

# PhD Programme in Plant Breeding and Biotechnology

A Joint Regional Training Programme by the  
Member Universities of the Regional Universities  
Forum for Capacity Building in Agriculture  
(RUFORUM)

Coordinated by:



RUFORUM Secretariat

Hosted by:



Makerere University

# **PhD Programme in Plant Breeding and Biotechnology**

**A Joint Training Programme by the Member Universities  
of RUFORUM**

**Information Booklet**

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(RUFORUM)

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## *Executive Summary*

African universities and indeed universities everywhere are undergoing unprecedented change and confront multiple challenges, including how to contribute to national development against a backdrop of declining funding and yet expanded student intake and expectations. These universities are undertaking major reforms to strengthen institutional capacity to build national human capital and also engage in innovation and development process and practice. Under the auspices of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), 12 universities in East and Southern Africa have formed a research and training consortium to marshal their resources to address common challenges. Some of the key challenges include:

- (i) How to organize and ensure sufficient staff capacity in universities.
- (ii) How to mobilize adequate resources for research and training.
- (iii) How to organize and rationalize adequate infrastructure for research and training.
- (iv) How to build a national and regional Research for Development innovation system based on partnerships and dialogue between all actors, impact oriented and well coordinated, where universities are an integral part.

These four challenges are particularly critical for ensuring that the New Partnership for Africa's Development (NEPAD) Agricultural growth rate of 6% for the next 20 years is realized if the region is to become food and income secure. Accordingly, investing in training of plant breeders becomes a major impact thrust area for most agricultural universities in Sub-Saharan Africa. Indeed, the Sub-Saharan Africa Challenge Programme and NEPAD's Comprehensive Africa Agricultural Development Programme (CAADP) highlights these issues. Given the current limited numbers of Plant Breeders in the sub-region, RUFORUM member universities, have developed and are implementing a regional training programme to produce high caliber PhD graduates as a Medium to long term response to the plant breeding gap in the region. The initiative is in line with the Forum for Agricultural Research in Africa (FARA) objective of strengthening Africa's capacity to build capacity. The programme will be hosted at Makerere University and implemented by a regional consortium who will assure quality, maintain responsiveness and impact of the intervention. Some key features of the programme include;

-  It aims at integrating both plant breeding and biotechnology at PhD level using local crops and facilities in the region. It will permit development of local capacity within the region to train and undertake research.
-  The focus is on regional constraints such as those identified by Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), CORAF/WECARD (Couseil Ouest Africain Pour la Recherche et le Developpement Agricole / West and Central African Council for Agricultural Research and Development), SADC / FANR (Southern African Development Community / Food Agriculture and Natural Resource Management) and national problems thus ensuring relevancy and settling-in of graduates as well as stabilizing universities. This will reduce attrition rates significantly.
-  It aims at rationalizing existing resources in the region by sharing existing human resources and infrastructure for training and research for development.
-  The programme has been developed by a regional consortium of universities who own and implement it. They may when own-capacity is built adopt the programme to their own universities.
-  Elements of credit transfer among universities is in-built to strengthen regionality and allow for sandwich training.
-  It is built on a model that aims at strengthening national institutions (universities and National Agricultural Research Institutes) to respond to development challenges
-  It permits Regional Universities to develop a collaborative research and training model and perfect it.
-  The academic programme is for three years and will draw students form eastern, central and southern Africa and beyond.
-  The courses will be based on modules to allow participation of both registered students and persons interested in particular modules and also to accomodate both full-time and part-time students.
-  Elements of e-learning is in-built to allow for distant education and student own learning.
-  There will be a flexible common grading system across the member universities, based on Grade point averages, to allow for transfer of credits across the member universities.

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## 1.0 Background

### 1.1 The need for plant breeding capacity

Investing in plant breeding is a matter of urgency because of the diverse needs of the Africa's farming community and persistent poverty and food insecurity. A recent survey by the Forum for Agricultural Research in Africa (FARA) and the New Partnership for Africa's Development (NEPAD) as well National Poverty Reduction Strategy Papers (PRSPs) all advocate for increased development and use of science and technology to address the continent's persistent hunger and poverty. At global level, the Food and Agricultural Organisation of the United Nations (FAO) has conducted similar studies which all point to the very limited capacity of especially high level trained plant breeders particularly in sub-Saharan Africa<sup>1</sup>. This has lead to limited variety releases and general weakened innovations systems which are critical for enhancing productivity to address food insecurity and livelihood issues.

