

Bahir Dar University



**College of Agriculture and Environmental Sciences
Plant Sciences Program**

Master of Science Program in Horticulture

**January, 2012
Bahir Dar**

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Contents

	Pages
1. General Background-----	2
1.1 Role of Agriculture in Ethiopian Economy-----	2
1.2 Horticulture as Subsector of Agriculture-----	2
1.3 Potentials of Ethiopia for Horticultural Development-----	4
2. Rationale of the Program and Horticultural Training Needs-----	6
3. Objective of the Program-----	8
4. Staff Profile-----	9
5. Graduate Profile-----	10
6. Academic Requirements-----	11
6.1 Duration of the Study-----	11
6.2 Assessment and Evaluation-----	11
6.3 Degree Nomenclature-----	12
6.4 Admission Requirements-----	12
6.5 Graduation Requirements-----	12
6.6 Assignment of the Course Cods-----	13
7. List of Courses Required-----	14
8. Course Breakdown-----	15
8.1 Regular Program Course Breakdown-----	15
8.2 Summer Program Course Breakdown-----	17
8.3 Extension Program Course Breakdown-----	19
9. Course Description -----	21
10. Quality Assurance Mechanism-----	28

1. General Background

1.1 The Role of Agriculture in Ethiopian Economy

Ethiopia is predominantly an agrarian country. Agriculture is the fundamentals of the country's economy. It contributes almost half of the GDP, employs about 85% the labor force. The largest proportion of the country's export earnings, more than 90%, comes from agriculture. Agriculture provides livelihood to over 85% of the population. Obviously, the country's future development heavily depends on the efficient and effective mobilization and utilization of agricultural resources. However, for several years, the rate of population growth has exceeded by far more than the rate of growth of agricultural production. As the result of this, Ethiopia is facing recurrent food insecurity and malnutrition problems that mainly resulted from unsustainable agricultural crops production which leads to unstable food production.

Nowadays, however there is a growing awareness for sustainable agricultural crop production systems to improve food security by realizing the natural resources potentials of the country without endangering the environment.

1.2 Horticulture as Subsector of Agriculture

Horticulture is one of the sub-sectors of agriculture from which many developing and developed countries have been benefiting a lot, not only for self-food security, but also to sustain their economy. Horticulture involves intensive cropping technology, including development, production, distribution, and utilization of vegetables, fruits, flowers and ornamental crops, coffee, tea and spices. Horticulture is an industry, profession and business.

Ethiopia has abundant agricultural resources and diverse environmental conditions for successful production of temperate, tropical and sub-tropical horticultural crops. There are also considerable opportunities for export of various fresh horticultural crops and their processed products. These potentials are however not yet exploited. The

contribution of horticulture as sub-sector of agriculture to country's economy is hence relatively low.

Fruits and vegetables play an important part in poverty alleviation programs and food security initiatives, providing employment opportunities, a source of incomes. In addition, they are well adapted for small-scale production units and they can provide relief for the people at the individual household level while they offer opportunities for trade and earning foreign currency. Fruits and vegetables have high nutritive value and because of which they help in protecting vulnerable group of the population from physiological disorders associated with low mineral and vitamin content of the traditional meal.

Generally the fruit and vegetable sector is less developed in Ethiopia. The sector is scattered throughout the country on small patch of lands in peasant smallholder with low productivity. The fruit and vegetable sector has potentially high market opportunities in domestic, regional and international markets. In order to use these potentials and opportunities the government of Ethiopia initiated in year 2008 Ethiopian Horticultural Development Agency with the objectives to coordinate and support public and private investments in the sector.

Coffee is a major cash crop of Ethiopia accounting for about 45% of national foreign exchange earnings. About 25% of the population is directly or indirectly dependant for its livelihood through production, processing, transport or marketing of coffee. The total area of land covered by coffee is estimated to be 500,000 to 550,000 hectares, and annual average production volume of coffee is about 250,000 tones. Compared to other countries the national average yield is however very low (0.5 tones/hectare). To improve the productivity and quality of coffee, policy guidelines have been developed under the national Coffee Development Plan to establish large-scale propagation sites and distribute improved high yielding varieties to replace old, poor performing and disease susceptible varieties.

The floriculture sector of horticulture is developing at a unique and unexpected high speed in the past ten years. In 2000, only 9 ha of land were under flower cultivation, and it has increased to over 1200 ha in 2008. More than 90,000 jobs have been created in and around these flower farms. Export earnings from floriculture increased from US \$ 4.7 million in 2000 to over US \$ 200 million in 2009. Similarly, the share of floriculture industry to the total export of the country increased in the last few years. The rapidly growing flower sector in Ethiopia has now become the fourth foreign currency generator of the country next to the top three: coffee, oilseeds and cereals. Thus the export oriented floriculture sector is now an integral part in the country's efforts to expand and diversify export products, raise export earnings and create employment.

