors - Demonstrate strong interpersonal skills - Be qualified through knowledge, training

<ul style="list-style-type: none"> - sheds, loading and transportation to depots - Disseminate technical information - Enforce good agricultural practices (GAP) - Coordinate and supervise duties like quality control, quality inspection - Develop training programs for workers working under him/ her - Instruct, inform and supervise workers to protect their health and safety - Ensure proper maintenance of equipment, materials and protective devices - Select and assign farm personnel, ensuring equal employment opportunity in hiring and promotion. - Coordinates activities by scheduling work assignments, setting priorities, and directing the work of subordinate employees. - Evaluates and verifies employee performance through the review of completed work assignments and work techniques. - Identifies staff development and training needs and ensures that training is obtained. - Ensures proper labour relations and conditions of employment are maintained. - Maintains records, prepares reports, and composes correspondence relative to the work. 	<ul style="list-style-type: none"> and experience--to organize the work and its performance - Be familiar with the Act and the regulations that apply to the work being performed in the workplace; - Know about any actual or potential danger to health and safety in the workplace - Thorough knowledge of farm tools and equipment. - Thorough knowledge of safety precautions and occupational hazards of farming. - Thorough knowledge of plant diseases and proper treatment. - Demonstrate knowledge of employee policies and procedures. - Ability to plan and direct farm operations. - Ability to train, instruct, and supervise farm personnel. - Ability to use farm equipment and to make general repairs. - Ability to maintain records, prepare reports - Ability to communicate effectively.
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It should be noted that these occupational profiles are defined at a different level than is described in the Occupational Standards⁴. The profiles above are based on the profession a graduate might enter after completing his/her vocational training, while the Occupational Standards are based on sub-activities a student at level II, III or IV of the ATVET College is expected to have knowledge and skills on after completing the respective unit.

4.3 University (BSc)

In total 4 different groups of agricultural occupational profiles were identified:

1. Unit managers, supervisors, team leaders
2. Trainers, subject matter specialists, civil servants at bureau or ministry level (service providers)
3. Researchers
4. Private investors/Entrepreneurs

For each group the core learning task, tasks and core competencies are defined. Please note that especially for the first group, which is a mixture of possible occupations, not all tasks and competences apply.

Group I: Unit managers, supervisors, team leaders
Core learning tasks: Manage, Planning, Lead, supervise, and handle technical issues
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application, storage, waste disposal), identification of pests, occupational & public health hazards & mitigation of risks, environmental impact, cost benefit, legislation & regulation, IPM principles (IPM crop protection plan, biological control, GAP) and dissemination strategies

⁴Federal Democratic Republic of Ethiopia Occupational Standard Field Crops Production NTQF Level II, III And IV, Addis Ababa, 2011. Similar standards exist for other agriculture related topics.

Tasks	Competencies
<ul style="list-style-type: none"> - Assist in generating farm plans and budget inputs of all farming activities - Design and implement systems to efficiently manage labour and equipment - Work closely with Packing and quality management to produce the highest quality products - Conduct and manage all preparations - Follow and document planting & stocking plan - Generate accurate crop/livestock survey and crop/livestock forecast - Produce spray/pesticide application forecast according to the crop/livestock survey - Help supervise harvesting - Help in quality control - Comply with all safety requirements - Design “spray programs” and spray crops with pesticides - Maintain farm data for analysis - Train and supervise the farm assistants - Conduct farm research - Work assignment for all employees - Supervision of all operations (Cultivation, planting, field operations) - Employ and supervise extra labour when needed - Maintain equipment and facilities at the farms - Order supplies as needed - Maintain irrigation and drainage system - Develop, implement and manage farm supplies business plans and budgets. - Manage the ordering, storage and administrative control of inventory. - Implement and control a key account management program. - Manage the process surrounding quotes and sales - Provide expertise on products across farming industries - Market and maintain good relations with customers and supply chain partnerships - Sales projection - Service delivery - Market linkages - Build business capacity of producers - Manage producer units as a business unit - Product stewardship - Coordinate and manage spray teams - Prepare production programs (planting, spray etc.) - Collect soil samples for external and internal analysis - Responsible for overall crop nutrition and crop protection - Recording of all activities including processing - Prepare and train other staff on crop protection and nutrition programs - Liaise with other units/departments to ensure success of the programs in the firm 	<ul style="list-style-type: none"> - Demonstrate disciplinary knowledge in crop/livestock science - Demonstrate farm management skills and experience - Mechanical knowledge and agricultural tools expertise - Demonstrate skills in Drip irrigation and State of the art Precision - Ability to manage assets - Equipment, labour - Ability to budget, program, manage, schedule - Results oriented - Ability to plan ahead and to look at the whole picture - Ability to apply new knowledge & research procedures. - Demonstrate oral and written communication skills. - Demonstrate effective interpersonal communication skills - Demonstrate excellent organizational and time management skills with emphasis on accuracy and attention to detail. - Capable of working independently and cooperation in a team environment. - Understand and apply research techniques - Technology application - Project management skills - Engage in lifelong learning - Assess and learn from worst and best practices in services - Knowledge of contemporary socio-political and economic issues - Critical thinking - Cost effective and efficiency orientation - Ability to do cost-benefit analysis - Knowledge of products, clients, competitors and overall markets in the region and beyond - Ability to contribute to local, regional and rural communities - Ability to recognize market potentials and react to new market developments - Ability to handle stressful circumstances - Ability to communicate effectively and demonstrate good presentation skills - Able to relate and work with others effectively - Demonstrate complex communication involving interacting and persuading people - Ability to collaborate with all players in the chain - Ability to work with global and multicultural teams - Ability to do market and user needs assessment - Demonstrate critical thinking - Able to keep abreast with regulations

<ul style="list-style-type: none"> - Responsible to the board for all firm's activities - Manage costs - inspect farms during active growth and inspection of products - Pest and disease diagnosis - Pest surveillance - Seed certification and Licensing - Registration of products - Facility inspection - Risk analysis - Maintaining high standard of crop/livestock management, crop/livestock hygiene and crop/livestock husbandry to ensure high quality standards and production. - Ensuring proper scouting of pests and diseases is done and promptly reporting any incidents. - Timely submission of production reports as per set deadlines. - Ensuring proper Safety, Health and Environmental issues are put into consideration in accordance with the company policy. - Ensuring that budgeted production unit is achieved and or exceeded. 	<ul style="list-style-type: none"> - affecting the crop/livestock subsector - Ability to analyse actors along the chain - Ability to observe work ethics with good time management ability - Highly self-motivated and results driven - Technical Product knowledge - Ability to efficiently and constantly establish good networks - Ability to manage growth - Brokerage and linkage skills - Ability to manage labour - Demonstrate time management skills - Dedicated and motivated to duty - Ability to coordinate various activities in the firm - Ability to plan various production activities and do right timing - Up to date with the current chemicals and their safe use - Have good people relations skills - Ability to mechanize activities in the firm using recent technologies - Understand and apply the basic reporting and presentation skills - Keen and attentive to details - Ability to keep records - Ability to work under pressure - Ability to manage and cope with change - Aware of the developments, regulations and workers' rights - Ability to work in a group and team - Demonstrate critical thinking - Ability to make independent decisions - Ability to analyse risks - Understand emerging safety issue and requirements - Knowledge in Integrated Pest Management and fertilizer application practices. - Team player with proven supervisory and people management skills and one who is able to work with minimal supervision. - Demonstrate good time management skills
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<p>Group II: Trainers, subject matter specialists, civil servants at BoA or MoA</p>	
<p>Core learning tasks: To disseminate knowledge and innovations, to design and implement policies</p>	
<p>Core knowledge requirements for pesticide management:</p>	
<p>General knowledge of pesticide (groups, modes of action, resistance, application, storage, waste disposal), identification of pests, occupational & public health hazards & mitigation of risks, environmental impact, cost benefit, legislation & regulation, IPM principles (IPM crop protection plan, biological control, GAP), dissemination strategies</p>	
<p>Tasks</p> <ul style="list-style-type: none"> - Management of producer organizations - Design and implement agricultural policies - Offer specialist technical advice to farmers/ farmers' groups on appropriate production technologies - Recruit and organise farmers into production and marketing groups - Train farmers in planning the production of crops/livestock in relation to supply and 	<p>Competencies</p> <ul style="list-style-type: none"> - Good communication and presentation skills - Creativity and innovativeness - Ability to disseminate knowledge and information - Ability to network - Demonstrate Financial management skills - Good interpersonal skills - Demonstrate technical knowledge on crop

