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PROJECT REPORT ON:

DELIVERABLE WP3: D3.2; D9: REPORT ON CURRICULUM CONTENT DEVELOPMENT BY BUILDING CAPACITY IN PLANT BREEDING AND BIOTECHNOLOGY EDUCATION AND RESEARCH THROUGH PARTNERSHIP PROGRAM IN AFRICA, MIDDLE EAST AND EUROPE FOR AGRICULTURAL TRANSFORMATION (BREEDTECH) PROJECT

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Executive Summary

The BREEDTECH project funded by the European Union is a collaborative initiative aims at modernizing education in area of Plant Breeding and Biotechnology in Africa and Middle East in partnership with pioneer institutes in Europe. Two institutes, each from Kenya, Ethiopia and Palestine engaged in a comprehensive curriculum revision/development at their own institutions based on the requirements of the institute and need of the country, and included the cutting-edge technologies, sustainable breeding practices, and data-driven approaches into ongoing or new academic programs. The revision process was guided by input from academic experts, industry stakeholders, and policymakers to ensure alignment with emerging trends in genomics, molecular breeding, bioinformatics etc. The revised curriculum emphasize on practical training, innovation-driven research, and ethical considerations to equip students with the competencies needed for the future demand of the subject. This report includes details of the progress made by the partner institutes in line with the deliverables of work package 3 (WP3) that focuses on the revision/development of course curriculum. It is worth mentioning that each partner institute contributed significantly in acheiving the deliverables of this work package. In summary, a total of 5 new programmes (PhD and MSc in Plant Pathology, MSc in Plant Breeding, MSc and BSc in Molecular biology and Biotechnolgy) have been developed in the institutions at Kenya and Ethiopia, whereas 8 programmes have been reviewed/updated in the partner institutes. Under the reviewed/updated programmes, more than nine(>9) new courses have been included and about 14 courses have been reviewed/updated significantly to meet the current and future market demand of subject matter experts. Overall, through this initiative, the BREEDTECH project strengthens institutional capacity, fosters international collaboration, and enhances employability in the plant breeding and biotechnology sectors. The updated curriculum is expected to drive agricultural innovation, support food security, and promote sustainability in plant breeding across diverse agro-ecological regions.

Table 1: Summary of all curriculums/programmes/courses developed by Universities engaged in work Package 3 of the BREEDTECH project

	EGERTON UNIVERSITY		
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
1. Doctor of Philosophy in Plant Breeding	Reviewed	Egerton University	In this program **2 courses** PBRD 828 course on Contemporary Issues in Molecular Plant Breeding and PBRD 820 Advances in Applied Genetics and Plant Breeding have been enhanced to include molecular and biotechniology applications in plant breeding, Bioinformatics, and gene editing techniques and practicals
2. Doctor of Philosophy in Crop Protection	Reviewed	Egerton University	In this Program **1 course** CRPT 851 was revised to include Molecular techniques that include: Immunoassays; Microarrays for gene expression; Proteomics; Genome editing tools; DNA analysis; Bioinformatics for DNA, RNA and protein sequences; Acess and utilization of genebank resources.
3. Doctor of Philosophy in Dryland Agriculture and Resource Management	Reviewed	Egerton University	The program revised **3 courses**; DARM 891 Contemporary Issues in Dryland Agriculture has been revised to incorporate the components of Plant Breeding and biotechnology and innovation DARM 892, Statistical Procedures and Techniques in Dryland Agriculture and Resource Management and DARM 850 Advances in Dryland Agriculture and Resource Management have incorporated plant breeding and biotechnology technologies and applications in dryland agriculture
4. Doctor of Philosophy in Plant Biotechnology	Reviewed	Egerton University	In this program **2 courses** PBTC 843 Advances and Applications of Plant Biotechnology and Cytogenetics and PBTC 821 Emerging and contemporary issues in plant biotechnology have been enhaced to include Genetic engineering and Genotyping by Sequencing techniques
LAIKIPIA UNIVERSITY			
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
1. PhD in Plant Pathology	New	Likipia University	All courses were newly described
2. MSc in Plant Pathology	New	Likipia University	Newly prescribed course units
3. MSc in Molecular Biology and Biotechnology	New	Likipia University	Newly prescribed course units
4. BSc in Molecular Biology and Biotechnology	New	Likipia University	Newly prescribed course units
5. BSc in Dryland	Reviewed	Likipia University	The nomenclature of this degree has been changed from its earlier nomenclature of BSc in Utilization and

Resource Management			Sustainability of Arid Lands (USAL) to better fit with the purpose. Further, the course units were aligned based on the needs and as per the new nomenclature.
	HARAMAYA UNIVERSITY		
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
1. MSc in Plant Breeding	Reviewed	Haramaya University	Under this program, major revision performed. • Content of each courses have been thoroughly reviewed to align with the current market demand. • **Four** new courses (Molecular breeding; Genomics and Bioinformatics; Plant Tissue Culture Techniques; and Academic and Scientific writing) have been included. • Content of **3 courses** (Genetics, Quantitative genetics and Plant Pathology) have been modified as per the current need of incorporating biotechnological tools in Plant Breeding. • To adjust the credit hours of newly added courses, few courses such as, Biochemistry, Current topics of Plant Breeding, and Cytogenetics have been deleted, however added as a chapter at appropriate places.
2. MSc in Plant Pathology	Review pending	Haramaya University	To be done
3. MSc in Agricultural Entomology	Review pending	Haramaya University	To be done
	Al-Quad Open University, Palestine		
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
1. BSc in Plant production and protection	Updated	Al-Quds Open University	In this program **1 new course** (Principles of Plant Breeding) has been added. This new course will be the part of plant production and protection program for BSc students. The aim of this course is learning the genetic and biological backgrounds of breeding. As well, learning the conventional and molecular methods in breeding to apply the breeding principles. Eventually, learning the positive impact of biotechnology application on plant breeding.
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
6.			
7.			
8.			
	Oda Bultum University		
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
1. MSc in Plant Breeding	New	Oda Bultum University	Under this program **5 courses** having direct relation with biotechnology and their application in plant breeding have been developed. The name of the courses included are:

			1) Germplasm and Seed Science Technology 2) Plant Genetic Transformation 3) Genomics and Bioinformatics 4) Molecular Plant Breeding 5) Plant Tissue Culture Technology
	An-Najah National University, Palestine		
Curriculum name	**New/updated/ Reviewed**	**Institution**	**Short description of change or development**
1. BSc in Agriculture Engineering	Updated	ANNU	In this program **2 course** were updated. 1. Technology for Crop Improvement: The course was developed by adding a module about biotechnology application in plant breeding including VR technology 2. Genetic Engineering: This course was updated by adding practical part to the theoretical part including VR technology

Defination and operationalization of terms

Curriculum: is the subjects comprising a course of study and standards-based sequence of planned experiences where students practice and achieve proficiency in content and applied learning in a degree programme

Programme: refers to a structured, organized and planned sequence of activities, courses, modules, or units of learning activities designed to achieve specific learning objectives or educational goals over a sustained period of defined time (2-4 years)

Course: is a unit of teaching that typically lasts one academic term is led by one or more instructors (lecturers/professors) and usually covers an individual subject with fixed sessions every week during the term (lessons or classes and students may receive a grade and academic credit after completion of the course.

1.0 Curriculum/Program/Courses Reviewed by Egerton University, Kenya under BREEDTECH Project

1.1 Doctor of Philosophy in Plant Breeding

1.1.1 Rationale

Development of crop cultivars in agricultural sector is rapidly changing with emerging use of both classical and molecular breeding technologies. This shift necessitates the transformation of education sector to train breeders ready to transform crop improvement practices using new techniques that are more efficient and precise to provide quality cultivars for growing population. The PhD training in Plant Breeding integrates applied genetics, molecular plant science and agricultural biotechnology. The graduates will thus broaden their scientific knowledge in crop improvement and promote professional development of different crop cultivars by providing well-founded knowledge and hands-on practical skills. The increasing demand for food, feed, fibre and biofuels requires that crop scientists keep pace with appropriate technologies. Stakeholders were involved in the development of the programme. They comprised alumni of Bachelor of Science in Agriculture, the Master of Science in Plant Breeding and Biotechnology, PhD in Plant Breeding and PhD in Biotechnology who are working in diverse settings comprising Higher Education Institutions (HEIs), Kenya Agricultural and Livestock Research Organization (KALRO), Consultative Group of International Agricultural Research (CGIAR) Centres, Ministry of Agriculture and Livestock Development and County Governments (CoGs). The aim of the programme it to train graduates with skills in both classical and modern technologies in addition to being well versed with research and emerging issues or technologies in Plant Breeding and genetics. By training a critical mass of competent plant breeders, the programme will contribute to the national agenda on food security, the African Union's Vision 2063 regional agenda and the United Nation's Sustainable Development Goals (SDGs) on zero hunger and development of human capacity.