In many countries application of biotechnology to agricultural research and production has hailed a new era. Indeed, studies by FAO (FAO, 2005)<sup>1</sup> and the Action Plans of NEPAD<sup>2</sup>, all point to the fact that sub-Saharan Africa region MUST harness science and technology including biotechnology if it is to attain the needed 6% annual expansion of the agricultural sector to stem poverty and hunger in Africa. Furtherance of the need for strategic capital development has been highlighted as a key factor to increase progress towards attainment of the Millennium Development Goals (MDGS). The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) together with its partners is responding to the need to develop the necessary human capital using a "capacity building for capacity building" framework. Training scientists at PhD meets that description, especially of university staff.

### 1.2 Implementation strategy

The training will be implemented at regional level, with Makerere University being the pilot hosting institution but implementing the programme in conjunction with the other RUFORUM member universities and other partners. At Makerere University the programme will be housed in the Department of Crop Science, Faculty of Agriculture. RUFORUM partners have contributed towards development of the syllabus and will continue to participate in joint supervision of students and as lecturers for some specialized courses. Some

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<sup>1</sup> FAO, 2005. The Way Forward to Strengthen National Plant Breeding and Biotechnology Capacity. Proceedings of a meeting to discuss results of a survey on Status of plant breeding. Rome 9<sup>th</sup> -11 February 2005.

<sup>2</sup> NEPAD, 2005. The New Partnership for Africa's Development. A Summary of NEPAD Action Plans.

of the courses, and skill enhancement activities, may be conducted at other RUFORUM universities and other specialised units within the region. The programme will accommodate both full-time and part-time students. In addition, e-learning is in-built to allow for distant education and student own learning. The programme will be implemented as course work and research thesis according to the requirements of Makerere University but also conforming to the agreed regional partnership arrangements. Students may undertake their research in their home countries or in the hosting country (Uganda). RUFORUM Secretariat will perform roles of advocacy, resource mobilization and coordination at regional level.

## *2.0 Title of the programme*

Doctor of Philosophy (Plant Breeding and Biotechnology)

## *3.0 Justification of the programme*

### **3.1 Why the focus on plant breeding and biotechnology**

- 📄 Enhancing productivity: Plant breeding has been instrumental in boosting crop production world over in the past century. High yielding varieties were at the heart of the Green Revolution, which produced a spectacular increase in food production in Asia in the 1970s. In the US, more than half the gains in yields of all major field crops over the past 70 years is attributed to genetic improvements. In contrast many farmers in Sub-Saharan Africa still largely grow unimproved land races attaining up to only 20% of yield potential. Most of the deficit is due to abiotic stresses (low soil fertility, drought) and biotic stresses (pests, weeds and diseases). Plant breeding alone will not bridge the gap, but plant breeders can contribute to higher yields by developing improved varieties that are suited to country agro-ecological peculiarities. Clearly enhancing productivity will require human capital and functional national plant breeding systems.
  
- 📄 Human resources: Africa's human resources suffer from severe attrition due to both socio-economic reasons and diseases such as HIV/AIDS (NEPAD, 2005<sup>2</sup>, Eicher, 2003<sup>3</sup>, Eicher, 2004<sup>4</sup>). Indeed, rebuilding the continent's human resources may require investment

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<sup>3</sup>Eicher, C. K. 2003. Rebuilding Africa's scientific capacity in food and agriculture. Background Paper No. 4 commissioned by the Inter-Academy Council (IAC) Study Panel on Science and Technology Strategies for Improving Agricultural Productivity and Food Security in Africa.