<p>demand in the market</p> <ul style="list-style-type: none"> - Ensure that only the produce that meet quality standards enter the marketing chain - Train farmers on proper input use - Organise input provision to farmers at a cost - Monitor input use by farmers to ensure they conform to Good Agricultural Practices (GAP) - Advise on new pest management practices - Identification and diagnosis of pests - Provide technical/agronomic/livestock support to farmers - Building the business capacity of producers - Train farm managers and technicians in companies - Plan and conduct community, stakeholders needs analysis - Select learning and development methodologies - Conduct cost effectiveness analysis - Link research results to training programs - Create and manage quality standards - Write reports and action plans - Keep up to date with new developments - Guide the farmers during field days and excursions - Report results about various programs, projects and activities 	<p>production</p> <ul style="list-style-type: none"> - Aware of worker's rights and safety issues - Ability to translate theoretical and scientific knowledge into practical trainings - Ability to apply various information dissemination methodologies - Ability to identify and apply new developments - Demonstrate report writing and drawing of action plan - Ability to work in a group and under pressure - Demonstrate organisational skills - Self-motivated and capable of working independently - Brilliant interpersonal, leadership and communication skills - Aware of current developments, new technologies and new products - Political sensitivity
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Group III: Researchers	
Core learning tasks: Conduct research and research related tasks	
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application), efficacy trials, identification of pests, occupational & public health hazards & mitigation of risks, environmental impact, IPM principles (IPM crop protection plan, biological control, GAP)	
<p>Tasks</p> <ul style="list-style-type: none"> - Draw logistics for survey - Design experiments - Design of pesticide efficacy trials - Data collection - Data analysis - Report writing - Sampling and analysis - Training of farmers - Assist in proposal writing 	<p>Competencies</p> <ul style="list-style-type: none"> - Demonstrate research skilled - Demonstrate organisational skills - To demonstrate an understanding of new information - Seek feedback from others and be receptive to new ideas and perspectives - Able to understand farmers' problems and needs and able to translate these in applied research proposals - Ability to communicate research findings - Able to write research proposals - Ability to manage data - Able to analyse, interpret and disseminate research findings - Ability to plan research activities - Able to construct relevant research instruments - Ability to use various statistical packages for qualitative and quantitative data - Creativity - Ability to work in intercultural environments

Group IV: Private investors/Entrepreneurs	
Core learning tasks: develop, implement and monitor established business	
Core knowledge requirements for pesticide management: General knowledge of pesticide (groups, modes of action, resistance, application, storage, waste disposal), occupational & public health hazards & mitigation of risks, environmental impact, cost benefit, legislation & regulation, GAP	
Tasks	Competencies
<ul style="list-style-type: none"> - Project development and management - Establish strong linkages - Develop and Maintain records - Draw project proposal - Develop a budget and apply/ implement it - Apply basic economics and accountancy skills - Production planning - Identify and analyse potential market opportunities - Collaborate with stakeholders - Control resources - Allocate labour guide and manage employees - Monitor overall project activities 	<ul style="list-style-type: none"> - Demonstrate business development skills - Ability to practice commercialization of ideas and products - Ability to nurture a new business - Understand and make use of linkages - Ability to do budgeting and cost benefit analysis - Demonstrate good interpersonal skills - Demonstrate personal responsibility and dependability - Demonstrate skills in critical thinking and in solving complex problems - Demonstrate work ethics - Demonstrate time management skills - Demonstrate leadership skills - Ability to identify potential markets - Demonstrate project planning and management skills - Demonstrate desire and ability for lifelong learning - Skills in critical thinking and in solving complex problems - Demonstrate interpersonal and team skills - Ability to adopt to change - Ability to monitor, understand and react to market and consumer trends - Ability to conduct market research

5 Curriculum outline ATVET

5.1 Introduction

“ATVETs seek to produce mid-level, skilled, and competent agricultural Development Agents (DAs) who will then teach farmers at Farmer Training Centres (FTCs)”, “expanded ... to include the provision of non-formal specialized short-term training, skill-gap training, entrepreneurial training, applied technology transfer, and services for farmers, agriculture businesses, and the public sector” (Davis et al. 2010).

‘ATVETs train development agents (DAs) to work in Farmer Training Centres (FTCs) to enhance the knowledge base and skills of farmers and thereby provide the institutional framework for increasing the efficacy of agricultural extension services. Before the ATVETs, the universities were the only institutions offering training at degree and diploma levels in general agriculture. The ATVET curriculum was first introduced in September 2000 by the MOARD in 28 ATVETs located across the country. In 2001, the number was reduced to 25. The 25 ATVETs graduated the first DAs in 2004. By 2008 the colleges had produced nearly 60,000 DAs (12 percent of them women)’ (see <http://www.worldwide-extension.org/africa/ethiopia/atvet>). The DA training takes three years, and from there, the extension workers are placed at FTCs. In general there are three DAs in each village, a crops, livestock and natural resources specialist. Farmers receive skills-based trainings through extension services and on-site demonstrations at FTCs.

In 2011 Occupational Standards were developed for the ATVETs, these are leading for the topics that are taught. From the needs assessment it became however clear that instructors did not always use the Occupational Standards for designing the courses. This is understandable as the structure of these Occupational Standards as input for the curriculum is not very clear.

5.2 Learning objective / outcome

Graduates of an ATVET Certificate on Sound Pesticide Management will have basic factual, technical and procedural knowledge on safe and sound pesticide management as applied in an IPM approach. The course will enable graduates to:

- Acquire professional skills, knowledge, and attitudes necessary to operate at assistant level in the pest management sector.
- Become creative and innovative in finding solutions to challenges in the management of pests using an IPM approach under different farming systems with the judicious use of pesticides as a last resort.
- Acquire practical skills to be able to apply pesticides judiciously and to advise applicators on the appropriate use of pesticides.

5.3 Curriculum structure

The proposed curriculum has been designed from a pesticide management perspective and then specifically for the crops area. Three modules are proposed:

- | | |
|---|-----------|
| 1) Introduction to pesticides | Level II |
| 2) Safe use and application of pesticides | Level III |
| 3) Advanced principles Integrated Pest Management | Level IV |

As compared with the occupational standards (see an overview of the relevant units in table 5.1) these modules integrate both knowledge of pests and pesticides. In the Occupational Standards for field crops these topics are given in separate units (see table 5.1). Apart from the specialist units on pests and pesticides many of the other units also incorporate some element of knowledge and skills

on pests and pesticides. However this knowledge is scattered across the different units and the impression is that there is no consistency in how knowledge on pesticides is offered in these units (see Annex 3).

Table 5.1 Overview of pest and pesticide related units as described in the Occupational Standards for each of the levels

Field Crops Production	Pests - Topic and unit no	Pesticides - Topic and unit no
Level II	Treat pests (weed, insect, disease and disorders)	Apply Chemicals under Supervision
	AGR CRP2 18 1213	AGR CRP2 19 1213
Level III	Control pests (Weeds, Insects, Disease) and disorders	Transport, store, handle, and apply pesticide
	AGR CRP3 18 1213	AGR CRP3 17 1213
Level IV	Implement pest management action plans	Plan and implement chemical use program
	AGR CPM4 07 0311	AGR CPM4 04 0311
	Control weeds, pests and/or diseases in crops	
	AGR CPM4 08 0311	

5.4 Modules and topics

The modules given below are specific for crop related pesticide management topics.

5.4.1 Module 1: Introduction to pesticides

This module aims to:

- Understand the advantages and disadvantages of pesticides
- Gain knowledge on the different pesticides groups and their various modes of action
- Be able to determine the pesticide that should be used as a last resort to control different pests within an IPM approach
- Understand that different pesticides attack pests in different ways and that these differences require that pesticides are used according to the directions on the label
- Calculate economic cost benefit of pesticide applications
- Understand the Ethiopian legislation and regulations and that pesticides must be applied according to the Ethiopian and in case of export as well international legislation and regulations

To fulfill the objective of module 1 the following topics have to be covered:

1. What are pesticides	Chemicals to control of pests is one of the many – and the least desirable – way to suppress pests by the use of mostly toxic substances. Introduction to various ways of classifying pesticides and modes of action. Definition of a pesticide.
2. Different types of pesticides	Types of pesticides are e.g. fungicides, insecticides, nematocides, acaricides, and herbicides. Some pesticides belong to more than one category as the active ingredient controls more than one group of organisms.
3. Chemical classification of pesticides	Main groups, being inorganic (mostly very toxic and very persistent) and organic. Examples of the different inorganic and organic pesticides.
4. Nomenclature of pesticides	- Chemical name - Common name (sometimes identical to chemical name): active ingredient (AI) - Trade name (may differ per country, per company selling, per formulation)

5. Modes of action of pesticides	Different classifications can be made in relation to the mode of action such as translocation or not translocation in the plant, or related to the way of uptake. In the latter case distinguish the route through which the pest will absorb the pesticide is distinguished, e.g. insects where the pesticide is effective in the organism or whether it prevents the pest or cures the pest as is applicable with fungi
6. Formulation of pesticides	<p>Active ingredients of pesticides are complemented with inert ingredients with specific purposes in order to facilitate the application and to improve their effectiveness. The different formulations have their advantages and disadvantages.</p> <p>The inert ingredients are: solvents, sticking agents, carriers, spreaders, emulsifiers, humectants (to delay evaporation), synergists or activators, colouring agent</p> <p>The following formulations with its advantages and disadvantages, including the toxicity variation in relation to the formulation, are reviewed: wettable powders, water soluble powders, dusts, granulates, liquids, emulsifiable concentrates, fumigants, emulsions (water in oil or oil in water), smoke generation, baits</p>
7. Toxicity of pesticides	<p>Toxicity in relation to the following topics</p> <ul style="list-style-type: none"> - Occupational health Issues like acute (LD50 and WHO classification of hazard levels) and chronic toxicity to the applicator and how it is measured, entry routes into man's body (oral, dermal, inhalation), re-entry intervals - Public health Issues like exposure for local residents, food safety & maximum residue levels (MRLs) - Pollinating insects and beneficials for biological control Effects of pesticides on bees and beneficial insects for biological control, the use of selective pesticides and their availability and other ways to avoid negative effects of pesticides on pollinators and other beneficial organisms - Environmental impact Risks of pesticides for non-target organisms, wildlife, aquatic life and ways to diminish these risks
8. Advantages and disadvantages of pesticides	<p>List the advantages and disadvantages and risks of pesticides as dealt with in the module earlier:</p> <ul style="list-style-type: none"> - Side effects - Protection of the environment - Pest resistance development - Resurgence of pests - Public health - Occupational health: applicator protection - Advisory
9. Short overview of preventive and IPM measures to control pests	Some practical examples of preventive and Integrated Pest Management control measures in Ethiopia
10. Ethiopian pesticide legislation and regulations	<ul style="list-style-type: none"> - Topics within the Ethiopian legislation and regulations that are relevant and have to be followed when applying pesticides - Ethiopian classification system of pesticides according to acute toxicity - Information that has to be on the label, such as: <ul style="list-style-type: none"> o Trade name o Active ingredient (a.i.)

