

Graduate Council Report
October 6, 2011

Special Consideration Item:

Graduate Council approved the College of Agriculture and Life Sciences proposed Master of Science in Plant Breeding – Distance.

Texas A&M University
New Certificate, Bachelors, Masters, or Doctoral Program
♦ Proposal Checklist ♦

Will new costs for the first five years of the program be under \$2 million?
If new costs exceed \$2 million, coordinating board approval is required.

Yes x

No

Submitted by (Contact Person):

Wayne Smith

cwsmith@tamu.edu

Name

Email

Professor and Associate Head

845-3450

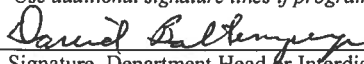
Title

Phone

Certification Statement

By signing below, the Dean of the College certifies the proposed program complies with coordinating board standards. If the program is delivered through Distance Education, the Dean of the College certifies that they are following the *Principles of Good Practice for Academic Degree and Certificate Programs and Credit Courses Offered Electronically*.

Use additional signature lines if program is between three or more departments or colleges.

 9/22/11

Signature, Department Head or Interdisciplinary Date

Program Chair

David Baltensperger

Typed or Printed Name



Signature, Department Head or Interdisciplinary Date

Program Chair *(if joint program)*

Leland S. Pierson III

Typed or Printed Name

Chair, College Review Committee Date

Chair, College Review Committee Date

Dean of College Date

Dean of College Date

Chair, University Curriculum Committee or Date

Chair, University Curriculum Committee or Date

Graduate Council

Graduate Council

Additional Approvals Required: Faculty Senate and President.

Submitted by (Contact Person):

_____ Name	_____ Email
_____ Title	_____ Phone

Certification Statement

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Use additional signature lines if program is between three or more departments or colleges.

_____ Signature, Department Head or Interdisciplinary Program Chair	_____ Date	_____ Signature, Department Head or Interdisciplinary Program Chair (if joint program)	_____ Date
_____ <i>Typed or Printed Name</i>		_____ <i>Typed or Printed Name</i>	
_____ Chair, College Review Committee	_____ Date	_____ Chair, College Review Committee	_____ Date
_____ Dean of College	_____ Date	_____ Dean of College	_____ Date
_____ Chair, University Curriculum Committee or Graduate Council	_____ Date	_____ Chair, University Curriculum Committee or Graduate Council	_____ Date

Wendy Webeed
Wendy Webeed
[Signature] OCT 06 2011



Additional Approvals Required: Faculty Senate and President.



Distance Education "Existing" Bachelor/Masters Degree Proposal (Electronic Delivery)

Directions: An institution shall use this form to propose a "existing" bachelor's or master's degree program they wish to be offered via electronic delivery.

In completing the form, the institution should refer to standards which can be found on the THECB Certification Form for Electronically Delivered and Off-Campus Education Programs. This form requires signatures of (1) the Chief Executive Officer, certifying adequacy of funding and approval for the new program and (2) Vice Chancellor of Academic Affairs (or designee)

Information: Contact the A&M System Office of Academic Affairs at 979-458-6072.

Administrative Information

1. Institution: Texas A&M University
2. Program Name – Show how the program would appear on the Coordinating Board's program inventory [*e.g., Doctor of Philosophy (Ph.D.) in Electrical Engineering*]. Master of Science (M.S.) in Plant Breeding
3. Proposed CIP Code: 01.1104.00
4. Program Description – Describe the program and the educational objectives.

This Proposal requests that Texas A&M University receive authority to deliver the MS, thesis and non-thesis option, in Plant Breeding electronically via the internet. Offering an on-line capability will allow Texas A&M University to train graduate students located at research facilities around the world, which will contribute to the alleviation of world food, feed, and fiber deficits.

Two such generalized research organizations are the International Agricultural Research Centers located in 14 countries and national/internationally structured agricultural variety development companies. The Departments of Soil and Crop Sciences and Horticultural Sciences currently offer this degree as a conventional, on-campus degree, and the Interdisciplinary Programs of Molecular and Environmental Plant Sciences and Genetics direct graduate students who often enter the plant breeding profession.

The major characteristics of the proposal are [1] Extends current course offerings, [2] Requires no additional faculty employment, [3] Increases access to higher education to a new market niche, [4] Builds on an established base of students already taking on-campus courses, [5] Expands the national and international reputation and presence of Texas A&M University, and [6] Will be the first distance delivered M.S. thesis option research degree in Plant Breeding among all Land Grant Universities in the United States. The M.S. in Plant Breeding Distance graduate degrees, thesis or non-thesis option, are an extension of the current Plant Breeding graduate degrees offered at TAMU. This program is an extension of protocols in place where M.S. thesis option students conduct their research guided by a committee co-chair located at one of the Texas AgriLife Research and Extension Centers located around the state.

5. Administrative Unit – Identify where the program would fit within the organizational structure of the institution (*e.g., The Department of Electrical Engineering within the College of Engineering*). The M.S. in Plant Breeding Distance would reside in the Department of Soil and Crop Sciences, and the Department of Horticultural Sciences.

6. Proposed Implementation Date – Report the first semester and year that students would enter the program. January, 2013.

7. Contact Person – Provide contact information for the person who can answer specific questions about the program.

Name: Wayne Smith

Title: Professor and Associate Head, SCSC

E-mail: cwsmith@tamu.edu

Phone: (979) 845-3450

REQUEST TO OFFER EXISTING DEGREE PROGRAM VIA DISTANCE

Texas A&M University

Texas A&M University is seeking permission to offer the following Master of Science in Plant Breeding via distance education (electronic delivery) beginning 1 January 2013.

Format for Distance Education Program Request via Electronic Delivery

For each of the following components, include the requested information as well as any differences between the on-campus program and the proposed distance education program.

I. Summary of the Request

This Proposal requests that Texas A&M University receive authority to deliver the Master of Science, thesis and non-thesis option, degrees in Plant Breeding electronically via the internet. Offering an on-line capability will allow Texas A&M University to train graduate students located at research facilities around the world. Two such generalized research organizations are the International Agricultural Research Centers located in 14 countries and internationally structured agricultural variety development companies. The Departments of Soil and Crop Sciences and Horticultural Sciences currently offer the M.S. in Plant Breeding as a conventional, on-campus degree, and the Interdisciplinary Programs of Genetics and Molecular and Environmental Plant Sciences directs graduate students who often enter the plant breeding profession.