The international market for flowers experienced a little shock in the past three years due to world economic crises. However nowadays it starts to rehabilitate again. Although the flower market is characterized by increased competition, it is expected that Ethiopia can further increase its market share by diversifying its product ranges and channels.

As sub-sector of horticulture, tea and spices play an important role in Ethiopian economy. Because of existed suitable climatic and soil conditions tea produced in Ethiopia has substituted import from other countries; hence tea saves a lot of foreign currency. Several endemic and exotic spices and herbs are also grown in Ethiopia.

1.3 Potentials of Ethiopia for Horticultural Development

In Ethiopia, a wide range of climatic and edaphic conditions permit the growing of a variety of horticultural crops all-year-round. The altitudinal differences create temperature variations. As the result, the country is suitable to produce all kinds of horticultural crops. In the highlands, where cool temperature prevails, common temperate horticultural crops can be cultivated such as apple, peach, plum, pear, etc., whereas many tropical and subtropical horticultural crops can be grown in low to mid altitudes, like citrus, banana, mango, avocado, tomato, pepper, eggplant and others.

Ethiopia has surface water bodies which can be used as potential sources of irrigation water for horticultural crops production. Ethiopia is also rich in underground water that can be also used as source of irrigation water. Ethiopia has not only favorable climatic conditions but also fertile and productive soils in most part of the country that are suitable to produce different types of horticultural crops.

Fruit and vegetable products of the country have high demand in EU-market, Middle East and regional markets such as Djibouti, South Sudan, North Sudan and Somalia. Proximity to market, relatively cheap labor suitable climatic and edaphic conditions increase competitiveness of Ethiopia in export markets. The increased demand of horticultural produces in domestic market is also an opportunity to boost horticultural development of Ethiopia.

Despite all these potentials and opportunities, however, horticultural development of the country, in terms of area and output is also small. The total production volume and the area coverage of horticultural crops are very small. Moreover productivity of horticultural crops is extremely low compared to neighboring countries like Kenya and Uganda. The contribution of horticultural crops especially that of fruit and vegetable sector in generating foreign exchange earnings of the country is also very low. Despite encouraging achievements in floriculture in recent time it is still low compared to existing potentials.

The low developmental level of horticulture and its poor productivity in Ethiopia is due to many reasons, among others, lack of improved production technologies, inappropriate management practices, pre- and postharvest losses and insufficient research and extension services are the most important ones. However around 95% of fresh horticultural products supplied to domestic as well as regional export markets are sourced from smallholder sector. In smallholder farmers the use of improved seeds or planting materials of high yielding varieties and other inputs such as fertilizers and plant protection materials is not common. Very poor postharvest handling, lack of cold storage and transport services and unorganized marketing systems are some of the characteristics of horticultural crop production in Ethiopia.

2. Rationale for the Program and Horticultural Training Needs

The current low level of development of horticulture of the country in general and of the Amhara National Regional State (ANRS) in particular is the result of lack of improved production technologies, inappropriate management practices, pre- and postharvest losses and insufficient research and extension services. To fill these gaps, it is necessary to develop qualified manpower that can be engaged in the processes of technology generation, dissemination and adoption. Hence human capital is one of the key drivers of development in horticulture sector.

As one of the leading universities of the country offering high level trainings on various fields of agriculture, Bahir Dar University is also responsible for the production of adequate horticultural professionals. Situated in Midst agrarian region, Bahir Dar University is particularly suitable for high level trainings on horticulture crops production and management. The region, like in other part of the country, has varied agro-ecological zones that enable the region to produce all types of horticultural crops (tropical, subtropical and temperate crops). Besides, the government of Ethiopia and the Amhara National Regional State have given due attention for horticultural development. Consequently, extensive irrigation schemes are being developed to produce high value cash crops such as fruits and vegetables for export market as well as for domestic markets.

Results of need assessment survey carried out by the Department of Plant Science of the University in different organizations, institutes and NGOs have shown that there is a high demand for horticultural specialists' high caliber, to develop all subsectors of horticulture. Especially the main stakeholders of the program, such as Ministry of Agriculture, Bureaus of Agriculture, Research Institutes, and other governmental organization showed interest for competent well skilled horticulture professionals at a graduate level. According to the respondents from Ministry of Agriculture and Regional Agricultural Bureaus, staff positions that have to be filled by horticultural specialist are mostly occupied by staffs from other disciplines for the lack of appropriate horticulture

professionals. In addition, they showed interest to upgrade their staffs to M.Sc. level at Bahir Dar University.