<sup>4</sup>Eicher, C.K. 2004. Flashback: fifty years of donor aid to African agriculture. A paper presented at an International Policy Conference "Successes in African Agriculture: Building for the Future", sponsored by InWent, IFPRI, NEPAD and CTA, Pretoria, South Africa, December 1-3, 2003.

levels similar to what China, South East Asia and emergent economies of Brazil and Argentina have undertaken to strengthen innovations for agricultural sector expansion and science led growth of their economies. Given that the agriculture sector remains the mainstay of most economies, and there is acute shortage of plant breeders in most National Agricultural Research Systems (NARS) in the region (FARA, 2006), strengthening crop improvement will go a long way in assuring the vision of NEPAD's Comprehensive Africa Agricultural Development Programme (CAADP) and the National Poverty Reduction Strategy Papers. Commonality of problems suggests that a rationalised intervention at regional level is needed.

- 📄 Multi disciplinarity: Most human development initiatives have been discipline specific. The proposed action aims at combining Plant breeding with biotechnology and other cross-cutting issues and skills required for work as innovators, and development agents. This is where training at PhD levels will produce new capacity and competences that have further capacity to produce new personnel and products.

### **3.2 The need for a regional programme in plant breeding and biotechnology**

The UNDP's Millennium Development Goals lay out a challenging but achievable vision for dramatically reducing poverty in all its forms. At continental level economies of sub-Saharan African countries must achieve a 7% annual GDP growth for the next 20 years, with 6% annual growth in agricultural output, anchored on a 3% annual increase in total factor productivity and an equivalent fixed investment in agriculture over the same period. Achieving these highly ambitious targets require, among others, revitalising plant breeding capacity to redress the declining capacity of many national plant breeding programmes. These challenges are common in East, Central and Southern Africa. A regional programme is thus justified.

- 📄 The gap in plant breeding and biotechnology has been identified as a core strategic investment area in sub-Saharan Africa by FARA and RUFORUM member countries. Therefore a regional approach is needed.
- 📄 A recent study among RUFORUM member universities shows that training can be done at regional level by marshalling existing resources among partner universities. Few universities have the personnel and labs to undertake such a training singly.
- 📄 Training at regional level provides for shared vision, networking, and production of regional public goods at lower transaction costs.

### 3.3 Niche and value addition of the programme

This programme is being implemented against a background of a real need in the region that needs to be filled. It specifically aims at building capacity to build capacity within the region. The programme complements other efforts in the region to train plant breeders and biotechnology experts such as by the East African Regional Programme and Research Network for Biotechnology and Bio-safety and Bio-policy Development (BIO-EARN). The proposed training has the following niche features:

- 📄 It aims at integrating both plant breeding and biotechnology at PhD level using local crops and facilities in the region. It will permit development of local capacity within the region to train and undertake research.
- 📄 The focus is on identified regional constraints such as those identified by the Sub-Saharan Africa regional research organisations (ASARECA, SADC/FARN and CORAF), and national programmes thus ensuring relevancy and settling-in of graduates as well as stabilizing universities and the NARS. This will reduce attrition rates significantly.
- 📄 It aims at rationalizing existing resources in the region by sharing existing human resources and infrastructure for training and research for development.
- 📄 The programme has been developed by a regional consortium of universities who own and implement it. They may, when own capacity is built, adopt the programme to their own universities.
- 📄 An element of credit transfer among universities is in-built to strengthen regionality.
- 📄 It is built on a model that aims at strengthening national institutions (universities and NARS) to respond to challenges.
- 📄 It permits the member universities to develop a collaborative research and training model and perfect it.
- 📄 The goal is to produce “well-grounded” plant breeders, knowledgeable and with skills to work in private and public sectors as researchers, trainers and policy advisors.

- ☞ The modular approach will allow people currently in-service the advantages of studying for a doctorate with taught courses with both contact time and personal learning opportunities, without having to take a full year out of their lives.
- ☞ The programme makes use of modern technology and learning methods and gives faculty a real opportunity to be facilitators of learning rather than “information bankers”. Emphasis will be given to building capacity within a continuous learning framework, taking advantage of modern technology.
- ☞ The programme provides universities with the opportunity to use some of the e-learning courses from internationally renowned institutions as part of their coursework.