1.1.2 Goal/objectives of Programme/curriculum/course

The purpose of the Doctor of Philosophy degree programme in plant breeding is to be a world class university programme for the advancement of humanity. The task of the programme is to train professional plant breeders for national and global development. The trained Plant Breeders will acquire knowledge and capacity to integrate in diverse settings comprising Higher Education Institutions (HEIs), agricultural research organisations, seed industry, seed regulatory authorities and agri-preneurship. The programme also aims at producing graduates with the highest level of knowledge and skills in plant breeding, molecular breeding and genetics and other related fields of crop science and also advanced level research culminating in effective and efficient performance, development and improvement of adapted crop cultivars of different key crop value chains in agricultural sector.

1.1.3 Admission requirements

Admission of students into this programme will follow the Egerton University Statute 41 (3) of 2023 and Egerton University Procedure for Admission and Registration of students DOC No. EU/AA/OP/03.

1.1.4 Course structure and duration

The Programme shall be administered by course work, examination and thesis as stipulated in the Egerton University Statute 41 of 2023.

1.1.5 Review we show what has been changed

The courses expected learning outcomes were redefined and aligned to course descriptions.
Cytogenetics and biotechnology were merged in PBRD 842
Programme Learning Outcomes (PLOs)
Upon successful completion of the training, the graduate of PhD in Plant breeding, should be able to:
PLO1: Execute advanced research knowledge, skills and competencies of the theory and practice in the field of plant breeding and plant genetics.
PLO2: Examine scientific information of advanced plant breeding and genetics research.
PLO3: Appraise appropriate innovations, technologies, mitigation measures and policies to address emerging issues in crop improvement to address food security
PLO4: Formulate plant breeding research or a breeding programme.
Change in course coding

a. PBRD 811 Advances in Applied Genetics and Plant Breeding
b. PBRD 842 Contemporary Issues in Molecular Plant Breeding
c. PBRD 824 Quantitative Analysis in Plant Breeding
d. PBRD 853 Seminars in Plant Breeding
e. PBRD 855 Independent Study in Plant Breeding
f. PBRD 866 Thesis

1.1.6 Examination requirements

All examinations for this programme shall be conducted in accordance with the examination regulation as stipulated in the Egerton University Statute 41 (6) of 2023.

1.1.7 Grading system

The grading of examination for this programme shall be conducted in accordance with Egerton University Statute 41 (6) of 2023.

1.1.8 Graduation requirements

A candidate shall be conferred the degree of Doctor of Philosophy in Plant Breeding in line with Egerton University Statute 41 (11) of 2023, a candidate shall be required to take and pass all scheduled courses within stipulated period.

1.1.9 Degree classification

The Doctor of Philosophy degree in Plant Breeding is not classified in accordance with Egerton University statutes Statute 41 of 2023.

1.2 Doctor of Philosophy in Crop Protection

1.2.1 Rationale

The Doctor of Philosophy (PhD) programme in crop protection takes cognizance of the fact that scientific research is a prerequisite for sustainable economic development. Egerton University as a premier centre for excellence in creating and disseminating knowledge especially in Agricultural Sciences, that is responsive to the current and emerging challenges in to crop protection. The programme development process recognized the value of key stakeholders and ensured that they were involved. The stakeholders involved included the alumni of the Doctor of Philosophy in Crop Protection and Doctor of Philosophy in Agronomy (Crop Protection Option) programmes, the Master of Science Degrees in Agronomy (Crop Protection Option) and Crop Protection Programmes who are working in various organizations that included Higher Education Institutions (HEIs), research organizations such as Kenya Agricultural and Livestock Research Organisation (KALRO) and peers in counterpart universities. The need for the Doctor of Philosophy Degree in Crop Protection is anchored on the emergence and resurgence of numerous native and transboundary pests and diseases such as the fall armyworm (FAW), maize lethal necrosis disease (MLND), the parasitic dodder plant and the desert locust among others. The programme will contribute to the national agenda on food security, the African Union's Vision 2063 regional agenda and the United Nation's Sustainable Development Goals (SDGs) on quality education, zero hunger, responsible production and consumption, industry and innovation for human development.

1.2.2 Goal/objectives of Programme/curriculum/course

The main objective of the programme is to contribute towards the development of human resource with high practical and conceptual skills through research, extension education, training, marketing and self-employment.

1.2.3 Admission requirements

The admission requirements for the Doctorate degree as specified in the Egerton University Statute 41(3) of 2023 shall apply.

1.2.4 Course structure and duration

The Programme shall be administered by course work, examination and thesis as stipulated in the Egerton University Statute 41 of 2023. The obligations of the learner, facilitator and institution shall be as appended below:

1.2.5 Examination requirements

The programme shall be examined in accordance with the examination regulation as stipulated in the Egerton University Statute 41 (6-12) of 2023.

1.2.6 Grading system

The grading of examination for this programme shall be conducted in accordance with Egerton University Statute 41(6) of 2023.

1.2.7 Graduation requirements

A candidate shall be required to take and pass all scheduled courses within the stipulated period, submit a thesis embodying the results of original research and publish at least two (2) papers from his/ her thesis in refereed journals as per Egerton University Statute 41(11).

1.2.8 Degree classification

The Doctor of Philosophy in Crop Protection is not classified in accordance with Egerton University Statute 41 of 2023.

1.2.9 Level of approval and Status of approval

The program has been submitted and approved by the board of postgraduate studies

1.2.10 Online link of the curriculum (if available)

https://www.egerton.ac.ke/a/guruPcategs/4

1.3 Doctor of Philosophy in Dryland Agriculture and Resource Management

1.3.1Rationale

The programme development process recognized the value of key stakeholders and ensured that they were involved. The stakeholders involved included the alumni of the Doctor of Philosophy in Dryland Agriculture and Resource Management, Doctor of Philosophy in Agronomy, Master of Science Degrees in Dryland Farming and Master of Science in Agronomy Programmes who are working in various organizations that included Higher Education Institutions (HEIs), research organizations such as Centre Consultative Group on International Agricultural Research (CGIAR), Kenya Agricultural Research and Livestock Organization (KALRO), peers in counterpart universities and National and County Governments. This program is designed after taking cognizance of the fact that and theoretical concepts and scientific research in Dryland Agriculture and Resource Management is a prerequisite for sustainable economic development of Arid and semi-arid lands (ASALs). The need for the Doctor of Philosophy Degree in Dryland Agriculture and Resource Management is anchored on the need to reposition crop production in response to climate variability and climate change and change in plant physio-biochemical processes given the dynamism in abiotic and biotic stressors and the need to enhance dryland resource-use efficiency especially soil and water, carbon sequestration in agroecosystems, global warming and climate change, socio-economic, environmental protection, new technologies and innovation and policy aspects in ASALs. The programme contributes to the national agenda on food security, the African Union's Vision 2063 regional agenda and the United Nation's Sustainable Development Goals (SDGs) on zero hunger (SDG 1), Climate Action (SDG 13), Quality Education (SDG 4) and Industry innovation and infrastructure (SGD 9).

1.3.2 Goal/objectives of Programme/curriculum/course

This programme aims to fill the human resource gap in agriculture by training graduates both in agriculture-related sciences and fundamentals of the professional agricultural disciplines mainly dryland agriculture, dryland resource management, crop science and Soil and water management. The trained Dryland agriculture and resource management experts will acquire

knowledge and capacity to integrate in diverse settings comprising universities, dryland agricultural research organizations, dryland seed industry and regulatory authorities and agri-preneurship. The programme equally aims at equipping graduates with the highest level of knowledge and skills necessary for pursuance of advanced degrees in dryland farming, livestock production systems, dryland agrobiodiversity conservation, dryland crop and pasture science and also advanced level research culminating in effective and efficient performance, development and improvement of different key crop and livestock chains in ASALs.

1.3.3 Programme Learning Outcomes

By the end of the course, the PhD graduate will be able to:

PLO1: Understand and interpret the advanced principles and practices of dryland agriculture and resource management zed skills and understanding in the field of dryland resource and management.

PLO2: Evaluate and critique scientific information, design and conduct advanced research and outreach in dryland resource and management.

PLO3: Appraise appropriate innovation, technologies and policies to address emerging challenges in dryland production system including food security, climate variability and development.

PLO4: Evaluate various dryland agriculture and resource management programmes for diverse crop, livestock and efficient resource use for increased productivity

PLO5: Design sustainable dryland agriculture and resource management programme for diverse crop, livestock and efficient resource use of economic importance in stress environments

1.3.4 Admission requirements

The admission requirements for the Doctorate degree as specified in the Egerton University Statute 41(3) of 2023 shall apply.

1.3.5 Course structure and duration

The Programme shall be administered by course work, examination and thesis as stipulated in the Egerton University Statute 41 of 2023.