For suitable environmental conditions available in the country and the higher attention given by the government of Ethiopia, the floriculture industry is expected to expand in the country. This expansion again needs competent well trained staffs at all levels.

According to most respondents, Horticulture M.Sc. Program at Bahir Dar University should address general horticulture, with especial emphasize to Olericulture and Pomology subsectors. Specialization into different subsectors such as Olericulture, Pomology, Floriculture and others seems not feasible in view of the current low level of horticultural development in the country.

Launching M.Sc. Studies in horticulture at the current status of Bahir Dar University is feasible and it is timely and necessary. Being aware of this fact, the Department of Plant Science of the university has devised this program to produce adequate number of well trained and qualified personnel in horticultural crop production and management science both in regular, extension and summer programs.

Increasing the level of horticultural development and its productivity by using improved production technologies, applying appropriate management practices, reducing pre- and postharvest losses and sufficient research and extension services helps to attain food security and to increase foreign exchange earnings from the sector. The program is thus developed in response to the country's need to increase horticultural crop production and productivity, and thereby to improve the livelihood of people in particular and to attain food security, as well as, to boost foreign exchange of the country at large. The program seeks to produce competent professionals who will be playing a key role in the processes of technology generation, dissemination and adoption which eventually results in the increase of horticultural crops production and productivity of the country. Hence, the program envisages to produce such competent professionals who are equipped with both academic and practical knowledge and skills in managing all aspects of the horticultural crop production and management, as well as, undertaking various research and extension

activities which can contribute for the region's and the country's food security and developmental endeavors.

3. Objectives of the Program

The program will fully involve in training and research, and, partly in extension activities of horticultural crops production and management. The ultimate goal of the program is, therefore, to increase production and productivity of horticultural crops in the region in particular and in the country in general, and thereby to improve the livelihood of the people, and to improve foreign exchange earnings of the country through producing adequate number and high caliber horticultural specialists who play a key role in generation, dissemination and adoption of improved technologies.

The specific objectives of the program of post-graduate studies in Horticulture are to:

- ◆ Produce horticultural professionals who can generate, demonstrate and distribute technologies in horticultural crops production, improvement and protection so as to improve productivity, sustainability and competitiveness of horticultural sector of the country;
- ◆ Deliver nationally and internationally recognized graduate program and save foreign exchange that would be used to train abroad; and
- ◆ Provide appropriate knowledge through integrating training, research and extension, so as to increase the efficiency and competitiveness of the graduates as horticulture professional.

4. Staff Profile

No	Name	Academic Rank	Educational Level	Specialization
1	Getachew Alemayehu	Assistant Professor	PhD (Germany)	Agronomy/Physiology
2	Tsige Genet	Associate Professor	PhD (South Africa)	Plant Breeding
3	Tadesse Dessalegn	Associate Professor	PhD (South Africa)	Plant Breeding
4	Merkuz Abera	Assistant Professor	PhD (Haramaya)	Plant Pathology
5	Melkamu Alemayehu	Assistant Professor	PhD (Germany)	Horticulture/Pathology
6	Kiflemariam Yehuala	Lecturer	M.Sc. (Haramaya)	Horticulture
7	Fentahun Mengistu****		PhD (Austria)	Horticulture
8	Yigzaw Dessalegn****		PhD (South Africa)	Horticulture
9	Melkamu Ayalew **	Lecturer	M.Sc. (Haramaya)	Plant Pathology
10	Dereje Ayalew **	Lecturer	M.Sc. (Haramaya)	Agronomy
11	Adane Tesfaye **	Lecturer	M.Sc. (India)	Entomology
12	Elsabeth Bizuayehu	Lecturer	M.Sc. (AAU)	Botanical Sciences
13	Demeke Mewa	Lecturer	M.Sc. (AAU)	Applied Genetics
14	Agumase Belie	Lecturer	M.Sc. (India)	Agronomy
15	* Enyew Adgo	Associate Professor	PhD (Germany)	Soil Science
16	* Yihnew G/ Sillassie	Associate Professor	PhD (Thailand)	Soil Science
17	* Berhanu Aberha	Associate Professor	PhD (Norway)	Stress Physiology
18	* Melaku Wale	Assistant Professor	PhD (Kenya)	Entomology
19	Adane Gebeyehu ***	Graduate Assistance	B.Sc. (BDU)	Plant Science
20	Masho Aklile	Graduate Assistance	B.Sc. (DBU)	Plant Science