The major characteristics of the proposal:

- Extends current course offerings
- Requires employment of no additional faculty but increases the number of TAMU recognized Graduate Faculty, both national and internationally
- Increases access to higher education to a new market niche
- Builds on an established base of students already taking on-campus courses
- Extends experience and expertise of Texas AgriLife faculty in mentoring M.S.-TO students who are guided by an advisory committee co-chair on campus and a co-chair located at a Texas AgriLife Research and Extension Center where the student's research is conducted
- Expands the national and international reputation and presence of Texas A&M University
- Makes available the first M.S. research degree in Plant Breeding among all Land Grant Universities in the United States.

The Plant Breeding Distance graduate degrees are an extension of the current M.S. in Plant Breeding graduate degree offered at TAMU. All distance learning students will be enrolled in the same classes as the on-campus students and all classes will be taught by the same professors with identical course material, homework, exams, etc. **The Departments involved, and currently granting M.S. in Plant Breeding degrees, have long standing experience guiding graduate academic and research programs with the student located away from campus through Texas AgriLife Research Centers (13) located across the state during the research phase of their TO graduate program. This collaborative research guidance is achieved through co-**

chairs of the committee, with the co-chair located at the research site intimately involved in the academic life of the student and the co-chair located on-campus intimately involved in the research life of the student. The M.S. distance degrees proposed in this program are an extension of that philosophy.

- A Degree program area : Agricultural and Horticultural Plant Breeding
- B Degree title designation (e.g.,BS, MS, etc.) M.S. in Plant Breeding
- C Program delivery

The program will be primarily delivered through the university learning management system, elearning.tamu.edu (Blackboard). This online delivery system has ease of development with modular design, ability to access instructional materials, assignment submission capabilities, Respondus quiz and testing features, and a variety of communication strategies. Content delivery will vary by class, depending on material to be presented but will include Streaming Media, PowerPoint (written format with voice over), video lectures, assignments, group projects, bulletin boards, chat rooms, reading assignments, virtual classrooms, and PDF handouts. Other distribution venues such as digital resources, email, facsimiles, etc. may be used. Any media will be encouraged that promotes educational interaction between professor and student. The Department of Soil and Crop Sciences and the Department of Horticultural Sciences will hire graduate students with technical expertise to support course development. Instructional Material Services offer professional development workshops for faculty to assist with course conversion.

Each distance student will be encouraged to spend time on campus at College Station. Since there will be many in this program where that will not be possible, e.g., a distance student at the International Rice Research Institute in the Philippines, such time will not be mandated but encouraged.

Graduate Advisor Committees for M.S. distance students, Thesis Option, will be co-chaired by a member of the TAMU Graduate Faculty on campus and a member of the TAMU Graduate Faculty at the distance site. The distant site co-chair is mandatory because that co-chair must provide for and guide the original research required of an M.S.-TO degree. For the M.S.-NTO distant student, such guidance is not required.

The delivery of distance Plant Breeding and related courses will not impact the knowledge imparted. The Plant Breeding Distance M.S. degree will be an extension of the current M.S. in Plant Breeding graduate degree offered at TAMU. All distance learning students will be enrolled in the same classes as the on-campus students and all classes will be taught by the same professors with identical course material, homework, exams, etc.

II. Reason for Request

World population doubled from three to six billion people between 1960 and 1999, and is expected to grow to nine billion by 2050. Providing food, feed, fiber, and biofuel for this ever increasing population is a significant challenge given no meaningful addition of new arable lands, changing weather patterns, and decreasing quantity and quality of fresh water available for agricultural production (Figure 1). Development of improved and superior crop varieties by plant breeders is the primary mechanism for meeting this challenge. Texas A&M University is one of the top tier U.S. universities training future plant breeders to meet this challenge and should expand that effort worldwide through distance delivery.

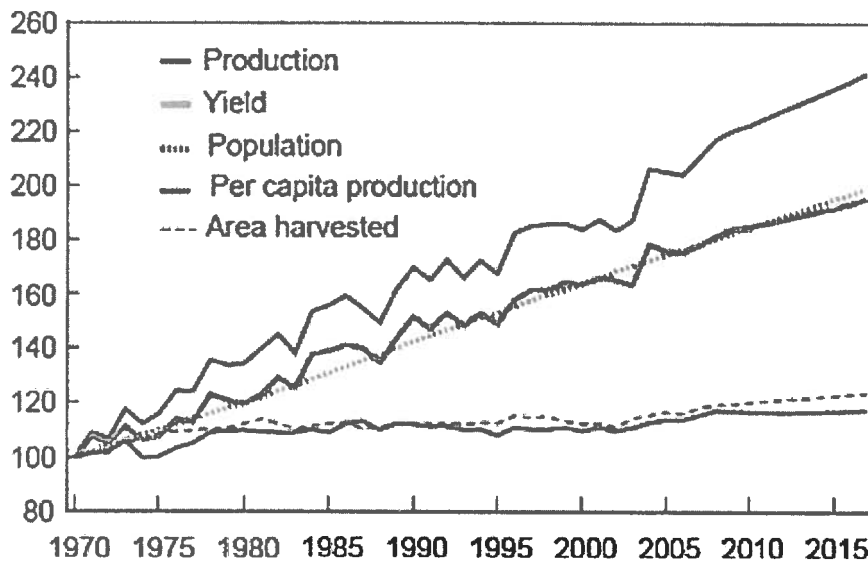


Figure 1. Changes in productivity of grains and oilseed crops since 1970 (from Plant Science 179:645-652).

Several authors, e.g., Guner and Wehner (Crop Science 43:1938) and Bliss (Crop Science 47:250), have reported that the number of graduate students trained in Plant Breeding has declined with a corresponding decline in the size of plant breeding programs at many U.S. universities. By 2006, seven Land Grant Universities, including Texas A&M University, accounted for over 50 % of graduate degrees in Plant Breeding. Concomitant with this decrease in LGU capacity, the passage of the 1994 U.S. Plant Variety Protection Act, rulings by U.S. courts that genes, traits, and varieties are patentable, and improved intellectual property laws in other countries spurred the creation of multinational variety development companies competing for graduates with plant breeding training. Many of the political events noted above combined with the growing or continuing mandate of the Consultative Group on International Agriculture Research Centers, CGIAR, to eradicate hunger around the world has created or supported the need for plant breeders. Texas A&M University can help fill the need for additional plant breeding expertise worldwide through the M.S. Plant Breeding distance degrees.