1.3.6 Examination requirements

The programme shall be examined in accordance with the examination regulation as stipulated in the Egerton University Statute 41 (6-12) of 2023.

1.3.7 Grading system

The grading of examination for this programme shall be conducted in accordance with Egerton University Statute 41(6) of 2023.

1.3.8 Graduation requirements

A candidate shall be required to take and pass all scheduled courses within the stipulated period, submit a thesis embodying the results of original research and publish at least two (2) papers from his/ her thesis in refereed journals as per Egerton University Statute 41(11).

1.3.9 Degree classification

The Doctor of Philosophy in Dryland Agriculture and Resource Management is not classified in accordance with Egerton University statutes Statute 41 of 2023.

1.3.10 Level of approval and Status of approval

The program has been submitted and approved by the board of postgraduate studies

1.3.11 Online link of the curriculum

https://www.egerton.ac.ke/a/gurupcategs/4-doctorate

1.4 Doctor of Philosophy in Plant Biotechnology

1.4.1 Rationale

Biotechnology is a discipline that integrates diverse sciences to serve many critical purposes in life science including recent advances in plant tissue culture and regeneration, protoplast isolation and fusion, somaclonal variation, genetic engineering, Hybridization techniques, Bio-Analytical Tools and Techniques in Biotechnology, Advances and Applications of Plant Biotechnology and cytogenetics and Gene expression of transgenic plant traits and the stability of engineered crops. The degree of Doctor of Philosophy in plant biotechnology shall represent the attainment of a high level of scholarship and achievement in independent research. This level of training shall grant candidates ample opportunity and time to conduct meaningful research on recalcitrant issues in plant biotechnology. Developing countries need to boost training initiatives so as to contribute to the advancement of plant biotechnologies appropriate to their regions and the world at large.

1.4.2 Goal/objectives of Programme/curriculum/course

The purpose of the Doctor of Philosophy degree programme in plant breeding is to be a world class university programme for the advancement of humanity. The task of the programme is to train professional plant breeders for national and global development. The trained Plant Breeders will acquire knowledge and capacity to integrate in diverse settings comprising Higher Education Institutions (HEIs), agricultural research organisations, seed industry, seed regulatory authorities and agri-preneurship. The programme also aims at producing graduates with the highest level of knowledge and skills in plant breeding, molecular breeding and genetics and other related fields of crop science and also advanced level research culminating in effective and efficient performance, development and improvement of adapted crop cultivars of different key crop value chains in agricultural sector.

1.4.3 Admission requirements

Admission of students into this programme will follow the Egerton University Statute 41 (3) of 2023 and Egerton University Procedure for Admission and Registration of students DOC No. EU/AA/OP/03.

1.4.4 Course structure and duration

The Programme shall be administered by course work, examination and thesis as stipulated in the Egerton University Statute 41 of 2023.

1.4.5 Programme Learning Outcomes (PLOs)

Upon successful completion of the training, the graduate of PhD in Plant biortechnology, should be able to:

PLO 1: Appraise the current international and national agricultural policies and emerging issues in plant biotechnology
PLO 2: Execute advanced research by applying appropriate research methodologies in data acquisition, analysis, packaging and presentation
PLO 3: Demonstrate holistic research capacity for translating research outcomes into a viable commercial venture to exploit the potentials of high-value plants;
PLO 4: Conduct and manage plant biotechnology projects and enterprises as a team or individually and ensure biosafety and bioethics in modern plant biotechnology.

2. Change in course coding to reflect plant biotechnology courses

1.4.6 Examination requirements

All examinations for this programme shall be conducted in accordance with the examination regulation as stipulated in the Egerton University Statute 41 (6) of 2023.

1.4.7 Grading system

The grading of examination for this programme shall be conducted in accordance with Egerton University Statute 41 (6) of 2023.

1.4.8 Graduation requirements

A candidate shall be conferred the degree of Doctor of Philosophy in Plant Breeding in line with Egerton University Statute 41 (11) of 2023, a candidate shall be required to take and pass all scheduled courses within stipulated period.

1.4.9 Degree classification

The Doctor of Philosophy degree in Plant Biotechnology is not classified in accordance with Egerton University statutes Statute 41 of 2023.

1.4.10 Level of approval/Status of approval at Egerton University

The programs were approved by the Department and submitted to Board of Post graduate School which were approved. The programs are awaiting Senate and Commission of University University (CUE) approval in 2025-2026.

1.4.11 Online link of the curriculum

https://www.egerton.ac.ke/a/gurupcategs/4-doctorate
Additional information links;
Egerton University Statutes 2023
https://www.egerton.ac.ke/images/egerton_university/downloads/staff/EU_Statutes_2023/Egerton_University_Statutes_2023.pdf

2.1. Doctor of Philosophy in Plant Pathology

2.1.1 Rationale

Accurate and timely diagnosis of crop pests and diseases is the key to improved crop production. The application of the up-to-date knowledge, skills and technologies are required in disease diagnosis and management. Key stakeholders that will benefit from PhD in Plant Pathology includes Agricultural Research organization like Kenya Agricultural and Livestock Research Organization (KALRO) and Kenya Plant Health Inspectorate Service (KEPHIS), Ministry of Agriculture, seed companies, private firms/farms, non-governmental organisations (NGOs), and farmers, which require individuals with enough expertise for diagnosis of plant diseases and advanced knowledge in identification and characterization of plant pathogens. The courses offered in this programme shall impart knowledge, skills and attitudes critical in training Plant Pathologists. Kenya's economy being agriculture based requires more trained Plant Pathologists to deal with the problem of perennial food deficits occasioned by plant disease epidemics in the wake of climate change and its effects, to realize the Vision 2030 National goal of food security.

2.1.2 Goal/objectives of Programme/curriculum/course

The PhD programme in Plant Pathology is intended to produce graduates with advanced knowledge and relevant skills in plant disease diagnostics, monitoring and innovative management of emerging and re-emerging plant diseases for sustainable crop production and improved food safety. The graduates are intended to serve as lecturers, research scientists, managers of companies; and directors of institutions and departments. Some are supposed to play a pivital role in private practice and as policy makers on matters of Plant Health.

2.1.3 Admission requirements for the Proposed Programme

Applicants must be holders of a Master's degree in Plant Pathology, Crop protection, Microbiology or its equivalent (as shall be determined by the senate) in a relevant field from Laikipia University or any other recognised institution of higher learning.

2.1.4 Course structure and duration

This program should take a minimum of 3 academic years and a maximum of 4 years.
Credit factors =96 and a minimum of 1920 lecture/ contact hours.
The academic year consists of two-semesters; each academic semester consists of 15 weeks.
The PhD degree in Plant Pathology shall be by Course Work and Thesis Examination.

2.1.5 Course Structure

Required Courses	32.0 CF
Thesis	64.0 CF
Total	96.0 CF

YEAR 1 SEMESTER 1

CODE	TITLE	L	P	CF
PPAT 911	Pathogenesis and Host Plant Resistance	60	0	4.0
PPAT 912	Physiological and Molecular Plant Pathology	60	0	4.0
PPAT 913	Epidemiology, modelling, and forecasting of Plant Diseases	60	0	4.0
PPAT 914	Scientific communication and publishing	60	0	4.0
TOTAL		240	0	16.0

Core Courses

YEAR 1 SEMESTER 2

CODE	TITLE	L	P	CF
PPAT 921	Advanced Integrated Plant Pathology	60	0	4.0
PPAT 922	Emerging Trends in Plant Pathology	60	0	4.0
PPAT 923	Practical in Plant Pathology	0	120	4.0
PPAT 924	Biometrics and Informatics	60	0	4.0
TOTAL		180	120	16.0

YEAR 2 and 3

CODE	TITLE	L	P	CF
PPAT 926	Thesis	0	1920	64

Total Requirements not less than 96.0 credits factors

2.1.6 Examination Regulations

The common regulations for examination for the university shall apply.

2.1.7 Grading System

The PhD programme is not graded. However, the pass mark is 50%.

2.1.8 Graduation Requirement

General university graduation requirements and CUE criteria shall apply

2.1.9 Classification of Degrees

The Doctor of Philosophy degree in Plant Pathology is not to be classified.

2.1.10 Level of approval/Status of approval:

Commission of University

2.2 Master of Science in Plant Pathology

2.2.1 Rationale

Keeping plants healthy requires an understanding of the organisms and agents that cause disease, their management as well as how plants grow and are affected by disease. The

courses offered in this programme impart knowledge, skills and attitudes critical in training Plant Doctors or Plant Pathologists. Kenya's economy being agriculture based requires more trained Plant Pathologists to deal with the problem of perennial food deficits and to realize the Vision 2030 National goals.

2.2.2 Goal/objectives of Programme/curriculum/course

The Master of Science in Plant Pathology Programme trains skilled Plant Pathologists also known as Plant Doctors. The graduates are intended to serve as lecturers, research scientists, managers of companies; and directors of institutions and departments. Some are supposed to play a vital role in private practice and as policy makers on matters of Plant Health.