	<ul style="list-style-type: none"> ○ Concentration of a.i. ○ Type of formulation ○ Net contents of the package ○ Registration number ○ Name and address of manufacturer, distributor and/or formulator ○ Specifications on its registered use: <ul style="list-style-type: none"> ✓ pests ✓ crop, ✓ formulation and how it should be applied ✓ dosage ✓ where the pesticide should be applied ✓ when it should be applied ○ Pre-harvest interval ○ Warnings on toxicity (WHO and/or national classification) ○ Symbols on its acute toxicity ○ Hazards to humans and domestic animals ○ Environmental hazards ○ Other hazards (fire, explosion) ○ First aid procedures ○ Re-entry of the crop ○ Storage and disposal directions ○ Misuse statement (violation of national laws for the use)
11. Short overview of main topics of international pesticide legislation and regulations in relation to the Ethiopian legislation and regulations	<p>Short explanation of the European pesticide regulations as relevant when exporting agricultural produce to EU, compared to the Ethiopian requirements,</p> <ul style="list-style-type: none"> - the FAO code of conduct on distribution and use of pesticides - Good Agricultural Practices

5.4.2 Module 2: Safe use and application of pesticides

This module aims to understand and develop practical skills of safe and judicious pesticide application in order to increase the effectiveness of the applications and to avoid the various negative effects of pesticides as discussed in Module 1, such as effects on:

- Occupational health
- Public health
- Resistance development and pest resurgence
- Beneficials such as pollinating organisms and biological control agents
- The environment

To fulfil the objective of module 2 the following topics have to be covered:

1. Understanding and applying the information on the label	<ul style="list-style-type: none"> - Information on a label and why this is important - When and why the label has to be read and understood - The applicator or the advisor has to be able to apply the label information to the use of any type pesticide
2. Types of application equipment	<p>Overview of pesticide application equipment in use in Ethiopia and their advantages and disadvantages and considerations of choosing application equipment.</p> <p>Equipment such as: dusters, knapsack sprayers, compression sprayers, spinning disc sprayers, mist blowers, lance sprayers, maintenance of spray equipment</p> <p>Types of pesticides that can be used in the different types of application equipment</p> <p>Maintenance of the equipment</p>

<p>3. Safety precautions and personal protection</p>	<ul style="list-style-type: none"> - Protective clothing - Safety precautions - Filling and mixing of pesticides <ul style="list-style-type: none"> • How, when, and where to mix concentrations of pesticides • Importance of protecting the environment from spills and the safety measures that should be taken • Compatibility of pesticides - Storage of pesticides <ul style="list-style-type: none"> • Choice and arrangement of a storage area for pesticides • Handling, storing, and disposing of pesticides properly • What to do in case of a pesticide spill - Disposal and pesticide waste <ul style="list-style-type: none"> • Preventing pesticide surplus. • What to do in case there is a pesticide surplus. • Steps to be taken to properly dispose of pesticide containers. • Procedure for triple-rinsing containers and equipment - Record keeping <ul style="list-style-type: none"> • Usefulness of pesticide application records • When and how to fill out record sheets. • Importance of standard forms - Symptoms of pesticide poisoning - Crop re-entry interval
<p>4. Calibration and maintenance of application equipment</p>	<ul style="list-style-type: none"> - When to calibrate - Different methods of calibration related to the formulation and/or spray equipment - Calculations related to calibration - Maintenance procedures
<p>5. Calculation of dosage</p>	<ul style="list-style-type: none"> - Preparing different types of dosage recommendations - Calculations for these dosage recommendations - Supporting worksheet
<p>6. Selection of nozzles</p>	<ul style="list-style-type: none"> - Different functions of a spray nozzle - Different types of nozzles and their spray patterns - Nozzle materials - Maintenance of nozzles
<p>7. Weather wise application</p>	<ul style="list-style-type: none"> - The role that weather conditions can play in both helping and hindering the applicator. - The hazards of windy day application and who is legally responsible for mistakes. - The advantages of early morning or evening application. - The roles of humidity and temperature inversion in regard to pesticide application
<p>8. First aid for pesticide poisoning</p>	<ul style="list-style-type: none"> - Signs of pesticide poisoning and the first aid treatment for it. - Pesticide first aid kit and its content. - Various types of poisoning and what to do and/or not to do
<p>9. Ecological and Environmental Considerations</p>	<ul style="list-style-type: none"> - The dangers of pesticides in the environment and what causes them. - How pesticides pollute groundwater and what steps can be taken to prevent it (e.g. drift issues). - How pesticides persist in the environment.
<p>10. Prevention and Management of Pesticide Resistance</p>	<ul style="list-style-type: none"> - Key factors in resistance development - Strategies to prevent resistance development (such as mixtures and rotation of pesticides with different modes of action and/or alternative control methods under IPM)

5.4.3 Module 3: Advanced principles Integrated Pest Management

This module will aims to develop skills for an integrated approach to pest management in order to reduce the use of pesticides and limit the impact on environment and public health. This module includes the following topics:

- The principles of IPM
- The role of pesticides in IPM
- How to apply IPM programme for specific crops
- How to work with farmers in farmers field schools

To fulfill the objective of module 3 the following topics have to be covered:

1. Introduction to IPM and crop protection plan	<ul style="list-style-type: none"> - What is IPM and its basic principles - Motivation for IPM - Link between IPM and GAP - Prevention of pests and diseases - Reducing environmental impact of crop protection practices - Contents of crop protection plan
2. Scouting and monitoring	<ul style="list-style-type: none"> - Why and how? - Important aspects/ methodical approach - Scouting and monitoring in relation to beneficials - Scouting aids - Registration of data
3. Non-chemical control of pests and diseases	<ul style="list-style-type: none"> - Use of bio agents or biological products - Inputs of natural enemies / predators - Input of natural enemies / parasites - Biological control and selective use of pesticides - Sterile insects techniques - Others (e.g. cultural measures, trapping)
4. Pesticides in IPM	<ul style="list-style-type: none"> - Toxicity of pesticides and WHO classification - Selective use of pesticides in GAP & IPM - Pesticide use, residues and international markets
5. Main Crop Pests and their Control	<ul style="list-style-type: none"> - Identification - Life cycle - Damage symptoms - Damage ≠ loss - Non-chemical control and chemical control in IPM - Control practices by farmers and strategies on how to advise farmers on (new) practical IPM approaches - Physiological disorders (e.g. blossom end rot, sunscald)
6. Design of an IPM strategy for a specific crop	<ul style="list-style-type: none"> - Writing an advice for farmers for an IPM strategy for a specific crop and its main pests
7. IPM and dissemination	<ul style="list-style-type: none"> - The principles of dissemination of knowledge; - Farmer Field Schools - Field practice

6 Curriculum outline University

6.1 Introduction

While the traditional focus for pest management and the use of pesticides is within the domain of the crop sciences at universities, the needs assessment clearly identifies other fields of study where knowledge of pesticides is crucial. The following studies were identified:

- Agriculture – crop sciences
- Agriculture – livestock sciences
- Environmental sciences
- Medical schools
- Public health
- Chemistry
- Business & marketing

Each of these degree programmes will produce graduates whereby, on entering the labour market, some or all will end up in jobs that deal with pesticides. Based on these possible occupations and the required competences, the learning objectives and curriculum outlines are described below. It should be noted however that, since the main focus of pesticide use lies in the domain of the crop sciences, the curriculum outline for crop related courses is more extensive than for the other degree programmes. For these other degree programmes a basic curriculum framework is described.

The outlined curriculum is based on the advice from the stakeholder workshop that the entry point for pesticide management is the agriculture system with emphasis on IPM supported by clear elements in the curriculum on pesticide management as a topic by itself.

6.2 Curriculum structure

During the validation workshop the curriculum structure for a specialised BSc paying sufficient attention to the issue of pesticide management was proposed. Two options were discussed, for the first option pesticide management was the main topic of the curriculum with as a minor topic IPM. For the second option agricultural systems with an emphasis on IPM would be the leading topic followed by pesticide management. Those present at the validation workshop all supported the second option as depicted in Figure 6.1.