* Associate staffs at different departments of Bahir Dar University

** Staffs on study leave (PhD)

*** Staffs on study leave (M.Sc.)

**** Potential Staffs in ARARI

5. Graduate Profile

The graduates of this program will be qualified horticultural professionals who are well equipped with scientific knowledge and practical skills that would enable them to:

- ◆ Identify, analyze and develop holistic solutions to problems related to horticultural crop production and protection;
- ◆ Generate, demonstrate and promote valuable technologies related to horticultural crop improvement, production and protection;
- ◆ Organize and leading the production and marketing of horticultural enterprises of different size and character;
- ◆ Consult policy makers in formulating appropriate horticultural policies;
- ◆ Consult private horticultural entrepreneurs in related to production, protection and marketing of horticultural crops, and organize and lead their own horticultural enterprises;
- ◆ Play leading role in the process of enhancing horticultural productivity and ensuring national food security;
- ◆ Take part in teaching and training activities at various levels in the field of horticulture and
- ◆ Be competent candidates in further national and international training opportunities

6. Academic Requirements

6.1 Duration of the Study

The M.Sc. study program in Horticulture is a two year program. In the first year (2 semesters) of the program courses are taught, while in second year of the program mainly the research project is carried out in a specific area of specialization.

6.2 Assessment and Evaluation

The progress of graduate students is assessed regularly and informally by the respective course owners in particular and by the Department of Plant Sciences and College of Agriculture and Environmental Sciences in general. Informal assessment focuses on both completion of coursework and the development of professional skills in research, writing, leadership and service provision. The formal ways of assessment includes the followings:

For coursework:

- Assignments
- Seminars and presentations
- Final semester examination

For Practical courses:

- Laboratory/Field reports
- Practical examination
- Written examination

For Thesis/Seminars/Report presentation:

- Paper organization
- Quality of paper presented
- Way of presentation
- Defending material presented

The final performance of the course will be evaluated using A (4.0), B⁺ (3.5), B (3.0), C⁺ (2.5), C (2.0), D (1) and F (0) grading system.

6.3 Degree Nomenclature

Upon successful completion of the program, the degree is labeled in English and Amharic as follows:

“MASTER OF SCIENCE DEGREE IN HORTICULTURE”
“ዎላስተር ስራ በሆርቲኬልቸር ሳይንስ”

6.4 Admission Requirements

Applicants must be graduates of in Crop Sciences, Plant Sciences, Horticulture, General Agriculture, Biology, Ecology, and related fields and passing qualifying examination, and meet other admission requirements of the School of Graduate Studies (SGS) of Bahir Dar University.

6.5 Graduation Requirements

The program of the study leading to the M.Sc. Degree in Horticulture requires 28 credit hours course and a 6 credit hour Master’s Thesis, with the total of at least 34 credit hours. The student must score a minimum of 3.00 cumulative G.P.A., with no “D” and “F” and successfully defended thesis.

6.6 Assignment of Course Code

Each course is coded with four letters and three numbers. The four-letters abbreviations show the program, while the first, second and third numbers show the year of the study, the course type and the semester, respectively. The assignment of numbers to present course types as follows:

- 0 = Advanced Biometry and Software Applications, Advanced Soil and Plant nutrition, Advanced Plant Physiology, Horticultural Crops Breeding and Biotechnology
- 1 = Horticultural Crop Pests and their Management, Postharvest handling and Marketing of Horticultural Crops, Horticultural Crops Propagation and Nursery Management, Entrepreneurship and Agribusiness Management
- 2 = Advanced Vegetable Crops Production and Management, Advanced Fruit Crops Production and Management, Basics of Floriculture and Landscaping, Vegetable Seed Production Technology
- 3 = Advances in Horticulture, Graduate Seminar, and Thesis Research

The even number at the end of the course code shows that the course is conducted in the second semester, while the odd number denotes that the course is conducted in the first semester.

7. List of Courses Required

No	Course No.	Course Title	Credit Hours
1	Hort601	Advanced Biometry and Software Applications	3
2	Hort603	Advanced soil and plant nutrition	2
3	Hort605	Advanced Plant Physiology	2
4	Hort607	Horticultural Crops Breeding and Biotechnology	2
5	Hort613	Horticultural Crop Pests and their Management	3(2+3)
6	Hort611	Horticultural Crops Propagation and Nursery Management	2(1+3)
7	Hort614	Postharvest Handling and Marketing of Horticultural Crops	2
8	Hort622	Advanced Vegetable Crops Production and Management	3(2+3)
9	Hort624	Advanced Fruit Crops Production and Management	3(2+3)
10	Hort626	Basics of Floriculture and Landscaping	2(1+3)
11	Hort731	Advances in Horticulture	1
12	Hort733	Graduate Seminar in Horticulture	1
13	Hort735	Thesis	6
	Total		34(32+2)