2.2.3 Admission requirements

Applicants should be holders of B.Sc (Botany, Zoology) or B.Ed (Botany, Zoology), or related disciplines with a minimum of Second Class Honours upper division from any recognized University. Under special circumstances and based on other University requirements, candidates with Second Class Honours lower division with two-year relevant working experience shall be considered.

2.2.4 Course structure and duration

This program should take a minimum of 2 academic years and a maximum of 4 years. Credit factors=53 and a minimum of 795 lecture/ contact hours.
The academic year consists of tri-semesters; each academic semester consists of 15 weeks
The master's degree in Plant Pathology shall be by Course Work and Thesis Examination.

2.2.5 Course Structure

Required Courses	31.5 CF
Elective Courses (Atleast two units)	6.5 CF
Thesis	15.0 CF
Total	53.0 CF

YEAR 1 SEMESTER 1

CODE	TITLE	L	P	CF
PPAT 811	Principles of Plant Pathology	30	30	3.0
PPAT 812	Plant Virology	30	45	3.5
PPAT 813	Plant Mycology	30	45	3.5
PPAT 814	Plant Bacteriology	30	45	3.5
PPAT 815	Soil -Borne Plant Pathogens	30	30	3.0
TOTAL		**150**	**195**	**16.5**

YEAR 1 SEMESTER 2

CODE	TITLE	L	P	CF
PPAT 821	Research Methods and Scientific communication	30	30	3.0
PPAT 822	Physiology of Plant Health and Disease	45	0	3.0
PPAT 823	Plant Nematology	30	30	3.0
PPAT 824	Breeding Crop Plants for	45	0	3.0

	Disease Resistance			
PPAT 827	Biometrics and Informatics	45	0	3.0
TOTAL		**150**	**60**	**15.0**

2.2.6 Electives Courses

Students are guided in selection of two optional courses based on interest/ minimum class size or National manpower requirements; one each semester.

CODE	TITLE	L	P	CF
PPAT 816	Detection and Diagnosis of Plant Diseases.	30	45	3.5
PPAT 817	Chemicals in Plant Disease Management	30	45	3.5
PPAT 825	Advances in Virology	30	30	3.0
PPAT 826	Epidemiology, Modelling and Control of Plant Disease	30	3.0	3.0

YEAR 2

CODE	TITLE	L	P	CF
PPAT 828	Thesis	0	450	15.0

Total Requirements not less than 53.0 credits factors

2.2.7 Examination Regulations

The common regulations for examination for the university shall apply.

2.2.8 Grading System

The grading system shall follow the guidelines provided for in the post graduate policy on examinations as listed below. Pass mark is 50%

Percentage Level	GRADE	Remark
70% and above	A	Distinction
60-69%	B	Credit
50-59%	C	Pass
49% and below	D	Fail

2.2.9 Graduation requirements

General university graduation requirements and CUE criteria shall apply

2.2.10 Degree classification

The Master of Science in Plant Pathology degree is not to be classified.

2.2.11 Level of approval/Status of approval:

Commission of University Education

2.3 Master of science in Molecular Biology and Biotechnology

2.3.1 Rationale

Globally there is increase in emerging and reemergence of human, animal and plant pathogens and other stressors which are devastating health systems and decreasing food security. Deployment of available molecular tools has successfully mitigated some of these problems. For example, Biotechnological products such as insulin, immune proteins and vaccines among others have been used to combat diverse medical conditions including the Covid 19 pandemic among others. Pending and new scientific and technological challenges in life, medical, agricultural, legal and pharmaceutical areas among others will require advanced molecular technologies such as gene editing whose development and proper deployment requires highly trained personnel. This course is therefore designed in line with stakeholder's recommendations to enable graduates to effectively contribute to these advancements and solutions. In particular graduates will contribute to the achievement of Kenya National development agenda (Kenya's Vision 2030) and sustainable agriculture and improved nutrition (Sustainable Development Goal (SDG) 2); tackling of communicable and non-communicable disease (SDG 3); quality education (SDG 4); mitigation of environmental degradation (SDG 12) and restoration of biodiversity (SDG 15).

2.3.2 Goal/objectives of Programme/curriculum/course

Masters of Science in Molecular Biology and Biotechnology intends to train and equip learners with cutting edge knowledge and skills in molecular biology and biotechnology. The programme is intended to equip learners with critical thinking and evaluation skills that would empower them with competency to effectively contribute to research aimed at understanding mechanisms of life, advancements in medicine and healthcare, biotechnology and industrial applications, evolutionary and ecological insights and fundamental research and scientific discoveries, besides, teaching at tertiary learning institutions and advancing in post graduate studies among others.

2.3.3 Admission requirements

To be eligible for admission, candidates must satisfy the minimum entry requirements as set out by Laikipia University Statutes and Students admission and records policy. In addition, candidates must have passed in a relevant specialty in life and biomedical sciences with a first class or second-class upper division or its equivalent at undergraduate or; a second-class lower division with evidenced relevant research experience orany other qualifications accepted by Laikipia University Senate as equivalent.

2.3.4 Course structure and duration

This program should take a minimum of 2 academic years and a maximum of 4 years.
Credit factors=54 and a minimum of 810 lecture/ contact hours.
The academic year consists of tri-semesters; each academic semester consists of 15 weeks
The master's degree in Plant Pathology shall be by Course Work and Thesis Examination

Option I: Animal molecular biology and biotechnology

Year 1 Semester 1

Course Code	Course Title	L	P	CF
MBIO 811	Cell and Cancer Biology	30	30	3.0
MBIO 813	Molecular Biology	45	0	3.0
MBIO 814	Cellular Metabolism	45	0	3.0
MBIO 816	Molecular Microbiology	30	30	3.0

MBIO 817	Molecular Techniques I	30	30	3.0
MBIO 818	Bioinformatics	30	30	3.0
MBIO 819	Biostatistics and Research Methods	30	30	3.0
Total		**240**	**150**	**21.0**

Year1 Semester 2

Course Code	Course Title	L	P	CF
MBIO 823	Molecular Protozoology	30	30	3.0
MBIO 824	Molecular Virology	30	30	3.0
MBIO 825	Molecular Immunology	30	30	3.0
MBIO 827	Molecular Techniques II	30	30	3.0
MBIO 828	Genetics and molecular Breeding	30	30	3.0
MBIO 829	Drug Discovery and Biopharmaceuticals	30	30	3.0
Total		**180**	**180**	**18**

Option II: Plant molecular biology and biotechnology

Year 1 Semester 1

Course Code	Course Title	L	P	CF
MBIO 812	Developmental Anatomy and Physiology	45	0	3.0
MBIO 813	Molecular Biology	45	0	3.0
MBIO 814	Cellular Metabolism	45	0	3.0
MBIO 815	Phytochemistry and natural products	30	30	3.0
MBIO 817	Molecular Techniques I	30	30	3.0
MBIO 818	Bioinformatics	30	30	3.0
MBIO 819	Biostatistics and Research Methods	30	30	3.0
Total		**255**	**120**	**21.0**

Year 1 Semester 2

Course Code	Course Title	L	P	CF
MBIO 821	Ecophysiology	30	30	3.0
MBIO 822	Plant Molecular Microbiology	30	30	3.0
MBIO 826	Plant Immunity	30	30	3.0
MBIO 827	Molecular Techniques II	30	30	3.0
MBIO 828	Genetics and molecular Breeding	30	30	3.0
MBIO 829	Drug Discovery and Biopharmaceuticals	45	0	3.0
Total		**195**	**150**	**18**

Year 2

Course Code	Course Title	L	P	CF
MBIO 801	Thesis research	0	240	15
Total		**0**	**240**	**15.0**

2.3.5 Examination Regulations

The common regulations for examination for the university shall apply.

2.3.6 Grading System

The grading system shall follow the guidelines provided for in the post graduate policy on examinations as listed below. Pass mark is 50%

Percentage Level	GRADE	Remark
70% and above	A	Distinction
60-69%	B	Credit
50-59%	C	Pass
49% and below	D	Fail

2.3.7 Graduation requirements

General university graduation requirements and CUE criteria shall apply

2.3.8 Degree classification

The Master of Science in Plant Pathology degree is not to be classified.

2.3.9 Level of approval/Status of approval

Commission of University Education

2.4 Bachelor of Science in Molecular Biology and Biotechnology

2.4.1 Rationale

In a bid to achieve the Sustainable Development Goals (SDGs) and the Vision 2030 Agenda, there has been recent technological advancements, which have resulted in the need for experts to pioneer new frontiers through research and development in disease diagnosis, detection, imaging, therapy, drug delivery, gene therapy, cell transplantation and tissue engineering, food processing and packaging and in biopharmaceuticals. This programme, which has been developed in consultations with diverse stakeholders, will contribute to the achievement of SDGs (zero hunger - SDG 2, good health and well-being - SDG 3, quality education - SDG 4, clean water and sanitation - SDG 6, industry, innovation and infrastructure - SDG 9 and responsible consumption and production - SDG 12 and the Vision 2030 Agenda on science, technology and innovation, agriculture, manufacturing, and education and training by providing technical knowhow and support to national and international workforce of the future.