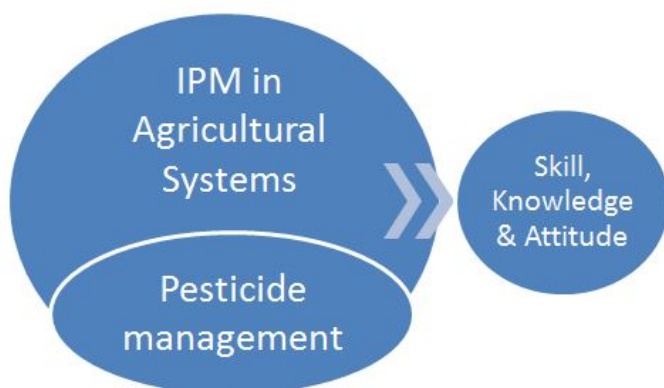


Figure 6.1 Proposed structure of course on “Pesticide management within agricultural systems with emphasis on IPM”

6.3 Learning objectives and core competences

The course provides a general introduction to agricultural systems and introduces the knowledge, skills and practices of IPM, the fundamental knowledge to prevent and control pests and effective and safe use of pesticides, while having the least impact on human and the environment.

Competencies (need to know):

- Ecological principles
- The IPM concept
- Basic knowledge about all pest groups
- Management methods for IPM programs
- Monitoring methods and decision making processes
- Setting up monitoring programs and field trials
- Health and environmental concerns
- How to set up an IPM program for economically important crops

Practical aspects, students learn how to

- Solve problems using the
 - Pest management models
 - Degree day programs
 - Pest identification tools
 - Environmental assessment tools
- Scouting exercise: field survey techniques such as trap construction and field setting, proper use of scouting equipment and field test
- Work with pesticides

Graduates are required to be devoted to sound pesticide use and management in field of agriculture and environment management. The following competencies are important in the successful performance of the graduate:

Technical:

- Demonstrated professional and technical competencies in pesticide management

Teamwork:

- Demonstrated ability to build strong relationships with peers, and colleagues
- Able to effectively plan, implement, and evaluate programs in pesticide management
- Demonstrated ability to work with people, cooperate as a team member, and communicate effectively
- Must show evidence of superior knowledge and skill related to pesticide management

Personal:

- Demonstrated ability to effectively set, plan and manage multiple priorities, establish goals and standards for performance, and organize work effectively, a commitment that supports continuous learning and professional development.

Action-Orientation:

- Demonstrated ability to effect and implement change, and respond positively and productively to change in the work places.

Development of Others:

- Demonstrated ability to train and mentor others (development agents and the public) effectively and appropriately in tasks related to pesticide use, handling, transporting and storage and all other management aspects

6.4 Course topics for Bachelor of Science (BSc) programmes

For a BSc programme on “Pesticide Management in Agricultural systems with emphasis on IPM”, the following complement of courses (including international credit) is proposed:

Course	Content	ECS
1. Crop health management	<ul style="list-style-type: none"> - Introduction to agricultural production system - Introduction to plant pathology - Introduction to weed science - Introduction to invertebrate and vertebrate pest management 	6
2. Introduction to principles of soil science		6
3. Introduction to principles of plant propagation		6
4. Introduction to agro-ecology		3
5. Pest management systems	<ul style="list-style-type: none"> - Plant pest diagnosis and identification - Concepts in Integrated Pest Management(IPM) - Introduction to biological control - Pesticides in IPM - Integration of chemicals and bio-control - Sustainability and agro-ecosystem management 	6
6. Safety standards in agricultural value chain	<ul style="list-style-type: none"> - Private and regulatory standards at global and national level 	3
7. Introduction to pesticides	<ul style="list-style-type: none"> - Definition - Pesticide chemistry - Evolution of pesticides - Types - Uses - Manufacturing process - Benefits and Risks - Pesticides and selectivity - Toxicity - Mode of action - Pesticide resistance & resurgence management - Quality control and management - Alternatives - Risk mitigation 	6
8. Pesticide impact on Human Health	<ul style="list-style-type: none"> - General principles of toxicology - Dietary exposure - Occupational exposure - Residential exposure - Risk Assessment - Human health risk management 	6
9. Pesticide impact on environment	<p>Water</p> <ul style="list-style-type: none"> - Cycling of water in the environment - The introduction of pesticides in the water cycle - Water quality in relation to pesticides <p>Soil</p> <ul style="list-style-type: none"> - The introduction of pesticides in the soil ecosystem - Soil quality in relation to pesticides <p>Air</p> <ul style="list-style-type: none"> - Drift <p>Non-target organisms</p> <ul style="list-style-type: none"> - Beneficial insects - Pollinators - Wildlife <p>Environmental risk assessment and management</p>	12
10. Pesticide policy, governance & enforcement	<ul style="list-style-type: none"> - Regulations <ul style="list-style-type: none"> o International 	6

	<ul style="list-style-type: none"> o Ethiopian - Policy and user responsibility - Managing the facilities - Pesticide related emergencies: planning, preventing and reacting to emergencies in the workplace - Hazardous Chemicals 	
11. Product development & registration	<ul style="list-style-type: none"> - Manufacture's product development and commercialization process - Registration 	3
12. Handling and using pesticide in agriculture and workplaces	<ul style="list-style-type: none"> - Pesticide selection - Transporting - Storage and management - Applications - Management practices for disposal and waste management - Spraying equipment and maintenance - Personal protective equipment (PPE) - Users commitments to pesticide safety 	6
13. Pesticide emergency management	<ul style="list-style-type: none"> - Types of possible emergencies - Planning for unforeseen risks - Hazard assessment - Use of fire extinguisher & first aid kits - Emergence response plan - The art of risk communication - Elective courses 	3
14. Introduction to pesticide chemistry and toxicity	<ul style="list-style-type: none"> - Major chemical aspects of pesticides giving detailed descriptions of the various groups of pesticides currently in use and their chemistry and toxicity 	6
15. Pesticide chemical residue and the (international) agriculture value chain	<ul style="list-style-type: none"> - Minimum Residue Levels and the (international) food safety standards and systems 	6
16. Others (elective courses)		6
17. Seminar	<ul style="list-style-type: none"> - Series on pesticide management & IPM 	3
18. Internship		12

The programme needs to cover a minimum of 108 (Ethiopian) credit hours (x 1,5 for international credit hours)

Apart from a specialised BSc programme on “Pesticide Management in Agricultural systems with emphasis on IPM” it is proposed that other regular programmes update their curriculum regarding the pesticide life cycle and incorporate more specialised courses that are relevant to the specific specialisation in their curriculum. The table below shows the proposed courses.

	Agricultural (crop) sciences	Agricultural (Livestock) Sciences*	Environmental Sciences	Chemistry	Medical schools	Public health**	Business & Marketing	ECS
Pest management systems	√	√				√		6
Safety standards in agricultural value chain	√	√					√	6
Introduction to pesticides	√	√	√	√	√	√	√	6
Pesticide impact on Human Health	√	√			√	√	√	6
Pesticide impact on environment	√	√	√	√			√	12
Pesticide policy and governance	√	√	√				√	6
Product development & registration							√	3
Handling and using pesticide in agriculture and workplaces	√	√			√	√		6
Pesticide emergency management			√		√	√		3
Introduction to pesticide chemistry and toxicity			√	√	√	√		6
Pesticide chemical residue and agriculture value chain	√	√					√	6
Additional courses								
Integrated veterinary management		√						6
Pesticide impact on animal Health		√						6
Symptoms & treatments of pesticide poisoning					√	√		6
Management of vector borne diseases		√				√		6

6.5 Master of Science (MSc)

Based on the needs assessment it was apparent that the need for incorporating knowledge on the pesticide life cycle in the BSc programme had a larger priority than the relevant MSc programmes. As such the curriculum for the pesticide life cycle at MSc is not described here. Additionally MSc courses are far more specialised than BSc courses and as such a generic curriculum at MSc level is difficult to describe. With regards to specialised MSc programmes the following suggestion was made during the stakeholder workshop:

“Establish a (MSc) programme dedicated to plant health which incorporates pesticide management”.

Other developments that will cater for the pesticide management aspects at MSc level are for instance the MSc on crop protection, which is currently being developed at Mekelle University.

At Cape Town University, School of Public Health and Family Medicine, Faculty of Health Sciences, there is a very specific postgraduate diploma in pesticide risk management. The diploma is aimed at those working in Africa for the pesticide registration authority in their respective countries. This programme (see Annex 2), which is structured around the International Code of Conduct on Pesticide Management, is a distance-learning programme with a small component of in residence training. This curriculum will also suit the needs of those working in pesticide registration in Ethiopia.

7 Recommendations

7.1 Recommendations ATVET Level

- To effectively incorporate pesticide management in ATVET education there are several options:
 - A. Make minor amendments to the Occupational Standards as proposed (see detailed suggestions in Annex 4);
 - B. Replace the Occupational Standards with alternative standards which put more emphasis on the integration of pest management and pesticide management. The proposed modules can be incorporated at the relevant levels as follows:

<u>Module</u>	<u>Proposed Level</u>
1) Introduction to pesticides	Level II
2) Safe use and application of pesticides	Level III
3) Advanced principles Integrated Pest Management	Level IV

- C. Offer the modules above as a short course training;
 - D. A combination of A & C;
 - E. Translate the content of the Occupational Standards into a clear curriculum and courses that makes it easy to apply for teachers at the ATVETs and that addresses the competences that are required for graduates of the ATVETs.
- Amendments made to the occupational standards, or replacement with alternatives should be done in close consultation with the Occupational Standards committee and stakeholders involved;
 - Current (and future) curricula development are based on and guided by the available Occupational Standards. Therefore the Occupational Standards should be prepared in a uniform manner and should be updated regular to in accordance with changes in the situation in practice;
 - Propose to the MoA introduction of spraying licenses in first instance for professional contract sprayer. This system should be supported by a relevant training structure.