The National Association of Plant Breeders (NAPB) represents all aspects of the national plant breeding community; focuses on the state of the plant breeding community in its fullest definition including public sector plant breeders, private industry breeders, and plant breeders

with non-government organizations. NAPB meets annually, recognizing outstanding plant breeders with awards, and advocating for issues relating to plant breeding in the political arena. The NAPB is an independent initiative of the Plant Breeding Coordinating Committee (PBCC) and serves as a forum for leadership, regarding issues, problems, and opportunities of long-term strategic importance to the contribution of plant breeding to national goals. These organizations have identified distance education as a priority.

Many of the companies and CGIAR Centers with potential distance learner employees have PhD level plant breeders in residence at the same location qualified and capable of mentoring M.S.-TO graduate students. We have many of these already associated with SCSC, HORT, and MEPS either as adjunct faculty or at least as members of the TAMU Graduate Faculty. The M.S. distance degree proposed in this program is an extension of that protocol and experience.

The primary objectives of this proposal is to provide the opportunity to gain advanced degrees in Plant Breeding for [1] industry professionals within the U.S., who cannot come to the campus for classes but wish to continue their education and professional development while remaining employed, [2] international industry professionals and NGO professional individuals who wish to continue their education in the field of plant breeding but who cannot come to campus or cannot come for extended periods of time, or [3] industry leaders who want to improve their knowledge of plant breeding and genetics.

A Program need

As noted above, there is ample evidence of an expanding need for well trained plant breeders whose career goals will be to alleviate the shortage of food, feed, fiber, and biofuel in a world of quickly expanding population. The proposed program will be unique not only in Texas but in the United States. **At this date, there is not another university in the U.S. that offers an M.S.-TO in Plant Breeding at a distance.** Washington State University, Oregon State University, University of Nebraska, Auburn University, and Iowa State University offer general M.S.-NTO distance degrees in Agronomy or similar area. Iowa State University is the only university offering a distance M.S.-NTO in Plant breeding. **The degree and protocol proposed herein will be unique.**

B Program demand

The passage of the 1994 U.S. Plant Variety Protection Act, rulings by U.S. courts that genes, traits, and varieties are patentable, and improved intellectual property laws in other countries have spurred the creation of national and multinational variety development companies competing for graduates with plant breeding training. Many of these political events along with the mandate of the CGIAR to eradicate hunger around the world has created or supported the need for plant breeders. Examples of demand are:

Monsanto Company web site (<http://jobs.monsanto.com/research>) listed the following on 2 September 2011:

Plant Breeding specific: 10 position announcements, four in the U.S., two in Argentina, two in China, one in Australia, and one in Italy. These mostly would require a Ph.D. but education for a Ph.D. in Plant Breeding requires an M.S. at TAMU.

Related, i.e., a Plant Breeding degree (M.S. or Ph.D.) would be competitive: 43 position announcements, 26 in the U.S. and 17 in other countries.

Syngenta Company web site (<http://jobs.syngenta.com/go/Research-Scientist-Jobs/265758/>) listed the following on 2 September 2011:

Plant Breeding specific: two U.S. positions, one requiring a Ph.D. and one requiring an M.S. degree.

Related, i.e., a Plant Breeding degree (M.S. or Ph.D.) would be competitive: nine U.S. positions.

Several leaders in industry and at CGIAR Centers around the world were asked about the desirability of a Distance Plant Breeding degree program. Only positive responses were received with selected quotes below.

Dr. Cynthia Green, Plant Breeding Lead, Monsanto: This sounds exciting. We have recently been discussing the need for development opportunities for current cotton breeding employees that desire advancement...do not have exact numbers but feel we would regularly have individuals suited for this distance degree.

Dr. Richard Sheetz, Plant Breeding Lead, Monsanto: I have been put on a team at Monsanto looking into ways to further the breeding careers of individuals currently in the Associate or Assistant breeding roles...I will definitely pass this along.

Dr. David Becker, Plant Breeding Management, BayerCropScience: We have averaged two to four people attending MS or PhD level courses while on full-time job status (just) within U.S. cotton breeding...I foresee this to continue or increase, so we may have two to three employees per year interested (in TAMU's distant plant breeding program).

Dr. Steve Calhoun, International Cotton and Rice Breeding Manager, BayerCropScience: I really like this idea...lot of people (in our organization) reach a career plateau because they lack a certain piece of paper...but too expensive to quit work and go back to school...can think of at least 5 inside Bayer in the U.S....another 4-6 in India...couple in Brazil.

Dr. Geoffrey Thomas, R&D Director, MayAgro Seed Corp: I believe such a course (program) would be very useful, especially to countries in Africa, the Middle East, East Europe, and Central Asia...would recommend that such a (program) have 4-8 weeks on the campus of Texas A&M...as R&D director of a large Turkish Seed company...over 30 staff...breeding 7 species...I have a great need for such a (program).

Dr. Melaku Gedil, Head and Molecular Breeder, Bioscience Center, International Institute for Tropical Agriculture (CGIAR-IITA), Ibadan, Nigeria: I am interested in the program...have three potential students for the M.S. thesis option...I have co-supervised graduate students at the University of Ibadan.

C Program's role

Texas A&M University is dedicated to the discovery, development, communication, and application of knowledge in a wide range of academic and professional fields. Its mission of providing the highest quality undergraduate and graduate programs is inseparable from its mission of developing new understandings through research and creativity. It prepares students to assume roles in leadership, responsibility, and service to society. Texas A&M assumes as its historic trust the maintenance of freedom of inquiry and an intellectual environment nurturing the human mind and spirit. It welcomes and seeks to serve persons of all racial, ethnic, and geographic groups, women and men alike, as it addresses the needs of an increasingly diverse population and a global economy. In the twenty-first century, Texas A&M University seeks to assume a place of preeminence among public universities while respecting its history and traditions.

The distance Plant Breeding M.S. degree upholds the above mission statement of Texas A&M University. The proposed program not only seeks to deliver a high quality and rigorous educational program at the graduate level, but also to seek, identify, and nurture research and scientific discovery through the science of Plant Breeding across the globe. This program seeks to provide quality education and research training within well equipped, well managed private companies to CGIAR Centers that address food, feed, and fiber needs in the poorest areas of the world. This program more fully makes graduate education in plant breeding from Texas A&M available regardless of borders, race, or gender.