Elective courses

1	Hort612	Entrepreneurship and Agribusiness Management (E)	2
2	Hort628	Vegetable Seed Production Technology (E)	2
	Total		4

Out of the elective courses, a student is required to take only one

8. Course Breakdown

8.1. Regular Program Course Breakdown

Lists of courses for Year 1, Semester-1

No	Course No.	List of Courses	Credit Hours
1	Hort601	Advanced Biometry and Software Applications	3
2	Hort603	Advanced Soil and Plant nutrition	2
3	Hort605	Advanced Plant Physiology	2
4	Hort607	Horticultural Crops Breeding and Biotechnology	2
5	Hort613	Horticultural Crop Pests and their Management	3(2+3)
6	Hort611	Horticultural Crops Propagation and Nursery Management	2(1+3)
		Total Credit Hours	14

Lists of courses for Year 1 - Semester-2

No	Course No.	List of Courses	Credit Hours*
1	Hort622	Advanced Vegetable Crops Production and Management	3(2+3)
2	Hort624	Advanced Fruit Crops Production and Management	3(2+3)
3	Hort626	Basics of Floriculture and Landscaping	2(1+3)
4	Hort628	Vegetable Seed Production Technology (E)	2
5	Hort612	Entrepreneurship and Agribusiness Management (E)	2
6	Hort614	Postharvest Handling and Marketing of Horticultural Crops	2
		Total Credit Hours	12 (10+2) **

* Students are expected to write and defend their research proposal in Year 1, Semester- 2

** Out of the elective courses, a student is required to take only one

Lists of courses for Year 2, Semester-1

No	Course No.	List of Courses	Credit Hours
1	Hort731	Current Topics in Horticulture	1
2	Hort733	Graduate Seminar in Horticulture	1
3	Hort735	M.Sc. thesis	6
		Total Credit Hours	8

Lists of courses for Year 2, Semester-2

No	Course No.	List of Courses	Credit Hours
1	Hort735	M.Sc. thesis	6**
		Total Credit Hours	

**** Continuation from Year 2, Semester-1**

8.2 Summer Program Course Breakdowns

Lists of courses for Year 1 - summer 1

No	Course No.	List of Courses	Credit Hours
1	Hort601	Advanced Biometry and Software Applications	3
2	Hort603	Advanced Soil and Plant nutrition	2
3	Hort605	Advanced Plant Physiology	2
4	Hort607	Horticultural Crops Breeding and Biotechnology	2
5	Hort613	Horticultural Crop Pests and their Management	3(2+3)
		Total Credit Hours	12

Lists of courses for year 1 – distance 1

No	Course No.	List of Courses	Credit Hours **
1	Hort628	Vegetable Seed Production Technology (E)	2
2	Hort612	Entrepreneurship and Agribusiness Management (E)	2
3	Hort614	Postharvest Handling and Marketing of Horticultural Crops	2
		Total Credit Hours	4

**** Out of the elective courses, a student is required to take only one**

Lists of courses for year 2 – summer 2

No	Course No.	List of Courses	Credit Hours*
1	Hort611	Horticultural Crops Propagation and Nursery Management	2(1+3)
2	Hort622	Advanced Vegetable Crops Production and Management	3(2+3)
3	Hort624	Advanced Fruit Crops Production and Management	3(2+3)
4	Hort626	Basics of Floriculture and Landscaping	2(1+3)
		Total Credit Hours	10

* Students are expected to write and defend their research proposal in Year 2, summer- 2

Lists of courses for year 3 – distance 2

No	Course No.	List of Courses	Credit Hours
1	Hort731	Current Topics in Horticulture	1
2	Hort733	Graduate Seminar in Horticulture	1
3	Hort735	M.Sc. thesis	6
		Total Credit Hours	8

Lists of courses for year 3 – summer 3

No	Course No.	List of Courses	Credit Hours
1	Hort735	M.Sc. thesis	6**
		Total Credit Hours	6

** Continuation from Year 3- Semester-1, but will not register again

8.3 Extension Program Course Breakdown

Lists of courses for year 1 – semester 1

No	Course No.	List of Courses	Credit Hours
1	Hort601	Advanced Biometry and Software Applications	3
2	Hort603	Advanced Soil and Plant nutrition	2
3	Hort605	Advanced Plant Physiology	2
4	Hort607	Horticultural Crops Breeding and Biotechnology	2
		Total Credit Hours	9