2.4.2 Goal/objectives of Programme/curriculum/course

The Bachelor of Science in Molecular Biology and Biotechnology aims to produce graduates with skills and knowledge to take on appropriate professional positions in industry, research and institutions of higher learning and/or pursue graduate studies in the field. The curriculum encourages the student to acquire the important skills of self-directed learning, problem solving and effective communication. In addition, the curriculum will trigger learners to be adaptable and creative.

2.4.3 Admission requirements

Laikipia University's regulations and requirements (section 1.3.1) for Bachelor's degrees shall apply. Applicants must have a mean grade of C+ (plus) with at least C+ (plus) in Biology/Biological Sciences and Chemistry and minimum of grade C (plain) in Physics or Mathematics.

2.4.4 Course structure and duration

This program shall take a minimum of 4 academic years and a maximum of 6 years, credit factors = 152; 2280 contact hours.

YEAR ONE

CODE	TITLE	L	P	CF
Semester One				
MATH 111	General Mathematics	45	0	3.0
BIOT 111	Introduction to Biotechnology	45	0	3.0
BIOT 112	Fundamentals of Botany	30	30	3.0
BIOT 113	Fundamentals of Zoology	30	30	3.0
BIOT 114	Bioinorganic Chemistry	30	30	3.0
BIOT 115	Biophysical Chemistry	45	0	3.0
BIOT 116	Scientific Communication	45	0	3.0
Semester Two				
STAT 111	Introductory Biostatistics	45	0	3.0
BIOT 121	Microbiology	30	30	3.0
BIOT 122	Bioorganic Chemistry	30	30	3.0
BIOT 123	Physics for Biologists	30	30	3.0
BIOT 124	Cell Biology and Genetics	30	30	3.0
BIOT 125	Bioethics	45	0	3.0
				39.0

YEAR TWO

CODE	TITLE	L	P	CF
Semester One				
BIOT 211	Biomolecules	45	0	3.0
BIOT 212	Enzymology	45	0	3.0
BIOT 213	Molecular Virology	45	0	3.0
BIOT 214	Molecular Protozoology	45	0	3.0
BIOT 215	Molecular Mycology	45	0	3.0
BIOT 216	Molecular Nematology	45	0	3.0
BIOT 217	Biotechnology Techniques	0	90	3.0
Semester Two				
BIOT 221	Metabolism	45	0	3.0
BIOT 222	Molecular Biology	45	0	3.0
BIOT 223	Plant Anatomy and Physiology	30	30	3.0
BIOT 224	Animal Anatomy and Physiology	30	30	3.0
BIOT 225	Plant Pathology and Immunity	30	30	3.0
BIOT 226	Microbial Physiology	30	30	3.0
BIOT 227	Molecular Techniques	30	30	3.0
				42.0

YEAR THREE

CODE	TITLE	L	P	CF
Semester One				
BIOT 311	Developmental Biology	30	30	3.0
BIOT 312	Hormones	30	30	3.0
BIOT 313	Immunology	30	30	3.0
BIOT 314	Microbial Biotechnology	30	30	3.0
BIOT 315	Drug Design and Biopharmaceutics	45	0	3.0
BIOT 316	Biometrics	45	0	3.0
Semester Two				
BIOT 321	Crop Biotechnology	30	30	3.0

BIOT 322	Insect Biotechnology	30	30	3.0
BIOT 323	Food Biotechnology	30	30	3.0
BIOT 324	Agrochemical Biotechnology	45	0	3.0
BIOT 325	Biotechnology in Animal Production	45	0	3.0
BIOT 326	Research Methods and Seminars	45	0	3.0
				36.0

YEAR FOUR

CODE	TITLE	L	P	CF
Semester One				
BIOT 411	Bioinformatics	30	30	3.0
BIOT 412	Nanobiotechnology	30	30	3.0
BIOT 413	Plant and Animal Tissue Culture	30	30	3.0
BIOT 414	Phytochemistry and Natural Products	30	30	3.0
BIOT 415	Toxicology and Pathology	30	30	3.0
BIOT 416	Research Project 1	0	60	2.0
Semester Two				
BIOT 421	Environmental Biotechnology	45	0	3.0
BIOT 422	Standardization in Biotechnology	45	0	3.0
BIOT 423	Biosecurity	45	0	3.0
BIOT 424	Entrepreneurship for Biotechnology	45	0	3.0
BIOT 425	Research Project 2	0	60	2.0
BIOT 426	Industrial Attachment	0	120	4.0
				35.0

2.4.5 Examination Regulations

The common regulations for examination for the university shall apply.

2.4.6 Grading System

The PhD programme is not graded. However, the pass mark is 50%.

2.4.7 Graduation requirements

General university graduation requirements and CUE criteria shall apply

2.4.8 Degree classification

The Bachelor of Science in Molecular Biology and Biotechnology degree shall be classified as follows:

Classification	Percentage Level	Grade
First Class	70% and above	A
Upper Second Class	60-69%	B
Lower Second Class	50-59%	C
Pass	40-49%	D
Fail	Below 40%	Fail

2.4.9 Level of approval/Status of approval

Commission of University

2.5 BSc in Dryland Resource Management (BSc in DREM).

2.5.1 Rationale

A self-assessment of the existing curriculum exposed some gaps in the curriculum that necessitated a review to include recommendations from the department, school, and other key stakeholders, including the students who had gone through the four-year programme, and potential employers.

2.5.2 Justification of the need for the programme

Kenya is endowed with a variety of productive Dryland resources in the form of both terrestrial and aquatic ecosystems. Sustainable exploitation of these dryland resources is essential for the economic, political, and social development of the country. In addition, efficient management of dryland resources would help in mitigating the negative effects of climate change. Therefore, this curriculum is intended to produce graduates equipped with requisite up-to-date knowledge and skills on sustainable use and conservation of dryland resources for Kenya's prosperity.

2.5.3 Goal/objectives of Programme/curriculum/course

The BSc in DREM is intended to produce graduates equipped with relevant knowledge and skills on how to exploit and utilize dryland resources sustainably. The graduates of the programme are, therefore, expected to be proficient in a variety of settings, which should include management skills and techniques.

2.5.4 Admission requirements for the Proposed Programme

To be eligible for admission into the BSc. DREM, applicants must have:

a) Either Kenya Certificate of Secondary Education (KCSE) with a mean grade of C+ with at least C+ (plus) in Biology or B- in Biological Sciences and a least a C in Geography, Chemistry or Mathematics at K.C.S.E. or equivalent examinations.
b) Or Kenya Advanced Certificate of Education or its equivalent with two (2) Principal passes obtained at the same sitting;
c) Or Kenya Advanced Certificate of Education or its equivalent with two (2) Principal passes obtained at different sittings provided the passes are of grade C or higher;
d) Or holds a Diploma and has passed with "Credit" and above or equivalent in Range Management, Forestry, Wildlife management, and other related fields recognized by the University Senate
e) Or any other qualification acceptable by the University Senate.

AND

f) Meet additional entry requirements as may be specified by Kenya Universities and Colleges Central Placement Board (KUCCPS) and/or the respective Department, School, or Institute.

2.5.5 Course structure and duration

a) The duration of the program shall normally be four academic years unless the Senate on the recommendation of the faculty board approves exemption.
b) Course Structure: Students shall be expected to undertake the DREM courses, the basic supportive courses on offer as well as the university core course. In addition to the normal semesters, there are industrial attachment programmes at selected industrial or educational establishments. The programme is at the end of the third year.