III. Program Description

A Program construction

Admissions: All students admitted to graduate classes in an M.S. degree program in Plant Breeding (PLBR) at TAMU, whether on campus or through this proposed Distance Plant Breeding program must be admitted as a Master's student (G7) or as a post-baccalaureate, non-degree seeking student (G6). Admission as a G7 or G6 student requires that the student complete the application for graduate admission, submit transcripts of baccalaureate work, and submit three letters of recommendation. If the applicant is a foreign national then they must meet the minimum English language requirement to be verified in English through the verbal portion of the GRE or other standardized exams such as the TOEFL. The Distance Plant Breeding degree program would require students entering as a G6 to have the necessary prerequisites for any courses in which the student enrolls. As indicated in the TAMU graduate catalogue, students may apply a maximum of 12 semester credit hours to an advanced degree when the hours are taken while in the G6 classification, if the student can meet all requirements for admission to the master's program, and if SCSC and HORT approves the applications of any or all of the courses taken while the student is in the G6 status. However, the departments are under no obligation to allow the student to apply any of the G6 hours toward the M.S. in Plant Breeding. All students, distant or resident, applying for admission in Plant Breeding must apply and meet all of the requirements for admission as set forth by the University, the College, SCSC, and

HORT, with the exception that applicants in the Distance Plant Breeding degree program do not have to meet the requirements for English language certification. They will be required, however, to meet the TAMU requirements for English language verification since all courses will be taught in English only.

The M.S.-TO Plant Breeding distance degree will have the same requirements as outlined in the TAMU Graduate Catalog, including a minimum of 32 hours post baccalaureate work composed of approximately 24 hours of course work, including one hour of seminar where the student presents their M.S. research results in an open forum that includes on-campus faculty and graduate students, and a maximum of 8 hours of Research and Thesis will be required. The M.S.-TO requires original research, a written thesis that will be submitted to the TAMU Thesis Clerk, and a defense of the thesis research.

The M.S.-NTO Plant Breeding distance degree will have the same requirements as outlined in the TAMU Graduate Catalog, which includes a minimum of 36 graduate credit hours.

All course materials used in the Distance Plant Breeding degree program have been and will be developed by the faculty responsible for each individual course. These materials provide the same content ideas and processes that are examined in resident classes taught on campus. The graduate faculty member teaching the graduate course is solely responsible for teaching, monitoring, and evaluating all course activities and assigning grades. The professor of record for all 691 research credit hours associated with the M.S.-TO distance candidates will be assigned to the campus co-chair.

Program specific courses currently available (CA) or under development (UD) for a Spring 2013 launch of the M.S. in Plant Breeding distance delivery.

Course #	Course name	SCH	Professor	Functionality
SCSC 304	Plant Breeding and Genetics	3	Hague	UD
SCSC 306	Grain, Fiber, and Oilseed Crops	3	Smith	UD
SCSC 422	Soil Fertility	3	Hons	CA
SCSC 613	Ethics in International Agriculture	3	Cralle	CA
SCSC 641	Plant Breeding I	3	Smith	CA
SCSC 642	Plant Breeding II	3	Rooney	UD
SCSC 643	Quantitative Genetics in Plant Breeding	3	Murray	UD
SCSC 654	Genomic Analysis	3	Zhang	UD
SCSC 660	Experimental Designs in Agronomy	3	Ibrahim	UD
MEPS 601	The Physiology of Plants	3	Hays	UD
MEPS 605	Plant Biochemistry	3	Koiwa	UD
STAT 651	Statistics in Research I	3	varies	CA
STAT 652	Statistics in Research II	3	varies	CA
STAT 653	Statistics in Research III	3	varies	CA
PLPA 603	Plant Disease Management	3	Starr	CA
PLPA 689	Genomic Informatics	3	Yuan	UD
ENTO 402	Field Crop Insects	3	Vinson	CA
AGEC 314	Marketing Agricultural & Food Products	3	Higgins	CA
Student and Advisory Committee could include such courses as the following, depending upon student's career goals and current situation				
EHRD 602	Critical Issues in Human Resource Develop.	3	Callahan	CA

EHRD 605	Principles & Practices of Leadership in HRD	3	Callahan	CA
EHRD 612	Training & Develop. in HR Development	3	Wang	CA
EHRD 613	Career Development in Human HR Develop.	3	Upton	CA
EHRD 625	Organizational Development and Perf. HRD	3	Wang	CA

Other web based courses are available at TAMU but those listed above make up the core of the plant breeding and agricultural science knowledge base for the proposed program. All graduate degree plans are developed by the student and their Graduate Advisory Committee after thorough review of the students previous transcripts and their career goals.

B Administrative oversight

The Departments of Soil and Crop Sciences, and Horticultural Sciences are committed to the Principles of Good Practice, as required by THECB. The proposed program meets all of the specific criteria set forth by THECB and SACS as outlined below.

- Instruction must meet the quality standards which an institution requires of similar instruction offered on-campus to regularly enrolled students.
- Courses which offer either regular college credit or continuing Education Units must do so in accordance with the standards of the Commission on Colleges of the Southern Association of Colleges and Schools.
- Students must satisfy the same requirements for admission to the Institution, to the program of which the course is a part, and to the class/section itself, as are required of on-campus students.
- Faculty must be selected and evaluated by the same standards, review, and approval procedures used by the institution to select and evaluate faculty responsible for on-campus instruction. Institutions must provide training and support to enhance the added skills required of faculty teaching classes via instructional telecommunications.
- The instructor of record must participate in the delivery of instruction and evaluation of student progress.
- Providers of graduate-level instruction must be approved by the graduate faculty of the institution.
- All instruction must be administered under the authority of the same office or person administering the corresponding on-campus instruction. The supervision, monitoring, and evaluation processes for instructors must be comparable to those for on-campus instruction.
- Students must be provided academic support service—including academic advising, counseling, library and other learning resources, tutoring services, and financial aid—that are comparable to those available for on-campus students.
- Facilities (other than homes as instructional telecommunications reception sites) must be adequate for the purpose of delivering instruction which is comparable in quality to on-campus instruction.

Typical Course and Delivery: SCSC 641 Plant Breeding I

SCSC 641: Plant Breeding

SCSC 641 is designed to provide graduate students with an understanding of the roll of genetics in plant improvement, genetic manipulation of plant characters, methodologies used in improving crop species for the benefit of mankind, the role of germplasm preservation in ensuring against genetic erosion, and the role of intellectual property rights.

The course is taught as three lecture hours/week. Lectures are designed to supplement the textbook and assigned reading material.