Lists of courses for year 1 – semester 2

No	Course No.	List of Courses	Credit Hours*
1	Hort613	Horticultural Crop Pests and their Management	3(2+3)
2	Hort611	Horticultural Crops Propagation and Nursery Management	2(1+3)
3	Hort622	Advanced Vegetable Crops Production and Management	3(2+3)
		Total Credit Hours	8

* Students are expected to write and defend their research proposal in Year 1, Semester- 2

Lists of courses for year 1 – summer 1

No	Course No.	List of Courses	Credit Hours
	Hort624	Advanced Fruit Crops Production and Management	3(2+3)
	Hort626	Basics of Floriculture and Landscaping	2(1+3)
	Hort614	Postharvest Handling and Marketing of Horticultural Crops	2
	Hort628	Vegetable Seed Production Technology (E)	2
	Hort612	Entrepreneurship and Agribusiness Management (E)	2
		Total Credit Hours	9 (7+2) **

** Out of the elective courses, a student is required to take only two

Lists of courses for year 2 – semester 1

No	Course No.	List of Courses	Credit Hours
1	Hort731	Current Topics in Horticulture	1
2	Hort735	M.Sc. thesis	6
		Total Credit Hours	7

**** Continuation from Year 1- summer -1, but will not register again**

Lists of courses for year 2 – semester 2

No	Course No.	List of Courses	Credit Hours
1	Hort733	Graduate Seminar in Horticulture	1
2	Hort735	M.Sc. thesis	
		Total Credit Hours	1

**** Continuation from Year 1- summer -1, but will not register again**

9. Course Description

Course title: Advanced Biometry and Software Applications

Course code: Hort 601

Credit hours: 3

Course description:

Descriptive analysis of data; types of variables and measurements; probability distribution; analysis of variance models; assumptions and their test; principles of experimental designs; means of reducing experimental errors; layout, blocking, randomization, replication, analysis of variance, mean separation, interpretation of results and missing plot techniques with respect to completely randomized design, randomized completely block design, latin squares design, youden square design, factorial experiments with confounding and fractional factorial design concepts; split plot design and strip plot design with two or more factors; compact family block design; incomplete block designs-simple and balanced lattice design; augmented randomized block designs; nested design; cross-over or switch-over design; combined analysis variance and its interpretation; analysis of covariance with randomized block design for adjustment; simple and multiple correlation and regression analysis GLM; application of chi-square and non-parametric statistics; application and management of statistical software such as SPSS, SAS, Agro-base, etc.

Course title: Advanced Soil and Plant nutrition

Course code: Hort 603

Credit hours: 2

Course description:

Soil formation (weathering, soil forming factors, soil forming process, the soil profile); physical properties of soils (soil texture, particle and bulk densities, pores space of mineral soils, soil structure, soil color, soil water, soil consistence, plasticity and strength, soil air and soil temperature); chemical properties of soils (soil colloids, adsorption and exchange of cations and anions, soil acidity, soil alkalinity, soil salinity, soil sodicity); soil organic matter (sources of soil organic matter, the carbon cycle, composition of plant residues, decomposition of organic matter in the soil, uses of organic matter in the soil); soil ecology (Important soil fauna and flora); soils fertility and

productivity; basic plant-soil relation; nutrient uptake from soil; charge properties and ion exchange principles; essential plant nutrients in soils and their availability to plants (N, P, K, Ca, Mg, S and micro nutrients); nutrient deficiency symptoms; biological nitrogen fixation; fertilizers and fertilizer management (organic fertilizers, inorganic fertilizers); soil/land classification (The USDA system of soil classification, FAO/UNESCO system of soil classification, other systems of soil classification); major Ethiopian soil types; Ethiopian soil maps.

Course title: Advanced Plant Physiology

Course code: Hort 605

Credit hours: 2

Course description:

Leaf canopy and root system; growth and development; phases of growth; measurement of growth; carbon-dioxide assimilation; growth and maintenance respiration; photo-respiration; dry matter production by interception and conversion of solar radiation; radiation and heat balance; transpiration and dry matter production; source-sink relations; translocation and partitioning of assimilates; nitrogen assimilation and biological nitrogen fixation; phenology of crops; yield components of crops; photoperiod effects; growth regulators; crop growth limited by water; crop growth limited by nutrients; crop response to environmental stress (drought, flooding, freezing, heat, salinity, radiation); postharvest physiology in horticultural crops; physiological basis of flower and fruit drop; fruit thinning; maturity; ripening.