2.5.6 Schedule of Course

Year 1 Semester 1

Code	Title	L	P	C.F.
DREM 112	Botany of Dry Land Plants	30	30	3.0
DREM 113	Introduction to Dry Land Resources.	45	0	3.0
DREM 114	Introduction to Animal Science	30	30	3.0
DREM 115	Introduction to resource economics	45	0	3.0
CHEM 113	Fundamentals of Chemistry	30	30	3.0
COMS 111	Communication Skills	45	0	3.0
ZOOL 113	General Zoology	30	30	3.0
Total		**255**	**120**	**21.0**

Year 1 Semester 2

Code	Title	L	P	C.F.
DREM 121	Principles of Crop Production	30	30	3.0
DREM 122	Introduction to Soil Science	30	30	3.0
DREM 123	Principles of Rangeland Management	30	30	3.0
BOTA 122	General Microbiology	30	30	3.0
COMP 111	Introduction to Computer Applications	30	30	3.0
HURI 111	Human Rights	45	0	3.0
SOCI 113	Rural Sociology	45	0	3.0
Total		**240**	**150**	**21.0**

Year 2 Semester 1

Code	Title	L	P	C.F.
DREM 211	Principles of Wildlife Management	45	0	3.0
DREM 212	Anatomy and Physiology of Farm Animals	30	30	3.0
DREM 213	Integrated Water Resource Management	30	30	3.0
DREM 214	Conservation Ecology of Drylands	45	0	3.0
BOTA 112	General Genetics	30	30	3.0
GEOG 215	Introduction to Geology	30	30	3.0
Total		**210**	**120**	**18.0**

Year 2 Semester 2

Code	Title	L	P	C.F.
DREM 221	Community Development	45	0	3.0
DREM 222	Dryland Agriculture and Food Security	30	30	3.0
DREM 223	Organizational Theory and Practices	45	0	3.0
DREM 224	Pastoralism	45		3.0
DREM 225	Biostatics	45	0	3.0
DREM 226	Quantitative Genetics and Animal Breeding	30	30	3.0
BOTA 222	Plant Physiology I	30	30	3.0
Total		**270**	**90**	**21.0**

Year 3 semester 1

Code	Title	L	P	C.F.
DREM 311	Ruminant Production	30	30	3.0
DREM 312	Research Methods for Natural Resource Management and report writing	45	0	3.0

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DREM 313	Renewable Energy Systems	45	0	3.0
DREM 314	Geology and Mineralogy	30	30	3.0
DREM 315	Soil fertility and Plant Nutrition	30	30	3.0
DREM 316	Participatory Approaches in Extension Services	45	0	3.0
Total		**225**	**90**	**18.0**

Year 3 Semester 2

Code	Title	L	P	C.F.
DREM 321	Apiculture and Sericulture	30	30	3.0
DREM 322	Ecotourism and Wildlife Conservancies	45	0	3.0
DREM 323	Climate Science: Adaptation and Mitigation	30	30	3.0
DREM 324	Land Degradation and Rehabilitation in Drylands	45	0	3.0
DREM 325	Animal Nutrition and Livestock Feeding	30	30	3.0
BOTA 321	Plant Breeding and Biotechnology	30	30	3.0
Total		**210**	**120**	**18.0**

Year 4 Semester 1

Code	Title	L	P	C.F.
DREM 411	Entrepreneurship Skills in Natural Resource Management	45	0	3.0
DREM 412	Grazing Management	30	30	3.0
DREM 413	Application of ICT in Natural Resource Management	30	30	3.0
DREM 414	Non ruminant Production	30	30	3.0
DREM 415	Natural Resource: Conflict and Management	45	0	3.0
DREM 416	Project planning, Monitoring, and Evaluation	45	0	3.0
Total		**225**	**90**	**18.0**

Year 4 Semester 2

Code	TITLE	L	P	C.F.
DREM 421	Livestock Handling and Routine Management	30	30	3.0
DREM 422	Gender and Social Inclusion in Dry land	45	0	3.0
DREM 423	Animal Diseases	30	30	3.0
ENSC 423	Environmental Impact Assessment and Audit	30	30	3.0
DREM 424	Natural Resources Policies and Laws	45	0	3.0
DREM 425	Research Project for Dryland Resources	15	60	3.0
Total	**Totals**	**19**	**150**	**18.0**
DREM 426	Industrial Attachment	0	120	4.0

2.5.7 Examination Regulations

The common regulations for examination for the university shall apply.

2.5.8 Grading System

Each course shall be graded as follows

GRADE	Percentage Level	GPA
A	70% and above	4.0
B	60-69%	3.0
C	50-59%	2.0
D	40-49%	1.0
F	0-39%	0.0

2.5.9 Graduation Requirement

General university graduation requirements and CUE criteria shall apply

2.5.10 Classification of Degrees

Classification	Percentage Level	Grade
First Class	70% and above	A
Upper Second Class	60-69%	B
Lower Second Class	50-59%	C
Pass	40-49%	D
Fail	Below 40%	Fail

2.5.11 Level of approval/Status of approval

Commission of University

3.0 Curriculum/Program/Courses Reviewed by Haramaya University, Ethiopia under BREEDTECH Project

3.1 Masters of Science in Plant Breeding

3.1.1 Rationale

Food security remains a critical issue across the world including in Ethiopia. Frequent drought and uncertain rainfall became the major problem in crop production and productivity. Therefore, improved crop varieties have been adapted to the existing and changing environment that had immense contribution in Ethiopian agriculture, and productivity has increase substantially in last decades. However, there is still scope to further improve production and productivity. To do so, highly qualified/skilled plant breeders in sufficient number are required in the country. Haramaya University is the pioneer institute of higher learning in agricultural and rural development sector in Ethiopia, where the Plant Breeding program of School of Plant Sciences is one of the oldest programs. Almost all the Universities, public, national and international research organizations, policy makers, and NGOs like to hire graduates of Harmaya University because of the knowledge and experience they are receiving during their study and research. In view of the above need and demand, the MSc program in Plant Breeding requires through revision of curriculum to satisfy the employer's need and to make the graduates more competent to the international market. Finally, in collaboration with the EU's BREEDTECH initiative, the curriculum of Plant Breeding at Haramaya University has been revised and four new courses; Molecular Breeding, Genomics and Bioinformatics, Plant Tissue Culture Techniques, and Academic and Scientific writing have been included. The major revisions that have been made are: refining the course load, inclusion of more relevant and current courses or topics directly related to the professional and graduate profiles of the students, proper description of the courses to avoid redundancy, inclusion of theoretical and laboratory/practical aspects in the description of the courses and collaborative course offerings.

3.1.2 Goal/objectives of Programme/curriculum/course

- To impart academic and research teaching at post graduate level and educate future generation of plant breeders
- To have massive human capacity building and alleviate skilled human resource in the country
- To plan and conduct research that encourages a multi-disciplinary team orientation, and fosters educational goals of relevance, quality and impact at the Ethiopian and east African level.

3.1.3 Admission requirements

- Applicants graduated with Bachelor of Science (BSc) degree in Plant Sciences, Horticulture, Crop Production, Biology, Biotechnology or related fields from a nationally and internationally known university;
-

- Applicants requesting for admission from fields other than Plant, Crop, Horticulture and Seed Science required to take bridging courses or additional courses to compensate for the deficiencies as per the recommendation of Graduate Council of School of Plant Science (SGC) and approved by Postgraduate Program Council (PGPC) of the Haramaya University.
- Must take and pass the National Graduate Admission Test (NGAT) administered by the Ministry of Education.
- Must pass an entrance exam given by the department, which will be based on the background of the program.
- Two letters of recommendation, preferably from the applicant's undergraduate instructors, employers, or professional associations.
- A letter indicating sponsorship for their research work or sign an agreement if self-sponsored.

3.1.4 Course structure and duration

The regular program requires two years of study, consisting of four semesters. The first two semesters will be dedicated to coursework, while the last two semesters will focus on research and Thesis writing. Under certain cases, the study may be extended for one year based on the judgement of the School Graduate Council (SGC) and the final approval ofthe Postgraduate Program Council (PGPC) of the Haramaya University.

3.1.5 What has been changed

The course outline for the all the courses have thoroughly been revised based on the market demands and advancement of the research techniques. Four new courses have been included in the revised curriculum of MSc in Plant Breeding.

1. Molecular Plant Breeding
2. Genomics and Bioinformatics,
3. Plant Tissue Culture Techniques
4. Academic and Scientific writing

3.1.6 Assessment and evaluation

Students will be evaluated through written examinations, participation in practicals, laboratories/tutorials, various presentations, and term papers, depending on the nature of the courses. Research work, compiled into a thesis, will be supervised by a major advisor and a co-advisor. Additionally, progress in research work will be evaluated at the end of each semester. Student performance will be assessed using numerical grades; and then converted into letter grades.

3.1.7 Grading system

Grading is carried out by a fixed scale grading system based on the legislation of OBU and MoE as described below

Row mark range	Letter grade	Grade points

[> 90	A+	4.00
[85,90)	A	4.00
[80,85)	A-	3.75
[75,80)	B+	3.50
[70,75)	B	3.00
[65,70)	B-	2.75
[60,65)	C+	2.50
[50,60)	C	2.00

3.1.8 Graduation requirements

To be eligible for graduation, all the candidates in the program must fulfil the following requirements:

i. A minimum of 35 and 34 credit hours of coursework with no 'F' grade in any course taken as well as not more than one 'C'or two 'C+';
ii. Six credit hours of research work on which a thesis is written and defended successfully; and
iii. A Minimum Cumulative Grade Point Average (CGPA) of 3.00 out of the maximum 4.0 grading scale.