7.2 Recommendations University Level

- Propose the idea of a BSc "Pesticide Management in Agricultural systems with emphasis on IPM" to the relevant universities;
- If the full BSc programme does not fit the ambition of the university, advise that they include pesticide management courses the relevant programmes;
- Organise a one day workshop with all relevant university faculties to present the proposed curriculum;
- Universities should take more into consideration the needs from the situation in practice and should link theory with practice.

7.3 General Recommendations

- A curriculum should aim at preparing students for the labour market and society;
- Learning goals should address what a student should be able to do after graduating (thus skills and not only on knowing and understanding);
- Learning activities and assessments should focus on demonstrating professional competence
- Practical teaching methods and 'on the job' training is important for making the linkage between theory and practice and need to be incorporated in the various curricula;
- Teaching method should be a blend of theory, problem solving and application;
- A training of trainers (ToT) specifically for teachers at ATVET colleges should be designed and executed;
- Development Agents need continuous training to update their skills, knowledge and attitudes. A programme to support this with specific reference to pesticide management should be designed and implemented;
- The domain of pesticide management and pesticide life cycle is with the MoA while the domain of curriculum development for universities lies with the MoE. It is proposed that a meeting between relevant staff from both ministries take place to discuss proposed curriculum;
- Future developments:
 - An EKN funded programme on smallholder horticulture will start soon. This programme puts a large emphasis on capacity development. Some of the suggestion in this report can be taken up by this programme;
 - Kenya has a training programme for BASIS training as is given in other countries like the UK. A exposure visit to this particular programme will give a good foundation if a license system is considered.

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Annex 1 Historical perspectives of pesticide use in Ethiopia

1975- 1995	1995-2005	2006-2010	2011 - ...
<ul style="list-style-type: none"> - Outbreak of coffee berry diseases- use of fungicides - CADU and WADU- latter EPID agricultural development programs promoted use pesticide by farmers (such as herbicides) use - Start of state farms – enhanced import of pesticides - Establishment of Desert locust eradication project - Malaria irradiation program started – use of DDT - AdamiTullu pesticide mixing and production plant established - Proclamation of crop protection - Ethiopian crop protection society - USAID sent experts on obsolete pesticide management - More agricultural research centres, colleges and universities established 	<ul style="list-style-type: none"> - Floriculture started - Private Pesticide trade association established - MOA requested USAID to related to disposal of Obsolete pesticides - Obsolete pesticide projects 	<ul style="list-style-type: none"> - Proclamation on pesticides - Disposal of 300 tons of obsolete pesticides from Ethiopia - Establishment of plant health clinics - IPM introduced into Ethiopian floriculture - Pesticide residue laboratory established - Detection of pesticide residue Ethiopian coffee sent Japanese market? 	<ul style="list-style-type: none"> - Pesticide registration and control (pro. 674/2010) - Organochlorines still not completely disposed - Code of practices on sustainable use of pesticides and also endorsed by the government as regulation - IPM workshop by the private sector - Workshop on Responsible and safe pesticide management - PRRP project - Ecologically pesticide control projects initiated

Annex 2 Pesticide education in the Netherlands, UK and South Africa

In the Netherlands the education on pesticide management at university level is mostly integrated in plant sciences programmes and focuses on methods of pest management for prevention of pest, disease and weeds with an emphasis on environmentally sound and safe methods of pest control and integrated pest management (IPM) approaches. Besides chemical control of pests and diseases also topics of biological control, biotechnology for pest control, food web interactions, cultural control and plant breeding for resistance are covered.

At higher agricultural education level the education on pesticide management covers more practical topics of sustainability, crop protection, environmental and health impact, policies and legislation, integrated pest management, biological control and development of a crop protection plan.

In this regard the education on pesticide management at university and higher education level in the Netherlands is focused more on the alternative methods of crop protection and less on chemical control. Some pesticide related topics are also part of environmental sciences and food sciences programs (e.g. toxicology, environmental pollution, food safety).

At vocational level the education on pesticide management is much focused on the application of crop protection chemicals and training for obtaining mandatory licences that authorize users to work with pesticides on a professional basis (see Box below).

Box: Spraying licenses in The Netherlands

License 1: Applying of crop protection chemicals

Mandatory for employees of companies or self-employed person who work with pesticides on a professional basis

Topics:

- Safe working conditions (storage of chemicals and personal protective equipment)
- Recognition of pests, diseases and weeds
- General background on diseases, pests and weeds
- Technology (equipment and nozzles)
- Read and interpret label
- Plant protection products (formulation and understanding function of all additives)
- Crop protection methods
- Government policies

License 2: Business involved in crop protection chemicals

License can only be obtained if in possession of license 1. Mandatory for managers and owners of companies, agricultural contract workers ('loonwerker'), private extension or advisors who work with or provide advice on pesticides on a professional basis

Topics:

- Crop protection methods (advanced)
- Crop protection plan
- Safety (advanced, legislation and accountability)
- Technology (advanced)
- Prepare spray equipment for inspection and the corresponding legislation
- Background on diseases, pests and weeds (advanced)
- Abiotic factors & environment

License 3: Trade & distribution of crop protection chemicals

Mandatory for all persons who have a storage of crop protection chemicals of more than 2500kg and for people who trade in pesticides intended for professional use

Topics:

- Government policies
- Storage of pesticides (theory and practice)
- Transport of pesticides (theory and practice)
- Emergency plan
- Certificate distribution of plant protection products
- Directive storage of packed dangerous goods

With regard to licenses, in the UK also those advising on the use of pesticides needs a certificate, the BASIS qualification (see: <http://www.basis-reg.co.uk/>).

At Cape Town University, School of Public Health and Family Medicine, Faculty of Health Sciences, there is a very specific postgraduate diploma in pesticide risk management. This programme is aimed at those working in Africa for the pesticide registration authority in their respective countries. This programme, which is structured along s structured around the International Code of Conduct on Pesticide Management, is a distance-learning programme with a small component of in residence training. The courses of the program are the following:

Programme Content Pesticide Risk Management⁵

Core Courses:

- Pesticide Risk Management
- Health and Safety Management
- Management of Environmental Risk
- Alternatives and Risk Reduction Strategies

Elective Courses:

- Containers & Contaminated Site Management
- Chemical Conventions
- Public Health and Pesticides
- Obsolete Pesticide Management

⁵http://www.publichealth.uct.ac.za/students/students_pg_dprm.php

Annex 3 Needs Assessment Method

The following steps were followed:

1.1 Mapping the network of actors in the context of pesticide management/use that included: educators and researchers (departments of agriculture, ecology, natural resources, water resources, plant protection, soil sciences, and others), suppliers/importers and traders, private commercial users, service providers and agricultural offices (department for input supply and extension), Ethiopian society for crop protections, EHPEA (IPM team and training unit), EAIR crop director, Ethiopian Quality Assurance, Agri-sher, Horn of Africa, public water supply offices, others, guided by issues related to the life cycle of pesticides(van den Berg et al., 2011):

- production and import (complemented by documents on legislation and statistics)
- registration (legislation, enforcement, institutional arrangements, guidelines, quality control, labelling, etc.),
- procurement(institutional arrangements, quality control)
- transportation and storage
- use (policy, code of practices, training, safety, public awareness, etc.)
- disposal(legislation, guidelines, etc.)
- here the focus is to identify the relative priority of different educational and community needs emphasizing about how existing pest management practices might be better co-ordinate and more efficient through training and further interventions... and other relevant actors
- "What do we know?"
- current state of pesticide management?
- new developments and issues regarding the pesticide management and related practices and field?
- important interventions focusing on training and research

Note: crosscutting issues such prevention and disposal of obsolete stocks, remediation of pesticide contaminated soils, pesticide stock management, support to pesticide quality control, pesticide residue monitoring, capacity building on various aspects of pesticide management and regulation, integrated pest management, pesticide risk reduction, related code of practices and policy related issues were considered as references for the interview and discussion with respondents.

1.2 Description of practices in the real world: direct observations of specific examples/cases to identify the competencies and illustrate how the competencies required can be applied to tasks as they are performed in their natural setting (focusing on pesticide management in commercial horticulture such as floriculture, and small holders agriculture and other areas of use).