Course title: Horticultural Crops Breeding and Biotechnology

Course code: Hort 607

Credit hours: 2

Course description:

Introduction to plant genetics; traditional and modern crop genetic improvements; conventional crop improvement through introduction, selection and hybridization; gene marker assisted crop breeding; breeding methods in self pollinated and cross pollinated crops; crop improvement through combinations of various methods of breeding; male sterility; self-incompatibility; sex-forms; creating variability and methods of variability creation for breeding purpose; mutation breeding; induction of polyploidy; application of

biotechnology; genetic engineering of plants (resistance breeding); tissue culture; production of disease free plants; GMOs and bio-safety against genetically modified organisms (GMO).

Course title: Horticultural Crop Pests and their Management

Course code: Hort613

Credit hours: 3 (2+3)

Course description:

Major horticultural Crop pests (diseases, insect pests, virus, nematodes, weeds) and their economic importance; epidemiology of plant pathogens; chemicals for pest management; classification of chemicals; problems associated with chemical application; methods of pest management in horticulture: physical, cultural, chemical, and biological control measures; principle and practice of integrated pest management; survey of economically important diseases, insect pests, nematodes, and their control measures in horticultural crops

Lab/practical studies:

Visit to horticultural farm or research sites and evaluating technically the status of farms; Identifying major diseases and insect pests in horticultural crops; diagnosing abiotic and biotic disease symptoms and insect pest damages; sample collection and preservation of diseased and damaged plant parts; isolation of pathogens from diseased plant part

Course title: Horticultural Crops Propagation and Nursery Management

Course code: Hort611

Credit hours: 2 (1+3)

Course description:

Fundamentals of plant propagation; physical plant propagation structures; media of plant propagation; soilless culture; sanitation in plant propagation; labeling and recording in propagation industry; methods of propagation; Sexual propagation; seed dormancy; seed viability and factors affecting seed viability and seed germination; seedbed preparation and seed sowing; vegetative propagation; layering, cuttings, grafting, budding; propagation by specialized plant structure (corm, bulb, tuber and rhizome); micro-propagation of plants (tissue culture); environmental factors in nursery; cultural practices in nursery; disease and insect pest control in nursery; production schedules in

commercial nursery; handling of nursery plants, marketing and economics of nursery business.

Lab/practical studies:

Introduction of propagation equipment and tools; seed viability and germination test; practicing different types of vegetative propagation methods; visiting nursery sites and evaluating their status; visiting tissue culture laboratories;

Course title: Advanced Vegetable Crops Production

Course code: 622

Credit hours: 3 (2+3)

Course description:

Importance of vegetables; classification of vegetables; current status and potential of vegetable production in Ethiopia, environmental and soil factors in vegetable production; Improving vegetable soil fertility; commercial nursery establishment and quality seedling production; transplanting and major cultural practices in vegetable production; Irrigation and fertilizer application; crop pests management; harvesting; postharvest handling and storage; marketing of vegetables; seed production; production technology of the major vegetables grown in Ethiopia

Lab/Practical studies:

Visit to vegetable farm or research site and evaluating its status; seed quality and germination test; practicing vegetable nursery activities including laying out and establishing nurseries; establishing and managing seedlings in nursery; establishing and managing vegetables in the production field; practicing harvesting, postharvest handling and processing vegetables; testing the quality of produces

Course title: Advanced fruit Crops Production

Course code: 624

Credit hours: 3 (2+3)

Course description:

Current status of fruit production in Ethiopia; orchard establishment; soil and climatic requirements; fruit classification; propagation methods; stock-scion incompatibility; reciprocal influence stock-scion cultivars; high-density systems (canopy management, yield and fruit quality); cultural practices (cultivation and weed control, irrigation, fertilization and pruning and training); flowering; pollination and fruit set; growth and fruit thinning; crop protection; harvesting and postharvest handling; production technology of the major fruits grown in Ethiopia (tropical, subtropical and temperate fruits); marketing and consumption in Ethiopia.

Lab/Practical Studies:

Visit to fruit production farm and identifying fruit crops; laying out and establishing a fruit tree nursery; practicing fruit tree nursery activities including preparation of growing media; establishing and managing fruit trees in nursery; laying out and establishing an orchard; establishing and managing fruit trees in orchard; practicing harvesting postharvest handling and processing of fruit crops; testing the quality of produces.

Course title: Basics of floriculture and Landscaping

Course code: 626

Credit hours: 2(1+3)

Course description:

Ethiopian and world floriculture industry; landscape gardening; styles of gardening; commercial floriculture; potentials and constraints of floriculture production in Ethiopia; criteria for site selection; classification of plants; production systems (protected house, open field); types and structures of greenhouse; propagation in floriculture; soils and nutrition in floriculture; control of greenhouse environment; flower induction and initiations; Irrigation management systems; insect pest and disease control; carbon dioxide injection; harvesting, grading, and packing; storage and extension of shelf-life; production and management technology of major cut flowers produced in Ethiopia;

principles of landscape designs for home garden and public areas; layout, establishment and maintenance of plants in the landscape including watering and fertilization, weed control, pruning and general tree and lawn care.