3.1.9 Degree classification

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

- English: **Master of Science Degree in Plant Breeding**
- Amharic version: **ማስተርስኦፍሳይንስበፕላንትብሪዲንግ**

3.1.10 Level of approval/Status of approval

The MSc in Plant Breeding at Harmaya University is one among old programs which is running since more than two decades. All the revision mentioned above has been approved at Program and School level, however pending at College and Senate level. The piloting of the program is ongoing while the curriculum is under revision.

4.0 Curriculum/Program/Courses Reviewed by Oda Bultum University, Ethiopia under BREEDTECH Project

4.1 Masters of Science in Plant Breeding

4.1.1 Rationale

Plant breeding is vital for global food security, enabling the development of resilient, high-yield crop varieties that address challenges such as population growth, climate change, and malnutrition. Ethiopia, a hub of crop diversity, contributes significantly to agricultural production but faces critical gaps: a shortage of skilled plant breeders, limited resources, and climate impacts (e.g., erratic rainfall, pests) threaten food self-sufficiency. Rapid population growth and rising food demand further exacerbate these challenges, necessitating advanced breeding technologies and trained professionals.

Oda Bultum University (OBU) addresses this gap through its MSc in Plant Breeding, integrating modern tools like marker-assisted breeding, gene editing, and bioinformatics. The program responds to urgent needs identified in a university-led survey, where 88.5% of stakeholders highlighted demand for specialists to enhance crop productivity, particularly for smallholder farmers. Ethiopia's growing foreign seed-sector investments and entrepreneurial agricultural opportunities further amplify this demand.

Developed in collaboration with the EU's BREEDTECH initiative, the curriculum combines classical and molecular breeding disciplines, including five new courses: Molecular Plant Breeding, Plant Tissue Culture Technology, Plant Genetic Transformation, Germplasm and Seed Technology, and Genomics and Bioinformatics. These innovations accelerate trait development, reduce resource use, and improve nutritional outcomes.

Graduates will bolster public/private sector capacity, drive sustainable agriculture, and mitigate climate impacts, aligning with OBU's mission to advance Ethiopia's agricultural resilience and global food security.

4.1.2 Goal/objectives of Programme/curriculum/course

- To impart academic and research teaching at post graduate level
- To have massive human capacity building and alleviate skilled human resource in the country
- To plan and conduct research in cereals, oil seeds, pulses and horticultural crops

4.1.3 Admission requirements

- ✓ Applicants graduated with Bachelor of Science (BSc) degree in Plant Sciences, Horticulture, Biotechnology, General Agriculture, Dry Land Agriculture, Seed Science, Crop Production, Crop Production and Protection, Biology, or related fields from a nationally and internationally known university;
- ✓ Applicants requesting for admission from fields other than Plant, Crop, Horticulture and Seed Science required to take bridging courses or additional courses to compensate for the

- ✓ deficiencies as per the recommendation of Graduate Council of Department of Plant Science (DGC) and approved by Council of Graduate Studies (CGS);
- ✓ Must take and pass the National Graduate Admission Test (NGAT) administered by the Ministry of Education.
- ✓ Must pass an entrance exam given by the department, which will be based on the background of the program.
- ✓ Must provide at least two letters of recommendation, preferably from the applicant's undergraduate instructors, employers, or professional associations.
- ✓ Must submit a letter indicating sponsorship for their research work or sign an agreement if self-sponsored.
- ✓ Must have a minimum CGPA of 2.00 upon graduation from the undergraduate program and directive given from MoE

4.1.4 Course structure and duration

The regular program requires two years of study, consisting of four semesters. The first two semesters will be dedicated to coursework, while the last two semesters will focus on research and Thesis writing. The maximum extension of six months will be allowed as recommended by Postgraduate Council of the Department of Plant Science (PGC).

For the continuing education program, the study duration is two and half years, comprising five semesters: three semesters for coursework and the final two semesters for thesis work. The maximum extension of six months is allowed as recommendation of Postgraduate Council of the Department of Plant Science (PGC)**.**

4.1.5 Review we show what has been changed

List of Exempted/modified courses with their justifications

S/No	List of courses	Credit Hour	ECTS	**Remarks/Justification**
1	Advanced Plant breeding	3(2+1)	5	Split into **Classical Plant Breeding** and **Molecular Plant Breeding** to deepen understanding of traditional and modern methods, emphasizing their synergy.
2	Crop Evolution and Plant Genetic Resources Management	2(1+1)	3	Content merged into **Germplasm and Seed Science Technology**. Some universities offer this as a standalone course.
3	Seed science and Technology	2(1+1)	3	Integrated into **Germplasm and Seed Technology**, though taught separately by specialized experts. Offered independently in some programs.
4	Biotechnology in Crop Improvement	3(2+1)	5	Excluded; content covered in **Plant Tissue**

				Culture, **Molecular Plant Breeding**, **Genomics & Bioinformatics**, and **Plant Genetic Transformation**.
5	Advanced Cytogenetics	2(1+1)	3	Topics integrated into **Advanced Genetics** and **Plant Genetic Transformation**.
6	Plant Biochemistry	2(1+1)		Elective in most programs; content addressed in **Breeding for Quality Traits** and **Advanced Genetics**.

4.1.6 New courses developed

Oda Bultum University has included the following five courses as proposed in the BREEDTECH project document:

5. Germplasm and Seed Science Technology
6. Plant Genetic Transformation
7. Genomics and Bioinformatics,
8. Molecular Plant Breeding
9. Plant Tissue Culture Technology

4.1.7 Semester/Year-wise Course Breakdown for Regular Program

Regular program: Year I Semester I

S/No	Course code	Course Title	Credit Hour	ECTS	*Remarks*
1.	PLBR511	Advanced Genetics	3(2+1)	5	
2.	PLBR521	Advanced Biometrics	3(2+1)	5	
3.	PLBR531	Classical Plant Breeding	3(2+1)	5	
4.	PLBR541	Germplasm and Seed Science Technology	3(2+1)	5	New
5.	PLBR551	Plant Physiology	2(1+1)	3	
6.	PLBR561	Plant Genetic Transformation	2(1+1)	3	New
7.	PLBR571	Genomics and Bioinformatics	2(1+1)	3	New
Total Credit Hours			**18**	**29**	

Regular program: Year I Semester II

S/No	Course code	Course Title	Credit Hour	ECTS	*Remarks*
1.	PLBR512	Quantitative Genetics	3(2+1)	5	
2.	PLBR522	Breeding for Quality Traits	2(1+1)	3	
3.	PLBR532	Breeding for Biotic and Abiotic Stresses	3(2+1)	5	
4.	PLBR542	Molecular Plant Breeding	3(2+1)	5	New
5.	PLBR552	Advanced Research Methods	2(1+1)	3	

6.	PLBR562	Plant Tissue Culture Technology	2(1+1)	3	New
7.	PLBR572	Graduate Seminar in Plant Breeding	1	-	
Total Credit Hours			**16**	**24**	

Regular program: Year II Semester I

S/No	Course code	Course Title	Credit Hour	ECTS
1	PLBR611	MSc Thesis	6	-

4.1.8 Assessment and evaluation

Students will be evaluated through written examinations, participation in practical, laboratories/tutorials, various presentations, and term papers, depending on the nature of the courses. Research work, compiled into a thesis, will be supervised by a major advisor and a co-advisor. Additionally, progress in research work will be evaluated at the end of each semester. Student performance will be assessed using numerical grades; and then converted into letter grades.

4.1.9 Grading system

Grading is carried out by a fixed scale grading system based on the legislation of OBU and MoE as described below

Row mark range	Letter grade	Grade points
[> 90	A+	4.00
[85,90)	A	4.00
[80,85)	A-	3.75
[75,80)	B+	3.50
[70,75)	B	3.00
[65,70)	B-	2.75
[60,65)	C+	2.50
[50,60)	C	2.00

4.1.10 Graduation requirements

The Master of Science (MSc) program in Plant Breeding requires the completion of **40 credit hours**, including a minimum of **34 credit hours of coursework** and **6 credit hours of thesis research**. Students must achieve a minimum cumulative grade point average (CGPA) of **3.00** and may not exceed **one grade of "C"** or **two grades of "C+"** throughout the program. Additionally, students must successfully defend their thesis and earn a minimum grade of **"Fair"** or higher on their thesis evaluation.

4.1.11 Degree classification

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

- English: **Master of Science Degree in Plant Breeding**
- Amharic version: **ማስተርስኦፍሳይንስበፕላንትብሪዲንግ**

4.1.12 Level of approval/Status of approval

Project No. (101128862)

Board of Graduate school/Senate/Commission of University. The curriculum was approved by the **Oda Bultum University Senate**, and students have begun their first-semester courses

5.0 Curriculum/Program/Courses Reviewed by An-Najah National University, Palestine under BREEDTECH Project

5.1 Technology of Crop Improvement

5.1.2 Rationale

The course Technology of Crop Improvement (10912403) is designed to equip students with a solid foundation in the principles and methodologies of plant breeding, emphasizing both classical and modern genetic techniques. Given the global challenges of food security, climate change, and the need for sustainable agriculture, this course provides essential knowledge for future agricultural engineers by integrating concepts from genetics with practical breeding strategies for both self- and cross-pollinated crops. Students will gain critical skills in evaluating genetic variability, applying selection methods, and utilizing biotechnological tools such as molecular breeding and genetic engineering. This rationale aligns with the broader goal of empowering students to develop innovative, science-based solutions for crop improvement that address current and future agricultural demands.