- collect data by observing people performing tasks related to pesticide management across value chain such as suppliers, traders and users (focusing on practices of local manufacturers, whole sellers, retailers, commercial farms and small holders or the whole pesticide life cycle from registration and procurement, import/local manufacture of pesticides, to distribution, use and monitoring, including quality control and waste management)
- mainly by targeting farmers(small holders) and managers and supervisors of spray operators in commercial farms to get understanding of what is involved in the pesticide use and the environmental and safety related issues.
- generate information of local practices using the following check lists focusing on some pesticides widely used in agriculture typically in areas of contemporary concern such as close to water bodies (lakes and rivers(irrigated commercial farms around lakes Ziway and Bahir Dar and river Awash can be potential targets):
 - how pesticides are used and regulated
 - pesticide safety
 - the Approval Process
 - independent expert assessment
 - label & Advice
 - how to people interpret and use label information
 - communication on Hazard signs (Risk Classification symbols)

- product label
- precautionary phrases
- environmental Information Sheets (EIS)
- formulation
- emphasis on the practical implications for Operators/Managers:
- types of formulation
- ingredients and their hazards
- safety effects
- active ingredients & product names
- strength of product
- compatibility of products
- legal aspects of tank mixing
- Understanding how

Pesticides work

- pesticide types
- e.g. Herbicides
- chemical mobility in soil
- buffer zones
- persistent / non persistent
- protectant / eradicant
- selective /non selective
- others

This approach will provide additional information on the types of pesticides, and local management aspects.

1.3 Next, discussions with focus groups to identify specific job duties (colleges and universities):

- focusing on the relations between the intended program and programs which already existed at the universities and colleges.

1.4 Based on the feedback from the network analysis (2.1) and practice in the real setting (2.2) , and the job description provided by the PRRP project, data will be collected through further interviews and focus group discussions with the key actors in the network focusing on the following key points (Kern et al., 2010):

- a specific problem and the need for improvement
- goals and specific measurable objectives (with competencies bridging the gap between existing roles and setting expectations about graduates role)
- a needs of learners that may represent the target learners(students in related training they are taking courses associated with pesticides management)- focus on courses related to pesticide management and use in universities and colleges applying competencies to the curricula (implementation)- (Addis Ababa, Haromaya, Hawassa, Mekelle, Bahir Dar and Ambo universities and Holleta, Ardayita-ATEVET will be possible targets)
- evaluation and feedback that include evolving concepts
- what are the existing constraints (local and beyond...) and resources (time and finance focusing on training)
- needs to be addressed through educational innervations?
- further questions and the need for additional research

1.5 Review of relevant documents to determine which parts of the existing curricula is covering the intended field of and also to identify gaps that needed to be filled and document reviews help reduce redundant effort and provide background information into how others have approached similar design efforts

1.6 The requirements for certification by Ethiopian Quality Assurance Agency and universities (including the education system and weight of courses and accreditation procedures) to align the new curricula with the national standards (Ministry of education, quality assurance agency, and universities):

- body of knowledge required
- applicability sufficient to support a the practice
- generate new information and research

-
- require a minimum training period of years
 - have a minimum number of trainees and training programs nationwide

1.7 After, a general understanding was gained related to issues and concerns in pesticide management and use in practice, further, a questionnaire will be developed to collect data to determine/verify (key actors identified in sections 2.1 and 2.2 were involved):

- if sufficient need exists in the key sectors to justify implementing a program
- the salary levels of graduates/technicians to make certain the field would be desirable to incoming students, and
- the level of education required (TEVET and above)
- the type of trainees to be involved,
- the tasks they must do and learn,
- others

Annex 4 Pesticide competences in Occupational Standards

Field Crops Production Level II – pesticide related competences as described under the header “evidences”

	Unit title ->	Operate specialized machinery and equipment *	Assist Preparation of Organic Fertilizer	Assist Field Crops Establishment	Assist crop maintenance **	Establish horticulture crops, Stimulates and Spice crops	Treat pests (weed, insect, disease and disorders)	Apply Chemicals under Supervision	Assist field crop harvesting and prepare grain storage	Observe and Report on Weather
	Unit code ->	AGR CRP2 03 1213	AGR CRP2 04 1213	AGR CRP2 05 1213	AGR CRP2 06 1213	AGR CRP2 09 1213	AGR CRP2 18 1213	AGR CRP2 19 1213	AGR CRP2 20 1213	AGR CRP2 26 1213
Pesticide related topic										
Demonstrate operating principles and operating methods for machinery and equipment.		x								
Apply procedures for cleaning, securing and storing machinery, equipment and materials.		x								
Crop protection						x				
Calibrate equipment				x					x	
Measure and calculate volumes, consumption and servicing requirements.		x							x	
Plan and organize activities involving maintenance and repairs to machinery and equipment		x								
Measure quantities of treatment				x						
Safely apply appropriate agricultural chemicals				x					x	
Identify hazards in			x							

handling raw (for composting i.e. pesticides) materials and implement risk control measures										
Selection, use and maintenance of relevant personal protective clothing and equipment		x			x					
OHS hazards are identified					x					
Signs of diseases and pests are recognised					x					
Crop control programme					x					
Relate forecasts to impact on current operations and activities relate weather and climate conditions and changes to decision-making and prevention of loss and damage										x
Safely and appropriate disposal of containers, leftover fluids, waste and debris					x					
Principles of sustainable horticultural practices						x				
Importance of field hygiene and quality control in regard to crop establishment						x				
Legislation, regulations and Codes of Practice with regard to workplace OHS, and the use and control of hazardous substances.		x								

* but no direct reference made to pesticide equipment; ** no evidences were provided for this unit

Annex 5 Proposed amendments to Occupational Standards level II, III and IV Field Crops

Level II

Proposed changes are given as:

Bold – addition

~~Strikethrough~~ – delete

Highlight – exact meaning of this section not clear

Treat pests (weed, insect , disease and disorders)

[AGR CRP2 18 1213](#)

Evidence Guide

Critical Aspects of Competence

Demonstrate skills and knowledge competence to:

- Identify common plant pests, diseases, weeds and disorders
- Apply different types of control measures and their principles, **also relation to IPM principles with pesticides as a last resort**
- **Different types of pesticides and basics of their chemical classifications**
- **Pesticide legislation, including** OHS legislative requirements and Codes of Practice
- Wear personal protective equipment appropriate to task
- **General aspects of life cycles of insect pests and diseases and weed growth characteristics**
- Modes of action of different chemicals
- **Different types** of equipment **and their** capability and limitations
- ~~Legislation relation to the use of chemicals for weed control~~
- ~~Occupational Health and Safety responsibilities employees and legislative requirements and associated hazardous substances regulations~~

Underpinning Knowledge and Attitudes

Demonstrate knowledge of:

- Recognition of common plant pests, diseases, weeds and disorders for a particular enterprise/situation.
- Different types of control measures and their principles.
- **Basic aspects of IPM and the relation with chemical control**
- **General advantages and disadvantages of pesticides**
- Modes of action of different chemicals.
- **Toxicity classes of pesticides and examples.**
- **Ethiopian** legislation in relation to the use of chemicals for plant pest, disease, weed and disorder control.
- **Introduction to the EU legislation and regulations (e.g. MRLs)**
- OHS **legislative requirements and codes of practice and consequent** responsibilities of employees. (move to Chemicals under supervision)
- Environmental considerations and precautions when using chemicals for plant pest, disease, weed and disorder control.
- ~~OHS legislative requirements and Codes of Practice.~~
- Correct wearing/fit of personal protective equipment and its cleaning after use.

Underpinning Skills	<p>Demonstrate skills to:</p> <ul style="list-style-type: none"> • Read and interpret chemical labels, Material Safety Data and toxicity class into safe and correct application practices • Sheets (MSDS), manufacturers specifications for setting up equipment, and maintain spray records <ul style="list-style-type: none"> • Prepare to treat plant pests, weeds and diseases. • Apply plant pest, disease, weed and disorder treatments. • Carry out post treatment operations. • Wear personal protective equipment appropriate to task. • Communicate ideas and information relating to applying plant pest, disease, weed and disorder treatments • Collect, analyze and organize information by inspecting the plant pest or disease, weed and the information gained • Consult, interpret and apply enterprise work procedures and control programs • Ask for clarification from the supervisor where necessary. • Plan and organize equipment, materials and work procedures for applying treatments • Work with others and in teams • Use mathematical ideas in relation to calculate dosages based on application rates, and areas, and application techniques • Solve problems in cases of machinery malfunctions or chemical spillage. • Use appropriate practices technology in the preparation, use and maintenance of spray equipment.
Resources Implication	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> • Access is required to real or appropriately simulated situations, including work areas, materials and equipment, • Documentation and information on <u>pesticides</u>, workplace practices and OHS practices. • Specifications and work instructions
Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> • Interview / Written Test / Oral Questioning • Observation / Demonstration
Context of Assessment	<p>Competency may be assessed in the work place or in a simulated work place setting</p>

Apply Chemicals under Supervision

AGR CRP2 19 1213

Evidence Guide

Critical Aspects of Competence	<p>A candidate must be able to demonstrate the ability to :</p> <ul style="list-style-type: none"> • use the correct equipment, • apply the chemical correctly, • record application, • identify safety hazards and how to avoid them, • interpret and follow directions • Work using a variety of chemical application tools and pieces of equipment • Respond to emergencies and apply first aid in the event of pesticide poisoning • Communicate ideas and information about chemicals and how they will be applied and recorded
Underpinning Knowledge and Attitudes	<p>Demonstrates knowledge of:</p> <ul style="list-style-type: none"> • Environmental effects of selected chemicals and how to minimize damaging effects of chemicals. • Different broad chemical types, e.g., insecticides, herbicides and fungicides and their mode of action symbols on the label. • Principles of Integrated Pest Management.