Lab/Practical Studies:

Visit to floriculture farm and identifying ornamental crops produced in Ethiopia; practicing propagation methods used in floriculture industry (grafting and cutting); postharvest handling processes in floriculture industry (harvesting, precooling, sorting, grading, packaging, storing and transporting).

Course title: Postharvest Handling and Marketing of Horticultural crops

Course code: 614

Credit hours: 2

Course description:

Postharvest physiology of horticultural crops; respiration; transpiration; ripening and senescence of produce; climacteric and non-climacteric produce; ethylene and other plant growth regulators and their role in postharvest; physiological disorder; factors affecting the quality of postharvest produce; postharvest insect pests and diseases and their management; postharvest losses and their reduction; environmental manipulation; cooling and pre-cooling methods; cool chain management; enhancing shelf-life of cut flowers; harvesting and preparing horticultural crops for market (washing, drying, sorting, grading, packing); storage and transport of horticultural crops; processing; factors for the success of marketing horticultural crops (quality, quantity, continuity, price); major factors complicating marketing of horticultural crops; actors in marketing process; marketing processes of horticultural products in Ethiopia; value addition and marketing; potentials and constraints in marketing horticultural products in Ethiopia

Course title: Vegetable Seed Production Technology

Course code: Hort628

Credit hours: 2

Course description:

Types of various seed classes; the seed industry; seed programs; reproductive systems and seed production; agronomic principles; genetic principles; seed maintenance techniques; principles in seed production; isolation distance; rouging; environmental factors associated with bolting; methods and procedures for seed production of important vegetables; physiology and biochemistry of seed dormancy; physiology and biochemistry of seed germination; seed drying; seed cleaning and upgrading; seed health management; seed treatment; seed marketing; seed packaging and handling; seed storage and marketing; germination and viability tests; seed vigor and vigor tests; seed health and moisture test; production of seeds of selected vegetables.

Course title: Entrepreneurship and Agribusiness Management

Course code: Hort612

Credit hours: 2

Course description:

Entrepreneurs; entrepreneurship; economics and entrepreneurship; push and pull factors; success, growth and failure; importance of business for economy; political social, , and environmental aspects of business; advantages and disadvantages in Ethiopia; forms of business ownership (sole proprietorship, partnership, corporations; cooperatives; marketing in business (product, price, promotion place; market segments; market research; marketing strategies); developing a business plan; financing a business (requirements, sources); business ethics and social and environmental responsibilities; risks and insurance (risk management, insurance forms)

Course title: Current Topics in Horticulture

Course code: Hort731

Credit hours: 1

Course description:

Supervised study on advanced topics in horticulture; review advanced works in horticulture; potential crops for the country; select and write a paper on one of current topics of horticulture; present paper to an audience especially colleagues of the student;

learning and studying current topics through attending presentations and experience sharing.

Course title: Graduate Seminar in Horticulture

Course code: Hort733

Credit hours: 1

Course description:

Current literature and horticultural developments; presentation on selected seminar topics by a graduate student; attending and participating in his/her colleagues seminars

Course title: Thesis

Course code: Hort735

Credit hours: 6

Course description:

Independent research in horticulture to be conducted under the supervision of professor(s) or scientist(s) including thesis write up and presentation, and discussed as partial requirement for the Master of Science Degree in Horticulture; research topics and plan of study to be determined jointly by student, his advisors and finally approved by school of graduate studies.

10. Quality Assurance Mechanism

The Department of Plant Sciences has Department Graduate Council (DGC) which follows up and evaluates the training quality at program and course levels. To control the quality of post-graduate studies undertakings *per se*, DGC of Plant Sciences will set evaluation approaches such as open discussion about the courses, their relevance and betterment, evaluation of instructors by students after each course completion and their considerations, and finally evaluation of the whole program by DGC every year for possible actions of improvement.

Annex 1: List of institutions and organizations included in training need assessment survey.

1. Hawassa University
2. Haramaya University
3. Jimma University
4. Amhara Bureau of Agriculture
5. S.N.N.P. Bureau of Agriculture
6. Oromya Bureau of Agriculture
7. Ministry of Agriculture
8. Amhara Region Agricultural Research Institute
9. Jimma Agricultural Research Center
10. Ethiopian Institute of Agricultural Research
11. Minaye flower farm
12. Dugda Floriculture development P.L.C.
13. Ethiopian Horticulture Producers and Exporters Association
14. Ethiopian Horticulture Development Agency
15. Menschen for Menschen