### **3.4 The hosting institution(s)**

Makerere University is among the prominent academic institutions in sub-Saharan Africa. Its Faculty of Agriculture, located in the main campus, and the research arm, the Makerere University Agricultural Research Institute (MUARIK) have been engaged in research and training over the last 60 years. Makerere University and the Faculty of Agriculture in particular, have fronted biotechnology as a new frontier for upgrading academic excellence in bio-sciences to address national and regional developmental constraints.

The implementation of the PhD programme is facilitated by several institutional collaborations that have been established among the RUFORUM universities, and with other partner institutions in the South and North.

## ***4.0 Aims and objectives of the programme***

### **4.1 Programme mission**

The mission of the PhD. (Plant Breeding and Biotechnology) programme is to produce scientists who meet the human resource needs of the public and private sector through crop improvement and related disciplines. They will provide training as well as lead scientific development agenda of their countries. This mission will be fulfilled through research and educational programmes that link advances in fundamental and applied biological sciences and provide skills for working in multi-stakeholder platforms.

### **4.2 Programme goal**






The goal of this programme is to develop and strengthen the human resource and research capacity for Crop improvement and related development areas

in sub-Saharan Africa but with particular emphasis on Eastern, Central and Southern African countries. This broad goal is consistent with the mission of RUFORUM. It is also consistent with the NEPAD's CAADP agenda, and contributes directly to FARA's SCARDA (Strengthening Capacity for Agricultural Research for Development in Africa) purpose of strengthening Africa's human resource and institutional capacity.

#### **4.2.1. Specific objectives**




- (i) To give graduates an opportunity to broaden and deepen their knowledge in Plant Breeding and Biotechnology that will permit them to effectively and efficiently engage in science-led agricultural development.
- (ii) To produce high calibre scientists who will lead training, manage and innovate the region's own Research for Development agenda by providing the students with an understanding and hands-on experience of the different disciplines within the realm of plant breeding and biotechnology and development.
- (iii) To strategically invest in the building of a strong national-regional-global consortium to support and develop (where non existent) PhD training programmes built on shared and rationalized regional resources for a strong agricultural science and innovative base within Eastern, Central and Southern Africa region.

Implementation of the programme will:





-  Lead to the development of a regional consortium upon which regional agricultural research for development agenda can be built;
-  Develop national capacities to train own scientists and development practitioners in the short term at MSc and in the mid to long term at PhD levels;
-  Provide for rationalized sharing of the region's research and training facilities to respond to common challenges by permitting shared training and research.
-  Develop the region's capacity to use advances in science for development including emergent knowledge areas there by permitting the region to benefit and be part of the new knowledge-based economy;
-  Lead to development of technologies (plant varieties and others) to enhance crop productivity.

### **4.3 Competences to be developed in graduates**




#### **4.3.1 Competences within basic sciences**

-  The ability to comprehend and evaluate new technologies in relation to existing knowledge.
-  The ability to transfer principles and results from basic and strategic sciences to the development of ideas and processes.
-  The ability to evaluate methods for solving complex development problems.

#### **4.3.2 Competences within applied science**

-  The ability to expand principles from basic science to organise experiments and solve problems.
-  The ability to analyse and comprehend existing knowledge and to transfer knowledge to develop hypotheses and evaluate their usefulness in the context of farming problems.
-  An understanding of all aspects of biotechnology related to crop improvement and management.
-  Competence to design, experiment and ultimately develop new crop varieties in conjunction with farming communities.

#### **4.3.3 Competences within ethics and values**

-  The ability to formulate ethical problems and clearly communicate possible solutions orally and in writing at the appropriate level for target audience.
-  An awareness of different attitudes to scientific innovations especially emergent scientific methods such as biotechnology and the ability to discuss and advice policy development for the greater benefit of society.
-  Personal mastery and soft skills to innovate change efficiently and work with communities and other actors.

## *5.0 Programme management and capacity*

### **5.1 Management at regional level**

#### **5.1.1 A regional programme management**

A Regional Academic Advisory Board (RAAB) will oversee the implementation of the programme to assure quality, regionality and responsiveness. The RAAB will be composed of one member from each RUFORUM country and two external. The RAAB will monitor progress and implementation, seek international and regional human resources for training, accreditation and advise RUFORUM Secretariat and hosting institutions on progress. In general it will ensure quality is adhered to and maintained within the programme.