Suggested Texts: *Breeding Field Crops* (J.M. Poehlman and D.A. Sleper)
Principles of Cultivar Development (W.F. Fehr)
Review articles to be provided

Grading system:

Major lecture exams (4), including Final	80%
Discussion participation	10%
Germplasm releases and other reviews (if required)	10%

Grading scale:

90 - 100: A
80 - 89: B
70 - 79: C
60 - 69: D
< 60: F

Lecture topics:

1. Introduction
2. Reproduction in plants
3. Genetic Variation and where to find it
4. GP preservation
 - CGIAR
 - USDA Plant Germplasm collection and preservation
5. Intellectual Property and WTO, GATT, GATS, and TRIPS
6. Symbols used in Plant Breeding
7. Gain from selection
8. Basics of segregation
9. Breeding self pollinated crop species
10. Back cross example: Grain sorghum conversion program
11. Commercial soybean breeding program
 - size and scale
 - preparing for next year this year
12. Issues in quantitative genetics and plant breeding
13. Hardy-Weinberg equilibrium
14. Mating systems
15. Breeding cross pollinated crop species
16. Deviation from expected F2 ratios
17. Commercial maize breeding program
 - size and scale
 - preparing for next year this year
18. Types of Texas AgriLife releases
 - what makes a cultivar
19. Review of statistics normally used by every plant breeder

20. Apomitic breeding program

All lecture ppt slides, with and without audio, and additional reading material is found at <http://cwaynesmith.tamu.edu/scsc641-600/index.htm> and shown below. Voiced over ppt presentations are available as the initial teaching of SCSC 641 distance M.S. in Plant Breeding.

TOPICS

- Syllabus
- Lecture Topic.1.introduction
- Lecture Topic.2.reproduction
- Lecture Topic.3.variation
- Lecture Topic.4.Genetic Preservation
- Lecture Topic.5.CGIAR
- Lecture Topic.6.intellectual property
- Lecture Topic.7.wto and trade
- Lecture Topic.8.symbols.Gs.table
- Lecture Topic.9.trait.id.to.comm
- Lecture Topic.10.basic.seg.self,
- Lecture Topic.11.self.brd.meth.
- Lecture Topic.12.grain.sorghum.conv.BC
- Lecture Topic.13.soybean.pgm
- Lecture Topic.13.5.selection hi lo protein and oil
- Lecture Topic.14.quantitative.genetics
- Lecture Topic.15.sel.HWE
- Lecture Topic.16.mating.systems
- Lecture Topic.17.cross.breeding.methods.I
- Lecture Topic.18.cross.brd.meth.II
- Lecture Topic.19.deviation.from.expected.ratios
- Lecture Topic.20.maize.hybrid.pgm
- Lecture Topic.21.cultivar.type.certification

SCSC 641-700 VIDEOS

<u>Lecture 1</u>	<u>Lecture 10</u>	<u>Lecture 19</u>	<u>Lecture 28</u>
<u>Lecture 2</u>	<u>Lecture 11</u>	<u>Lecture 20</u>	<u>Lecture 29</u>
<u>Lecture 3</u>	<u>Lecture 12</u>	<u>Lecture 21</u>	<u>Lecture 30</u>
<u>Lecture 4</u>	<u>Lecture 13</u>	<u>Lecture 22</u>	<u>Lecture 31</u>
<u>Lecture 5</u>	<u>Lecture 14</u>	<u>Lecture 23</u>	<u>Lecture 32</u>
<u>Lecture 6</u>	<u>Lecture 15</u>	<u>Lecture 24</u>	<u>Lecture 33</u>
<u>Lecture 7</u>	<u>Lecture 16</u>	<u>Lecture 25</u>	<u>Lecture 34</u>
<u>Lecture 8</u>	<u>Lecture 17</u>	<u>Lecture 26</u>	<u>Lecture 35</u>
<u>Lecture 9</u>	<u>Lecture 18</u>	<u>Lecture 27</u>	

READING MATERIALS

- Borlaug: Ending World Hunger...
- 'Saber' Rice
- Report of Technical Committee on Seed Release and Increase
- Tamcot 22 release proposal

- **Notice Release Three Germplasm Lines Upland Cotton Improved Fiber Length**
- **Canola- A success Story in Biotechnology**
- **Personal Perspective**
- **Sources of Genetic Advance for the future**
- **Vegetable of a different color**
- **Rules in World Trade Law-Patents or Plant Variety Protection**
- **Simple Cultivar Pedigrees**
- **Ten Cycles of Full-Sib Selection in Maize**
- **Genetic Variability for Desirable Agronomic Traits**
- **The Last Harvest**
- **Intellectual Property Rights Protection**
- **Historical Aspects of Plant Breeding**
- **Vavilov Institute Scientists**
- **Winter Barley - Marshall-Sutton-Lazar-Nelson-McDaniel-Carver**
- **Backspin Creeping Bentgrass - Engelke - Davis**
- **Bentgrass - Engelke-Reinert**
- **Cotton - El Zik-Thaxton-Milford**
- **Jalapeno - Crosby - Villalon**
- **Oats - Marshall**
- **Peach - Byrne**
- **Peanut - Simpson-Starr**
- **Saber Rice - McClung-Marchetti-Bergman-Fjellstrom**
- **Soybean - Travis**
- **Texas Early White - Pike-Horn-Rogers-Miller-Lander**
- **Wheat - David Marshall**
- **Release Proposal Miscane**
- **Neches synthetic white clover rel**
- **Intercross synthetic ryegrass rel**

Academic integrity:

Science cannot be conducted in isolation and thus I highly encourage you to collaborate with your colleagues in the class. You will likely have interactions with them or through them for the rest of your career. You will also learn more from them than you do from me. If you do not personally need help then please help others who do. This being said I will not tolerate any direct copying or lack of effort (i.e. laziness) in problem solving and neither should you.

“An Aggie does not lie, cheat or steal or tolerate those who do.”

Please see the Honor Council Rules and Procedures on the web:

<http://www.tamu.edu/aggiehonor>

Americans with Disabilities Act (ADA) policy:

The Americans with Disabilities Act (ADA) is a federal antidiscrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room B-118 in the Cain Building, or call 845-1637.