5.1.3 Goal/objectives of Programme/curriculum/course

This course deals with basic principles and concepts of genetic improvement of crop plants through application of basic qualitative and quantitative genetic principles. Different plant breeding methodologies relative to the mode of reproduction of crop plants will be presented and discussed. Application of modern tools in the breeding of crop plants will also be included.

The course objectives are:

1. Fostering student understanding of genetic principles underlining plant improvement.
2. Understanding plant improvement methods.
3. Promote critical thinking in relation to improvement strategies and methods

5.1.4 Admission requirements

1. **Program Enrollment**:
    - Students should be enrolled in the faculty of Veterinary Medicine and Agricultural Engineering – Plant Technology program.
2. **Prerequisite Course**:
    - Students must complete **Genetics (Course number: 10911206)** before enrolling

5.1.5 Course structure and duration

- The course spans 16 weeks.
- Each week is dedicated to specific topics, progressing from foundational principles to advanced applications.

5.1.6 Review we show what has been changed

As part of the recent enhancements to the Technology of Crop Improvement course, we introduced a new module focused on the application of molecular markers in plant breeding.

This addition reflects the growing importance of molecular breeding techniques in modern agricultural practices and aims to equip students with the tools and understanding needed to incorporate marker-assisted selection (MAS) into real-world breeding programs. Furthermore, we have integrated virtual reality (VR) into the educational experience to provide immersive, interactive learning environments. This innovative approach enhances student engagement and comprehension, particularly in complex topics such as genetic mapping and breeding strategy simulations. These updates align the course with current technological advances in both plant science and educational methodology.

5.1.7 Examination requirements

1. Midterm exam (Instructor responsibility).
2. Assignments are given on the 2nd week of the semester (Instructor and mentors responsibility).
3. Final exam (Instructor responsibility).

5.1.8 Grading system

An-Najah National University employs a grading system that combines percentage scores with corresponding letter grades and qualitative descriptors. The minimum passing grade for a course is typically D (60%). However, specific programs may have higher passing criteria. For instance, students in medical and engineering faculties are required to maintain a GPA of 2.0 or higher, while other faculties may have a minimum GPA requirement of 1.70.

5.1.9 Graduation requirements

Graduation requirements at An-Najah National University (ANNU) are designed to ensure that students acquire a comprehensive education, meeting both university-wide standards and specific program criteria.

5.1.10 Degree classification

BSc in agricultural engineering – plant technology track

5.2 Genetic Engineering

5.2.1 Rationale

The rapid advancement of genetic engineering has revolutionized modern agriculture, enabling precise modification of organisms to enhance productivity, disease resistance, and environmental adaptability. This course is designed to provide students with a solid foundation in the principles and practices of genetic engineering, emphasizing its practical applications in plant and crop improvement. As agriculture faces increasing challenges from climate change, pests, and food insecurity, there is a growing demand for professionals equipped with both theoretical knowledge and hands-on skills in genetic manipulation techniques. This course fulfills that need by integrating scientific innovation with ethical and

regulatory awareness, preparing students to contribute responsibly and effectively to the future of sustainable agriculture.

5.2.2 Goal/objectives of Programme/curriculum/course

The primary objective of this course is to equip students with a comprehensive understanding of the principles, techniques, and applications of genetic engineering, with a specific focus on its role in modern agriculture. Through a combination of theoretical instruction and hands-on laboratory experience, students will learn how genetic material can be isolated, modified, and introduced into organisms to enhance desirable traits. The course also aims to develop students' critical thinking on ethical, environmental, and regulatory issues related to the use of genetically modified organisms (GMOs) in agricultural systems.

5.2.3 Admission requirements

Program Enrollment**:**

- Students should be enrolled in the faculty of Veterinary Medicine and Agricultural Engineering – Plant Technology program.

Prerequisite Course**:**

- Students must complete **Genetics (Course number: 10911206)** before enrolling

5.2.4 Course structure and duration

- The course spans 16 weeks.
- Each week is dedicated to specific topics, progressing from foundational principles to advanced applications.

5.2.5 Review we show what has been changed

To align with evolving educational strategies and advancements in biotechnology, significant updates have been made to the Genetic Engineering 10912301 course. A comprehensive laboratory component has been added, providing students with hands-on experience in essential genetic engineering techniques such as DNA isolation, PCR, gel electrophoresis, and gene transfer methods. This practical section bridges the gap between theory and real-world application, enhancing students' technical competence and scientific inquiry. Additionally, the course now incorporates Virtual Reality (VR) as an innovative educational tool, allowing students to explore molecular structures, genetic processes, and simulated laboratory environments in an immersive and interactive manner. These enhancements aim to deepen understanding, foster engagement, and prepare students for future roles in biotechnology and agricultural innovation.

5.2.6 Examination requirements

Assignment Criteria	Activity	Percent
	Midterm Exam	25 %
	Quiz Exam	5 %

	Lab	30 %
	Final Exam	40 %

5.2.7 Grading system

An-Najah National University employs a grading system that combines percentage scores with corresponding letter grades and qualitative descriptors. The minimum passing grade for a course is typically D (60%). However, specific programs may have higher passing criteria. For instance, students in medical and engineering faculties are required to maintain a GPA of 2.0 or higher, while other faculties may have a minimum GPA requirement of 1.70.

5.2.8 Graduation requirements

Graduation requirements at An-Najah National University (ANNU) are designed to ensure that students acquire a comprehensive education, meeting both university-wide standards and specific program criteria.

5.2.9 Degree classification

BSc in agricultural engineering – plant technology track

6.0 Curriculum/Program/Courses Reviewed by Al-Quad Open University, Palestine under BREEDTECH Project

6.1 Course title: Principles of Plant Breeding
QOU Credit: 3
Degree: 1st degree (Bachelor)
Department: Plant Production and Protection
Semester: 1st semester
Teaching language: Arabic
Compulsory / Elective: Elective
Instructor name(s): Aziz SALAMEH
Email: azsalameh@qou.edu
Pre-request course: Genetics

6.1.1 Course Description:

Highlighting the principles in crops with and vegetative production. Achievements and potential of improved plants. Creating genetic variation in different ways. Coupling systems and methods of pollination in plants. Breeding methods and their adaptation for plants with self-foreign pollination and; adoption; selective methods, hybridization. Preparing breeding plans. Principles of new plant breeding methods, and Application of biotechnology technologies such as gene editing and molecular markers in breeding.

6.1.2 Course Aims:

Learning the genetic background of breeding. Learning the biological background of breeding. Learning the common and new methods in breeding to apply the breeding principles. understanding the positive impact of biotechnology application on plant breeding.

6.1.3 Learning Outcomes:

Upon successful completion of the training, the student, should be able to:

- Familiarize with genetic background of breeding
- Recognize the application of various breeding methods (conventional and molecular)
- understand the principles of plant breeding and advantages of new breeding methods application

Attendance Requirement (%): 75
Teaching Method: Text Book, Lectures, Exercise

6.1.4 Course Content(s)

Introduction to plant breeding

1. Modes of Reproduction: (Week 1)
2. Phenotype and genotype (Week 2 & 3)
3. Selection methods (Week 4&5)

Biotechnology and Plant breeding

4. Marker assisted Selection (Week 6)
5. Molecular Markers (Week 7 & 9)
6. Mapping of Genes (Week 10)
7. Mutation Breeding (Week 11 &12)
8. Gene Editing (Week 13 & 14)
9. Practical exam (Week 15)
10. Mid-term and final Exam (weeks 8&16)
11. Modes of Reproduction: (Week 1)
12. Phenotype and genotype (Week 2 & 3)
13. Selection methods (Week 4&5)

Biotechnology and Plant breeding

14. Marker assisted Selection (Week 6)
15. Molecular Markers (Week 7 & 9)
16. Mapping of Genes (Week 10)
17. Mutation Breeding (Week 11 &12)
18. Gene Editing (Week 13 & 14)
19. Practical exam (Week 15)
20. Mid-term and final Exam (weeks 8&16)

Acknowledgement

Building capacity in plant breeding and biotechnology education and research through partnership program in africa, middle East and Europe for Agricultural Transformation (BREEDTECH) Project acknowledges the contribution of the curricullum teams from Egerton and Laikipia Universities Kenya; Haramaya and Oda Bultum Universities Ethiopia; Open University and An Najah National University Palestine.

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