#### **5.1.2 Management at national level**

In all RUFORUM partner countries, the National Forums (Universities and their partners) will be involved in recruitment of students by identifying and recommending suitable candidates. The National Forums will also identify relevant research areas for the students and provide for internship. At the hosting institution, the programme will be managed by a Programme Implementation Committee (PIC) comprised of the Dean, Department Chair, the Programme Coordinator and the National Forum Coordinator. The PIC will report directly to the Dean and RUFORUM Secretariat.

#### **5.1.3 Local and regional personnel**

The programme will draw resource persons from all the RUFORUM member universities, and from other partners in the north and south. Particular emphasis will be placed to link with the National Agricultural Research Institutions and seed companies working in the region.

## *6. Admission of students*

The general requirements for admission to Makerere University and specifically the Faculty of Agriculture will apply. Applicants for admission to the PhD programme must meet the following criteria

- ☐ Candidates must satisfy all minimum requirements for admission into a PhD programme in Makerere University including holding a relevant MSc degree in plant sciences;
- ☐ Candidates should not be more than 35 years old although special cases may be considered;

- ☐ An effort to achieve at least a 40:50% female to male ratio in the intakes will be made. In addition special consideration will be made for institutions with severe gaps.

## ***7.0 Programme description***

### **7.1. Type of programme**

The PhD (Plant Breeding and Biotechnology) shall be constituted by course work and research leading to writing a thesis and will accommodate both full-time and part-time students.

### **7.2 Duration of the programme**

The minimum duration shall be 36 months and the maximum shall be 7 years.

### **7.3 Guidelines for research areas**

- ☐ Should support development of human resources for country and regional needs;
- ☐ The research should as much as possible cover the “orphan crops” that are not receiving much support through regional and global research efforts;
- ☐ Should impart new knowledge and advances in science and technology and research for development;
- ☐ Should lead to development of high quality research products;
- ☐ Should be linked to national and or regional development agenda to strengthen the knowledge base and ability to innovate;
- ☐ Should address regional or national constraints.

### **7.4 Structure of the programme**

#### ***7.4.1 Course work***

Depending on the theoretical background of candidates, they will be required to take courses recommended by the doctoral committee as established under the Makerere University School of Graduate Studies. The doctoral committee will structure the course content to include:

- (a) Core courses mandatory for all candidates
- (b) Electives among courses considered relevant and beneficial to the candidate
- (c) Courses available in other institutions to deepen understanding for special research interests and personal competence skills development of the student.

#### **7.4.2. Assessment of courses**

- (a) Each course shall be assessed on the basis of 100% total marks with proportions as follows: Course work – 40% , Written examination – 60%
- (b) Course work shall consist of laboratory work and progressive assessment (assignments/tests), each component assessed at 20%
- (c) For a course without laboratory work, progressive assessment shall carry 40%
- (d) A minimum of four course work assignments shall be required per course
- (e) A grade point system below will be used to grade courses.

<b>Marks</b>	<b>Letter grade</b>	<b>Grade point</b>
80 - 100	A+	5.0
75 - 79.9	B+	4.5
70 - 74.9	B	4.0
65 - 69.9	B-	3.5
60 – 64.9	C+	3.0
55 – 59.9	C	2.5
50 – 54.9	C-	2.0
45 – 49.9	D+	1.5
40 - 44.9	D	1.0
35 - 39.9	D-	0.5
Below 35	E	0

- (f) These additional letters shall be used where appropriate: W- Withdrawn from course; I-Incomplete
- (g) The pass grade point per course is 3.0
- (h) No credit unit shall be awarded for any course in which a student fails

### **7.4.3 Progression**

Progression through the course shall be assessed in one of three categories, i.e.,

- (a) Normal Progression- This occurs when a student passes all courses taken
- (b) Probationary – This is a warning and occurs if:
  - (i) A student fails a core/compulsory course, or
  - (ii) A student obtains a grade point average (GPA) or a cumulative grade point average (CGPA) of less than 3.0
- (c) Discontinuation – A student shall be discontinued from the programme for one of the following reasons:
  - (i) Receiving two probations on the same core/compulsory course
  - (ii) Receiving two consecutive probations based on GPA or CGPA

### **7.4.4 Retaking a course**

There shall be no supplementary examination in any course of the programme. However, a student may retake any course when it is offered again in order to:

- (a) Pass if the student had failed it before
- (b) Improve the grade if the first pass grade was low
- (c) A student who does not wish to retake a failed course shall be allowed to take a substitute elective.