SCSC 641 is delivered as a conventional on-campus class and proposed as a 700 section for students not located on campus. On-line classes are taught as a section of an on campus class. The on-line class has the same schedule in most cases, the same course material, the same homework, and the same exams. This approach allows for the duplication of the on campus class experience. Web-conferencing through various venues such as Web CT Blackboard options, distance students can ask questions with voice over the internet and interact with other students. Time zone differences for distance students in other countries may present some challenges but they are not insurmountable at the graduate level. In those cases, I will interact with the distant student in a standard format that will insure understanding of the course material and timely completion of assignments and course content. The on-line section will be completely on-line except in those situations where the student is a full time employee within driving distance of College Station and occasional on-campus meetings can facilitate the education process.

The student-faculty ratio for SCSC 641 has been 13.2 to 1 over the past five years. The distance section may add 1 to 10 for any given year (note that SCSC 641 is only taught in the Spring Semester). Other specific plant breeding courses in the course outline above have student to faculty ratios as high as 50 to 1. In the anticipated enrollment structure, distance students will be spread across states and countries and each distance student will have independent access to the professor through various types of internet media.

C Administrative structure

The Department Heads in Soil and Crop Sciences and Horticultural Sciences are responsible for the academic offerings within their respective departments. The daily management of the graduate programs in each department is in the purview of the Associate Heads for Academic Programs. The contact person for the M.S. in Plant Breeding Distance Program is Wayne Smith, Associate Head, Department of Soil and Crop Sciences. No changes in his areas of responsibilities are anticipated at the initial offering of the M.S. in Plant Breeding distance delivery degree.

IV. Relationship to Existing Authorized Degree Programs

A Relationship between proposed distance education program and any existing on-campus program

On-line classes are taught as a section of an on campus class. The on-line class has the same schedule in most cases, the same course material, the same homework, and the same exams. This approach allows for the duplication of the on campus class experience. Web-conferencing through various venues such as Web CT Blackboard options, distance students can ask questions with voice over the internet and interact with other students. Time zone differences for distance students in other countries may present some challenges but they are not insurmountable at the graduate level.

The M.S.-TO Distance Plant Breeding degree proposed herein can only be pursued under unique circumstances where there is a Graduate-Faculty-eligible Ph.D. scientist at the same employment location as the student. Such opportunities exist in U.S. variety development companies, national and multinational variety development companies, and such entities as the

International Research Centers associated with CGIAR. The Graduate Faculty at the distant site would serve as co-chair of the Graduate Advisory Committee with a co-chair on campus in SCSC or HORT. The M.S.-NTO would not require such collaborative opportunity.

Full time employees of Texas AgriLife Research or Texas AgriLife Extension, or full time employees on one of the Texas A&M University System campuses are eligible for enrollment in this Ph.D. in Plant Breeding Program. However, students who are compensated as Graduate Assistant Research, Graduate Assistant Teaching, Graduate Assistant Non Teaching, or through any scholarship/fellowship funding and associated with the entities identified in this paragraph in any capacity less than full time employment are not eligible for this Ph.D. in Plant Breeding program.

B Student interaction

The ITS development team is comprised of instructional designers, technology specialists and a web content developer to assist in the development and implementation of this program. This includes elements for effective course management, meeting course and program objectives and learning outcomes, and complying with ADA requirements, Copyright Law, and the Principles of Good Practice for Electronically Offered Academic Degree and Certificate Programs from SACS and THECB.

The on-line classes will have graduate faculty teaching the course and the same course requirements as on-campus students. When appropriate, live or recorded video feeds from on-campus courses will be used. Distance students can interact with instructors and students synchronously using desktop or interactive videoconferencing, Skype, and texting features. This approach allows for the duplication of the on campus class experience. Distance students can ask questions with voice over IP and interact with other students. Tutorials, advising, and course presentations can occur with the use of Centra (online conferencing). Time zone differences for distance students in other countries may present some challenges but they are not insurmountable at the graduate level. In those cases, the professor will interact with the distant student in a standard format that will insure understanding of the course material and timely completion of assignments and course content. The LMS platform supported by ITS provides technical support for students having difficulty. This platform also provides email, chat, discussion (blog and journal) communication tools to further facilitate interaction with the instructor and learners.

The distance students will have the opportunity to interact with on-campus students through webinars, social media, and other communication technologies. Some courses may be appropriate to deliver to some places using technology such as TTVN or Skype that would allow on-campus and distance students to see and converse in real time. This format would be appropriate for small on-campus classes.

V. Expected Enrollment

Student Loc.	2012/13	2013/14	2014/15	2015/16	2016/17
U.S. residents	6	10	12	12	12
Foreign Nationals	5	8	10	10	10

A Anticipated head count

Based on responses from variety development companies in the U.S. and from scientists and administrators at CGIAR Centers to date, we anticipate the number of students shown in the table above for this program. Most of these are expected to be M.S.-TO and co-chaired by one of the ten plant breeder professors in SCSC and HORT departments.

B Impact on existing face-to-face program(s)

The proposed M.S. in Plant Breeding Distance is not expected to impact our on-campus student numbers. It may reduce the amount of time a traditional M.S. student who is co-chaired by a faculty member at one of the Texas AgriLife Research and Extension Centers is required to be on campus but those students would remain traditional on-campus students by our definition.

The extra time and energy required to delivery on-line courses and manage/mentor M.S.-TO distance graduate students will be absorbed by the SCSC and HORT plant breeding faculty. With electronic posting of grades, delivery of exams, etc., administrative assistance, clerical, etc. will be minimal.

Addition of a half time technical assistant to keep faculty up to date and assist with IT is desirable.

C Student projections

Graduate programs in agriculture and specifically plant breeding are not considered commonly as cohort teaching/training activities. The need to train a limited number of plant breeders (or, e.g., veterinarians) does not reduce the need for those numbers. Since the distance delivered plant courses will be synchronous with on-campus delivered courses in many cases, and can be delivered to a single person under certain conditions, the number needed to sustain the effort is minimal. The Department of Soil and Crop Sciences currently has 17 M.S. plant breeding majors (and 29 Ph.D. plant breeding majors), additional distance students will only add to our efforts to fulfill the educational mission of Texas A&M University.

Assumptions Underlying Enrollment and Growth Expectations

1. Most admitted distance education M.S. students will be part-time, remaining employed. The availability of 24/7 access to course materials via digital technology will enhance the appeal of the program. Employed students who would otherwise not consider the traditional delivered on-campus program due to their professional and family responsibilities will be able to pursue the distance program.
2. Students are expected to finish the M.S. TO or NTO in two to four years. Students should be able to enroll in at least two courses each long semester. The availability of a 24/7 digital program will provide candidates with options for

completing course requirements. We expect the completion rate to be similar to that of residence Plant Breeding students.