	<ul style="list-style-type: none"> • Paths of entry of poisons into the body and methods of limiting exposure. • Methods of minimizing risk during application. • Personal protective equipment and how, when and why it should be used and stored. • Maintenance of personal protective equipment. • Relevant Ethiopian legislation, regulations and Codes of Practices with regard to hazardous substances or the use of chemicals. • In relation to previous point, differences with EU legislation/regulations • Occupational Health and Safety concerning personal safety and safety of others in the workplace. • Use of chemicals as one tool (and a last resort within IPM) of pest management. • Possible effects on health of bystanders/public in addition to applicators. • Weather conditions and means of assessing them in line with risks, and recognizing when they become unsuitable for application to continue. • Correct wearing/fit of personal protective equipment.
Underpinning Skills	<p>Skills include the ability to:</p> <ul style="list-style-type: none"> • Accurately interpret labels, translate these to application techniques, correct measuring of dosages and record relevant information and measure application amounts • Work using a variety of chemical application tools and pieces of equipment that are suitable for the particular application task using safe and environmentally responsible work practices. • Respond to emergencies and apply first aid in the event of pesticide poisoning • Communicate and demonstrate ideas and information about chemicals and how they will be applied and recorded • Collect, analyzing and organize information from chemical labels, MSDSs, operators manuals or from Codes of Practice and advisory materials outlining regulations relevant to chemical use. • Plan and organize activities such as recognizing and using equipment, application and cleaning up of chemicals • Use mathematical ideas and techniques to apply, recording information and working out time periods before work can continue in the area.
Resources Implication	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> • Access is required to real or appropriately simulated situations, including work areas, materials and equipment, • Documentation and information on workplace practices and OHS practices. • Pesticide labels • Specifications and work instructions • Approved assessment tools • Certified assessor /Assessor's panel
Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> • Interview / Written Test / Oral Questioning • Observation / Demonstration
Context of Assessment	<p>Competency may be assessed in the work place or in a simulated work place setting</p>

Level III

Transport, store, handle, and apply pesticide
AGR CRP3 17 1213

Evidence Guide	
Critical Aspects of Competence	<p>Must demonstrate knowledge and skills ability to:</p> <ul style="list-style-type: none"> • Communicate orally and in writing. • Read and interpret labels. • Calibrate and adjust equipment to apply chemicals • Measure quantities and calculate application rates. Report on and record activities. • Use safe and environmentally responsible work practices • apply OHS issues, legislative requirements and Codes of Practice relevant to chemical use and hazardous substances. • Use, maintenance and storage of equipment to prepare and apply chemicals
Underpinning Knowledge and Attitudes	<p>Demonstrates knowledge of:</p> <ul style="list-style-type: none"> • Pesticides free options for pest control. • Use, maintenance and storage of pesticides and equipment to prepare and apply pesticides. • OHS issues, legislative requirements and Codes of Practice relevant to pesticide use and hazardous substances. • Use, maintenance (inclusive cleaning) and storage of personal protective equipment, including how, when and why it should be used. • Licensing requirements and relevant State authorities. • Modes of pesticides absorption and paths of entry associated with risks to bystanders/public and applicators. • Environmental effects of pesticides. • Drift management. • Calibration and adjustments of application equipment. • Integrated Pest Management and Integrated Resistance Management principles. • Cost effective use of pesticides. • Hazard identification, assessment and control, and emergency response. • Correct wearing/fit of personal protective equipment. • Safe methods of transport • Pesticides concerned and related control measures • Relevant Occupational Health and Safety legislative requirements and Codes of Practice with regard to hazardous substances and the use of chemicals
Underpinning Skills	<p>Demonstrates skills to:</p> <ul style="list-style-type: none"> • Read and interpret labels • Accurate read and interpret instructions for transporting and handling pesticides • Communicate ideas and information about the transport arrangements for pesticides • Measure quantities, application rates and calibrate equipment. • Report on and record activities. • Use safe and environmentally responsible work practices. • Collect, analyze and organize information about hazards and risks associated with transporting pesticides • Plan and organize activities transport and storage • Work and communicate with others and in teams ensuring others are aware of transport of pesticides, and the hazards and control measures • Use mathematical ideas and techniques amounts of pesticides that can be safely transported in one load and how they can be stored • Solve problems difficulties with transport vehicles or the storage area

	may require problem solving
Resources Implication	The following resources MUST be provided. <ul style="list-style-type: none"> • Access is required to real or appropriately simulated situations, including work areas, materials and equipment, • Documentation and information on workplace practices and OHS practices. • Specifications and work instructions • Approved assessment tools • Certified assessor /Assessor's panel
Method of Assessment	Competency may be assessed through: <ul style="list-style-type: none"> • Interview / Written Test / Oral Questioning • Observation / Demonstration
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting

Control pests (Weeds, Insects, Disease) and disorders
AGR CRP3 18 1213

Evidence Guide	
Critical Aspects of Competence	A candidate must be able to demonstrate the ability to: <ul style="list-style-type: none"> • Identify Weed types pests (= insect pests, diseases and weeds) • Explain economic, aesthetic or environmental thresholds for a range of pests weeds • Apply chemical, biological and cultural control methods and treatments available, while using pesticides as a last resort and selectively, not endangering biological control methods • Range and use of tools, equipment and machinery available • describe monitoring and analysis techniques that may be used to implement and Integrated Pest Management program • For the specific pesticide treatments, apply occupational Health and Safety issues and legislative requirements • Apply a correct fitting, cleaning and storage of personal protective equipment • Interpret and apply test results and calculate the quantities and application rates of control materials • Coordinate work group, contractors and own activities to sequentially and effectively complete Integrated Pest • Manage activities in a timely and cost effective manner
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: <ul style="list-style-type: none"> • Pest recognition and biological control agents (naturally available and/or introduced) • Economic, aesthetic or environmental thresholds for a range of pest • Pesticide, biological and cultural control methods and treatments available to the enterprise within the parameters of an Integrated Pest Management program • Range and use of tools, equipment and machinery available to the enterprise for implementing the control measures (chemical and mechanical) • Range of site monitoring and analysis techniques that may be used to implement and Integrated Pest Management program • Limitations, environmental implications, end market and horticultural objectives for the site • Occupational Health and Safety issues and legislative requirements associated with hazardous substances, regulations and Codes of Practice • Occupational Health and Safety responsibilities of employers and employees

	<ul style="list-style-type: none"> • Correct wearing/fit of personal protective equipment • Association of Integrated Pest Management methods with • Site limitations, environmental implications, end market and production or environmental objectives for the site • Correct wearing/fit of personal protective equipment
Underpinning Skills	<p>Demonstrates skills to:</p> <ul style="list-style-type: none"> • Recognize a range of pests, natural enemies and beneficial organisms within the crops of a particular enterprise • Communicate with and advise work team members, supervisors, contractors and consultants • Utilize proforma reporting, analysis and work procedure documents • Understand Integrated Pest Management symbols (it is not clear what symbols are meant here) and information • Interpret and apply Integrated Pest Management program spatial and logistical specifications • Correct fitting, cleaning and storage of personal protective equipment • Interpret and apply test results and calculate the quantities and application rates of control materials • Coordinate work group, contractors and own activities to sequentially and effectively complete Integrated Pest • Manage activities in a timely and cost effective manner • Communicating ideas and information relating to Integrated Pest Management implementation, activities and problems encountered will be required with the supervisor, work group, contractors or consultants • Collect, analyze and organize information on Enterprise work procedures and Integrated Pest management • Consult, interpret and apply Management program to coordinate pests • Pest control activities • Implement the Integrated Pest Management program and lead members of a team to complete Integrated Pest Management activities, and meet Integrated Pest Management standards and specifications on time and budget • Understand Integrated Pest Management symbols and information
Resources Implication	<p>The following resources MUST be provided.</p> <ul style="list-style-type: none"> • Access is required to real or appropriately simulated situations, including work areas, materials and equipment, • Documentation and information on workplace practices and OHS practices. • Specifications and work instructions • Approved assessment tools • Certified assessor /Assessor's panel
Method of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> • Interview / Written Test / Oral Questioning • Observation / Demonstration
Context of Assessment	<p>Competence may be assessed in the work place or in a simulated work place setting</p>

Level IV

Plan and implement chemical use program

AGR CPM4 04 0311

Evidence Guide

Critical Aspects of Competence	<p>Candidate must able to:</p> <ul style="list-style-type: none"> • Select, apply specific chemicals and clean up the application equipment afterwards, • Supervise others working with the application equipment and the chemicals (including calibration, measuring etc.), • Ensure that all prescribed safety directions are followed, • Monitor the implementation of the systems and procedures developed for chemical concerned, • Supervise the record keeping of treatments.
Underpinning Knowledge and Attitudes	<p>Demonstrates knowledge of:</p> <ul style="list-style-type: none"> • Hazards involved in the use of the specific chemical concerned and related risk control measures. • Signs of pest damage and signs of beneficial organisms. • Life cycle of pests and crop stages. • Life cycles of beneficials for biological control. • Pest resistance to chemicals and preventive measures. • Types of chemical and modes of action. • Maximum residue limits, and if relevant, also in relation to export requirements. • OHS legislative requirements and Codes of Practice relevant to chemical use and hazardous substances. • International requirements (eg EU) and limitations applying pesticides on export crops. • Application equipment features. • Calibration. • Knowledge of record keeping systems. • Knowledge and understanding of relevant control of use Acts. • Use, maintenance and storage of personal protective equipment. • Correct wearing/fit of personal protective equipment. • First aid and emergency procedures. • Insurances required for chemical use, transportation and storage. • Calibration and calculation of equipment and chemicals
Underpinning Skills	<p>Skills include the ability to:</p> <ul style="list-style-type: none"> • Access, accurately read and interpret conditions and labels information for chemicals. • Direct others to perform tasks. • Identifying hazardous situations and to correct these. • Communicate procedures, policies and safety information to others in the workplace. • Collect, analyze and organize Information on labels, MSDS and legislation need to be interpreted and analyzed. • Plan and organize activities to be planned in conjunction with chemical use. • Use mathematical ideas and techniques in calibration and calculation of equipment and chemicals. • Identify hazards and potential problems that may arise during chemical use and developing suitable preventive measures to avoid the risks .
Resources Implication	<p>The following resources must be provided.</p> <ul style="list-style-type: none"> • Access is required to real or appropriately simulated situations, including work areas, materials and equipment, • Documentation and information on workplace practices and OHS practices.