### **7.4.5 PhD qualification examinations**

All students will be required to sit and pass an oral and written PhD candidature exam to be considered PhD candidates. These exams will be graded as described in the Table in section 7.4.2 part e. Students who fail to pass this exam thrice may be awarded an MSc. degree instead and will be discontinued from the PhD programme.

## **7.5. Guidance**

A Doctoral Committee will be established for each candidate to set acceptable standards for the doctoral programme, and serve as the student's advisory and performance assessment committee. The committee will monitor the student's progress throughout the study period on behalf of the Higher Degrees and Research Committee of the Department of Crop Science. The Committee will provide additional guidance on research and overall professional development and shall support timely completion of the PhD training.

The Doctoral Committee shall principally be constituted by 6 persons of whom at least two members should be experts in the major field of study (who may be supervisor(s) or potential supervisor (s), Faculty administrators (Head of Department or Deputy Dean Research) and two other experts (minor field) deemed helpful in the pursuit of the study in question and one external member who is not a member of the research team and out of the university.

## **7.6 Guidelines for the Doctoral Committee (DC)**

### ***7.6.1 Assessment of research project synopsis and final proposal***

Full admission to the PhD programme will require development, submission and acceptance of a proposal from the candidate within the first year of admission. The DC shall assess the following:

- (i) The applicant's credentials and worthiness for PhD based on (a) the set university criteria (b) past experience, performance and past records, recommendations and other attributes (c) Evidence of ability to write clearly and concisely is particularly important.
- (ii) The synopsis and final research proposal for its academic character, feasibility/achievability within the time limits and depth (advancement of human and scientific understanding is essential). The DC shall either recommend or reject the synopsis/proposal or recommend revision.
- (iii) High risk projects may only be acceptable if the applicant indicates alternative strategies, should the initial plan of action prove unfeasible.
- (iv) Assess the intellectual challenges and merits of the proposed research.
- (v) Assess the quality and range of research opportunities and the training environment and facilities available at the unit or within the university or elsewhere.
- (vi) Assess and make sure the safety/ethical/legal considerations have been covered and adhered to.
- (vii) Assess the student's competences/skills and needs and recommend PhD/doctoral courses that are envisaged to be of high relevance for the applicant or his/her ability to audit courses from other Units.

These processes should be adequate to allow a provisionally admitted student to proceed to FULL Admission in one year's period or less without undergoing external vetting process of final proposal.

### **7.6.2 Identification and roles of supervisor(s)**

- (i) The DC shall identify and nominate amongst themselves but with an input from the candidate, a minimum of two supervisors. At least one supervisor shall be Makerere University based but the other could be from one of the RUFORUM member universities or elsewhere as long as the person is accessible to the candidate.
- (ii) Build linkages and forge collaborations to broaden the network of the student and guidance in career.
- (iii) Supervisors' roles shall be active involvement, field visits, guidance/support, mentoring the student, active grant searching, and facilitating networking with others.

### **7.6.3 Performance monitoring**

The Doctoral Committee will review the independent reports from the student and supervisors and

- (i) Monitor progress reporting.
- (ii) Identify other academic and research opportunities both inside and outside the university (such as academic conferences, workshops, training, collaborating industries, research centres/labs etc.).
- (iii) Identify external examiners for the thesis.

### **7.6.4 Qualification for graduation**

The doctoral committee shall meet on a regular basis (2-4 times in year 1; 2 times in year 2 and 2-3 times in year 3 during data analysis and final reporting period). A minimum of 2-3 progress reports from this committee plus evidence of at least two manuscripts (or equivalent) accepted in a peer reviewed journal will be the expected key outputs from a PhD/doctoral research before a candidate is awarded a degree.