3. The program will admit additional students each year as the on-line program becomes established and known by perspective students. We will market the degree by contacting CGIAR Centers, Seed Companies in the U.S. and in other countries, and through trade and academic publications. Capitalizing on the reputation of the University, the College of Agriculture, and the Departments of Soil and Crop Sciences and Horticultural Sciences, extensive marketing of the array of on-line course offerings each semester will result in greater enrollment in the program by students from distant locations because travel to campus will not be necessary.
4. Graduate Advisory Committee meetings and TO M.S. thesis defenses can be handled through electronic communication devices. These include such commercially available options as Skype, Go-To-Meeting, teleconferencing. Thesis and dissertations can be move almost immediately via email attachments or assigning dedicated space on a shared drive or server.
5. The degrees offered in this program will be exempt from TAMU, COALS, Department, or IDP residency requirements and exempt from the minimum number of students required for on-campus course section delivery.

VI. Faculty Resources

A Faculty resources

The faculty listed below are tenured or tenure track faculty on campus at Texas A&M University, College Station. Most of those listed teach and all direct graduate students. Thus they have the background and experience to deliver on-line course information and co-chair distance M.S. Plant Breeding graduate students. Additional faculty will not be required at the initial offering of the M.S. Plant Breeding distance degree.

Professor	Ph.D. Institution	Date of Ph.D.
Cralle, Harry	University of Minnesota	1983
Hagūe, Steve	Texas A&M University	2000
Haye, Dirk	University of Calgary	1997
Honb, Frank	Texas A&M University	1978
Ibrahim, Amir	Colorado State University	1998
Murfay, Seth	Cornell University	2008
Rooney, William	University of Minnesota	1992
Smith, Wayne	University of Tennessee	1974
Byrne, David	Cornell University	1980
Crosby, Kevin	Texas A&M University	1999
King, Steve	Cornell University	1994
Koiwa, Hisashi	Kyoto University	1996
Starr, James	Cornell University	1976
Yuan, Joshua	University of Tennessee	2007
Vinson, Brad	Mississippi State University	
Higgins, Lindsey	Texas A&M University	
Callahan, Jamie	The George Washington University (EdD)	1998
Wang, Jia	University of Georgia	2004
Upton, Matthew	Texas A&M University	2006

Appendices A and B provide a sampling of Ph.D. Plant Breeding Scientists associated CGIAR Centers and with national or multiple national variety development companies, respectively.

The faculty located in the Department of Soil and Crop Sciences and the Department of Horticultural Sciences will be provided with such additional training as necessary to use the distance delivery and communications with distant students. This instruction will be handled by existing IT personnel in each department and a part time IT individual devoted to the program. Most faculty currently are familiar with the basic concepts and techniques of such delivery and communications such that minimal additional training will be necessary.

Start up funds is provided in the amount of \$ 174,000 for both the proposed distance delivered Ph.D. and M.S. (separate submissions) programs from the College of Agriculture and Life Sciences. These funds will provide salary for a part time IT person to help familiarized faculty with any of the new technology with which they are not familiar and help faulty to make their courses electronic and distance ready.

B Describe equipment, software and connectivity needs for delivery of this program both for students and for the institution.

In general, faculty members and students need access to a computer that is less than four years old, common office software and plug-ins, CD/DVD player/burner, a high-speed (cable or DSL) Internet connection and an up-to-date Web browser. Individual courses may have specific technology requirements.

To capture and edit audio/video-over-PowerPoint: instructors need screen recording/editing software such as Techsmith Camtasia (available from Texas A&M

Software Center), access to a semi-professional quality microphone, and/or digital camcorder, a computer with upgraded sound and/or video cards, access to file storage space, as well as training and/or support.

To participate in Web-conferencing: instructors and students need an Internet-connected computer with microphone and/or video camera (built-in or external), and free conferencing software.

To participate in high-quality Video-conferencing: instructors and students need access to networked video conference facilities.

To capture, scan or modify images, instructors may need access to a digital camera, scanner, and/or photo editing software such as Adobe Photoshop, as well as training or assistance to modify images.

C. How will students access library resources, including print, electronic, and human.

Distant graduate students will have access to many of the services of the University library with ever increasing electronic data bases and other electronic services. Distance Plant Breeding degree program students will be informed fully on how to access the TAMU library system and provide initial information about how to access within each syllabus. Off-campus access to electronic holdings is available by NetID and password to currently enrolled students and faculty and staff of Texas A&M University and its affiliated agencies.

Other Student Services can be accessed through the Offices of the Dean of Student Life at <http://studentlife.tamu.edu/contact>.

VII. Financial Support

A Anticipated costs

No new faculty costs are required for the M.S. in Plant Breeding Distance Program. All plant breeding faculty and associated faculty in Soil and Crop Sciences Department and the Horticultural Sciences Department are fully supportive of the program capable of meeting expectations.

The M.S. in Plant Breeding Distance Program will require a 0.25 FTE in technical/administrative assistance and a GAT assistantship to assist faculty in development, maintenance, and update of course contents. The Differential Tuition assessment will be utilized by individual professors and the Departments to maintain quality and quantity of course content and course delivery systems

The College of Agriculture and Life Sciences is providing start up funds sufficient to cover these costs for the first three years of the program.

B Budget

Start up funds for three years for the M.S. (and Ph.D. (see separate documentation) in Plant Breeding provided by the College of Agriculture and Life Sciences are:

Technical Assistance @ 0.25 FTE: \$ 20,000/yr for three years (total \$ 60,000)

Course Development: \$ 24,000 (first year only)

GAT: \$ 30,000/yr for three years (total \$ 90,000)

C Financial support

No financial support is anticipated for M.S. Plant Breeding distance students. It is anticipated that these students will be full time employees of national or international variety development companies or such NGO entities as the CGIAR Centers around the world.

VIII. Additional Distance Delivery Considerations

A Adherence to *Principles of Good Practice*

Texas A&M University certifies that the Master of Science in Plant Breeding as described herein to be delivered electronically via the Internet meets the standards and criteria established in Chapter 4, Subchapter p of the rules and regulations of the Texas Higher Education Coordinating Board. Those standards include:

1. Quality Standards: The Distance Plant Breeding degree program is composed of courses outlined in the documentation of this request. As required under Subchapter P, distance students in this program will complete the same work as students in the resident sections of the courses. Since the distance courses are taught via the Internet, students may be “at a distance” or on campus. No distinction in requirements is made for students based on their location.