	<ul style="list-style-type: none"> Specifications and work instructions
Methods of Assessment	Competency may be assessed through: <ul style="list-style-type: none"> Interview / Written Test / Oral Questioning Observation / Demonstration
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Implement pest management action plans
AGR CPM4 07 0311

Evidence Guide	
Critical Aspects of Competence	Assessment must confirm one's ability to: <ul style="list-style-type: none"> Schedule (is this to design a crop protection plan?), cost, communicate a pest management action plan to staff and stakeholders, and effectively implement and report Plan and manage resources and time. Communicate, negotiate and liaise with other statutory authorities, agencies and stakeholders. Organize the work of others. Record and report actions and work progress.
Underpinning Knowledge and Attitudes	Demonstrates knowledge and understanding of: <ul style="list-style-type: none"> Relevant legislative and regulatory requirements and the consequences for the control methods. Pest control methods and techniques. Integrated pest management. Pest and natural enemies biology. Social (occupational and public health) and environmental issues. Contingency management principles. First aid and rescue procedures. Ecological systems. Sustainable production systems, such as applicable under GAP.
Underpinning Skills	Demonstrates skills to: <ul style="list-style-type: none"> Plan and manage resources and time. Implement Pest control methods and techniques and demonstrate it to staff that have to apply the methods Communicate, negotiate and liaise with other statutory authorities, agencies and stakeholders. Organize and supervise the work of others. Record and report actions and work progress.
Resources Implication	The following resources must be provided. <ul style="list-style-type: none"> Access is required to real or appropriately simulated situations, including work areas, materials and equipment, Documentation and information on workplace practices and OHS practices. Specifications and work instructions
Methods of Assessment	Competency may be assessed through: <ul style="list-style-type: none"> Interview / Written Test / Oral Questioning Observation / Demonstration
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Control weeds, pests and/or diseases in crops

AGR CPM4 08 0311

Evidence Guide	
Critical Aspects of Competence	Assessment must confirm one's ability to: Apply weed, pest and/or disease treatments effectively, safely in line with an Integrated Pest Management approach , and with clear precautions taken to ensure that negative environmental, public and occupational health impacts are minimised.
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: <ul style="list-style-type: none"> • Pest and weed species, including their life cycles and reproduction/multiplication capability and of relevant biological control agents • Integrated pest and weed management techniques • The effects on crops of weeds, pests and/or diseases, including competitive effects on crop yield; threshold levels; and the effects of alternative methods of control • Environmental controls and codes of practice applicable to the enterprise • Relevant legislation and regulations relating to public health and OHS, contractor engagement, chemical use and application, and vehicle and plant use • Environmental controls and codes of practice applicable to the business and to the weed, pest and/or disease control operations • Sound management practices and processes to minimize noise, odours, and debris from weed, pest and/or disease control operations.
Underpinning Skills	Skills include the ability to: <ul style="list-style-type: none"> • Interpret monitored information on pest and weed numbers, density and consequent control options • Plan and schedule weed, pest and/or disease control including amending plans during the operations • Calculate resource requirements from the long-term plan • Prepare written plans and procedures for implementation by others • Explain, and deliver instructions about, the plans and scheduling of the weed, pest and/or disease control operations to both staff and contractors • Recognize poor growth and lack of vigour caused by nutrient deficiency • Observe, identify and react appropriately to environmental implications and OHS hazards • Prepare a written report on the conduct and results of the operation and possible improvements for the future.
Resources Implication	The following resources must be provided. <ul style="list-style-type: none"> • Access is required to real or appropriately simulated situations, including work areas, materials and equipment, • Documentation and information on workplace practices and OHS practices. • Specifications and work instructions • Approved assessment tools • Certified assessor /Assessor's panel
Methods of Assessment	Competency may be assessed through: <ul style="list-style-type: none"> • Interview / Written Test / Oral Questioning • Observation / Demonstration
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Annex 6 List of Key Informants

	Key respondents	Organization
1.	Mr GirmayeTeshome	Ministry of environment and forestry
2.	Mr Yeraswork Yilme	Ministry of Agriculture
3.	Fekadu Shewekile	Addis Ababa University
4.	Dr. Tibebe Habtewold	TIL & TIB CONSUL
5.	Beyene Ibrahim	EPA
6.	Selam Kidane	Ministry of environment and forestry
7.	Selamawit Desta	Ministry of environment and forestry
8.	Teodros Eshtu	TEDY CONSULT
9.	Gizachew Mern	Ministry of environment and forestry
10.	Serbessa Negera	NTRTP
11.	Dr. MelakuGirma	ICIPE
12.	Fiker Markos	Ministry of Agriculture
13.	Dr AsnakeFekre	Ethiopian Agricultural research Institute
14.	Getamesay Geremew	EHC
15.	AbnetBelachew	BASF
16.	SelamawitWoldu	Ethiopian Horticulture Development Agency
17.	Sieffu Rikiti	Syngenta
18.	Myrthe Mahalena	Marangle plants PLC
19.	Fikre Ewunetu	Tana Flora PLC
20.	TsegayeTewolde	Ziway roses
22.	BeyeneYalew	Florensis
23.	Kidst Gelaw	Sher Ethiopia
24.	AmanTemam	Lafto Rose PLC
25.	Henock Alemayehu	Herburg Roses PLC
25.	Newayinessh Shimeles	Red Fox Ethiopia
26.	AlemayehuWoyena	Saron Rose
27.	Amanuel Abrahe	Amannu Farm
28.	Anteneh Markos	Desa Plants PLC
29.	FekeduTemessen	Ethio vege Fruits
30.	Sayane Adane (Barave)	Dugda Flora
31.	Yidnekachew Demere	Agrisher Trading PLC
32.	Wordworem Legasse	Et. Highland
33.	ZemachuYadette	Margnter
34.	Eyob Kebede	Minaye
35.	Hailye Negussie	Yassin Rose
36.	Amare Gebeyehu	Jittu Hort
37.	Yones Assefa	EnyiEthio Rose
38.	Dr Baye Mulate	FAO
39.	Dr Befirdu Azerefegn	Hawasa Univesity
40.	Dr. Adhanom Negasi	Ethiopian Horticulture producer Exporters Association (EHPEA)
41.	Dr Argaw Ambelu	Jimma University
42.	Dr Derbew Belew	Jimma University
43.	Solomon Dagne	Ministry of Agriculture, Director for Small holder's horticulture
44.	Dr Mohammed Dawod	Ethiopian Agriculture Research Institute – Ambo plant protection

45.	Dr Asnake Fikre	Ethiopian Institute of Agricultural Research – Crop Director
46.	Dr Edossa Ittissa	Ethiopian Institute of Agricultural Research- Melkassa Research Center
47.	Getachew Cherinet	Croplife Ethiopia
48.	Sue Edwards	PAN
49.	Dr Yeneneh	USAID- Washington
50.	Teku Bayisa	Ministry of Agriculture – Nathereth quatrain
51.	Felege Elias	DLCOEA
52.	Dr Abdurehamen Abdulahi	
53.	Gebremichael Melese	Head of ATVET Ministry of Agriculture
54.	Haile Gebyehu	ATVET
55.	Tadesse Amera	PAN Ethiopia
56.	Wondewossen H/Michael	Ministry of Agriculture – Animal health
57.	Samuel Taye	Ministry of Agriculture – Apiculture
58.	Students	'on the job' MSc in horticulture
59.	DAs	

To explore
the potential
of nature to
improve the
quality of life



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CDI Report 14-032

The Centre for Development Innovation works on processes of innovation and change in the areas of food and nutrition security, adaptive agriculture, sustainable markets, ecosystem governance, and conflict, disaster and reconstruction. It is an interdisciplinary and internationally focused unit of Wageningen UR within the Social Sciences Group. Our work fosters collaboration between citizens, governments, businesses, NGOs, and the scientific community. Our worldwide network of partners and clients links with us to help facilitate innovation, create capacities for change and broker knowledge.

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.