### 7.6.5 Viva Voce

The DC shall form part of the Viva voce committee with 2-5 additional independent members (from firms, industries, retired academicians, relevant Ministries etc.). However, the presentation will be OPEN to the public although the final assessment will be by the committee members.

### 7.7 Research

Research work may be spread over the four semesters or longer depending on the dictates of the season or other factors but registration for research shall be done only during year 2 first and second semesters. A student is required to write a thesis out of the research, which will be defended orally.

### 7.8 Courses

#### Year 1: Semester I

Core Courses		CU	LH	TH	PH	CH
CRS 9101	Principles of Plant Breeding and Cultivar Development	3	30	-	30	45
CRS 9102	Practical Plant Breeding Methods I (Conventional approaches)	2	-	-	60	30
CRS 9103	Advanced Molecular Genetics	3	30	-	30	45
CRS 9104	Applied Agricultural Statistics and Biometry	3	30	-	30	45
CRS 9106	Biometrical Procedures in Plant Breeding	3	30	-	30	45
Electives		6				
Total Required CU		20				
<b>Electives</b>						
CRS 9107	Forest Genetics	3	30	-	30	45
CRS 9108	Agronomy	3	30	-	30	45
CRS 9109	Molecular Plant Microbe Interactions	3	30	-	30	45
CRS 9110	Plant Genetics	3	30	-	30	45
<b>Year I: Semester II</b>						
<b>Core courses</b>						
CRS 9201	Practical Plant Breeding Methods II	3	-	-	60	30
CRS 9202	Project Planning and Management	3	30	30	-	45
CRS 9203	Applied Molecular Biology and <i>In vitro</i> Techniques	3	30	-	30	45
Electives		6				
Total required CU		15				
<b>Electives</b>						
CRS 9204	Bioinformatics	3	30	-	30	45
CRS 9205	Insect Pest Management Systems	3	30	-	30	45
CRS 9206	Advanced Disease Management	3	30	-	30	45
<b>YEAR 2 to 3</b>						
Research		60				
Total Credit units		95				

## *8.0 Programme roll out*

The RUFORUM strategy is to pilot targeted PhD programmes at lead institutions, build capacity and utilize the capacity to mount similar programmes at the other member universities.

The RAAB will therefore review progress of the programme at Makerere University. Based on feed-back, lessons learnt, capacity developed and demand, RAAB will plan roll out to other universities, including arranging for joint degrees.

## *9.0 Contacts details*

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## About RUFORUM: Investing in Africa's Future

The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) is an association of 12 universities in East and Southern Africa that recognises the important and largely unfulfilled position that universities occupy in contributing to the wellbeing of small-scale farmers throughout the sub-region. This task may be addressed not only through better trained graduates entering the rural development workforce, but also by conducting more relevant and development-oriented research that is directly linked to participatory outreach programmes. In keeping with these needs, the RUFORUM is guided by five Strategic Goals:

- Capacity building at Masters, PhD and Post-doc levels
- Shared research and training facilities and capacities for enhanced economies of scope and scale
- Innovative training, research and outreach activities supported by adaptive management structures in universities contributing to policy and development practice
- Operational capacity and approaches for innovative quality and impact-oriented research for development mainstreamed in universities
- A dynamic regional platform for policy advocacy, lobbying, coordination and resource mobilisation for improved training, research and outreach by universities

### RUFORUM'S ROLE AND CORE FUNCTIONS

RUFORUM's mode of operation as a regional umbrella body which targets the five strategic goals determines that RUFORUM plays the following roles:

- RUFORUM will be an **INNOVATOR** that catalyses change within universities in terms of research training, outreach and related management aspects.
- RUFORUM will be a **CATALYST** and **COORDINATOR** for partnerships and collaboration within the countries and across the region
- RUFORUM will be an **INFORMATION** and **KNOWLEDGE BROKER**
- RUFORUM will be a **REPRESENTOR** and **ADVOCATE** of universities and their stakeholders

All the four roles are based on the value-addition at regional level to on-going national universities' efforts. Fundamental to RUFORUM success is a *well focused, prioritised, and efficiently implemented research, training and outreach agenda*. RUFORUM will therefore work with participating universities and their partners to build human resource and institutional capacity aimed at strengthening the region's innovation capacity and competitiveness.