The original research requirements for the M.S.-TO and the Ph.D. degree will be directed by a Graduate Advisory Committee that is co-chaired by a graduate faculty member located at TAMU at College Station and a graduate faculty member located at the residency of the distance student. The criteria for Graduate Faculty Membership is defined by TAMU, COALS, and the Office of Graduate Studies and all members must meet those criteria. Since the M.S.-TO and Ph.D. Distance Plant Breeding degrees can only be attained with original research and since the criteria for membership in the Graduate Faculty of TAMU is the same for candidates on campus or off campus, the rigor and scientific expectations for research leading to a thesis or dissertation of students in the Distance Plant Breeding degree program will be the same as for on campus graduate students. On-campus faculty within the departments and MEP IDP have extensive experience collaborating with colleagues at Texas AgriLife Research and Extension Centers across the state of Texas in guiding original research away from campus.

The Distance Plant Breeding degree program faculty in Soil and Crop Sciences, and Horticultural Sciences, along with faculty in MEPS, are committed to providing a level of quality for off-campus students equivalent to that of on-campus resident credit instruction. All standards required of regularly enrolled on-campus students will be required of the students who use remote instructional services. These services include the use of regularly employed graduate faculty members, the same faculty contact hour requirements, courses being taught only by graduate faculty, availability of faculty support services, and standard evaluation.

The Distance Plant Breeding degree program will be systemically reviewed every seven years, coinciding with the recurring Departmental Review. This review will

include surveys and interviews with current students, graduates, faculty, administration, and others with interests in the program and the plant breeding discipline. Teaching, evaluation, review, and refining are important steps in ensuring quality.

2. SACS Standards: Distance Plant Breeding degree program courses are the same as resident courses and are offered in accordance to SACS standards.

3. Admissions: All students admitted to graduate classes in Plant Breeding (PLBR) at TAMU must be admitted as a Master's student (G7), a doctoral student (G8), or as a post-baccalaureate, non-degree seeking student (G6). Admission as a G6 student requires that the student complete the application for graduate admission, submit transcripts of baccalaureate work, and submit three letters of recommendation. If the applicant is a foreign national then they must meet the minimum English language requirement to be verified in English through the verbal portion of the GRE or other standardized exams such as the TOEFL. The Distance Plant Breeding degree program would require students entering as a G6 to have the necessary prerequisites for any courses in which the student enrolls. As indicated in the TAMU graduate catalogue, students may apply a maximum of 12 semester credit hours to an advanced degree when the hours are taken while in the G6 classification, if the student can meet all requirements for admission to the master's program, and if SCSC and HORT approves the applications of any or all of the courses taken while the student is in the G6 status. However, the departments are under no obligation to allow the student to apply any of the G6 hours toward the M.S. or Ph.D. in Plant Breeding. All students, distant or resident, applying for admission in Plant Breeding must apply and meet all of the requirements for admission as set forth by the University, the College, SCSC, and HORT, with the exception that applicants in the Distance Plant Breeding degree program do not have to meet the requirements for English language certification. They will be required, however, to meet the TAMU requirements for English language verification since all courses will be taught in English only.

4. Faculty: Texas A&M University allows only graduate faculty to teach graduate courses with membership gained only through application through respective colleges within the University. All applications are vetted by individual departments and a college committee, Graduate Program Council, prior to submission to the Office of Graduate Studies. Non-teaching faculty are granted Graduate Faculty status through the same process and are required to meet the same criteria as teaching faculty.

Teaching faculty are required to allow students to evaluate their effectiveness through the Teaching Evaluation Questionnaire. Faculty teaching distance sections will add appropriate questions for students taking distance classes that will allow the professor to refine and improve their distance delivery. The same faculty who teach resident sections of courses will also teach the distance sections within the Distance Plant Breeding degree program. TAMU offers support for distance degrees through the Office of Distance Education. All faculty shown in the section below either have an on-line course or have agreed to develop their resident course for distance delivery for the Distance Plant Breeding degree program.

5. Training and support of faculty using instructional telecommunications is available through the SCSC and HORT Departments.

6. Instructor of Record: the graduate faculty member teaching the graduate course is solely responsible for teaching, monitoring, and evaluating all course activities and assigning grades. The professor of record for all 691 research credit hours associated with the M.S.-TO and Ph.D. distance candidates will be assigned to the campus co-chair.

7. Instruction: All course materials used in the Distance Plant Breeding degree program have been and will be developed by the faculty responsible for each individual course. These materials provide the same content ideas and processes that are examined in resident classes taught on campus.

8. Support Services: distance students receive academic advising from graduate faculty responsible for the program and the courses that comprise the graduate programs delivered via distance. Support and guidance for the original research component of the M.S. Distance Plant Breeding degree program is provided by the students co-chairs, one on campus and one required at the distant site, collaboratively with the other members of the student's Graduate Advisory Committee. Such guidance will be equivalent to that provided plant breeding graduate students solely on campus and those co-directed by an AgriLife Research co-chair at a Research and Extension Center and a co-chair on campus.

TAMU has library services available for distance graduate students available online. Distant status graduate students may apply for financial aid if they meet the University criteria just as in-residence students, although the primary target population for the Distance Plant Breeding degree program will be full time employees who would not seek financial aid outside of their employer.

9. Ease of communications is a must for efficient on-line instructions, conveyance of knowledge, interaction with other students and professor, and examinations. Electronic mail, telephone, instant messaging, and texting are examples of instant communications available. The Blackboard learning management system provides the ability to utilize the web creating connection with students via the internet literally anywhere-anytime. Professors in SCSC, HORT, and MEPS will be provided assistance in utilizing the appropriate hardware and software.

Advertisements of the Distance Plant Breeding degree program will be placed in trade journals, academic media, and professional society media with pertinent program descriptions and links to professors, web sites, phone numbers, and email addresses. Distant learners enrolled in classes will be provided appropriate contact information and web addresses as part of the syllabi.

10. Computing Services:

All TAMU graduate students, whether in residence or distant, should have the same access to computing services provided by the Department of Computing and Information Services. Such services can be found at (<http://cis.tamu.edu>). CIS provides information technology resources, facilities and support to help the students, faculty and staff of TAMU achieve their learning, teaching and research goals. Instructional Technology Services (ITS) (itsinfo.tamu.edu) supports Blackboard Vista and provides training workshops for instructors and students. TTVN (ttvn.tamu.edu)

provides support for video- and Web-conferencing services.

11. Departmental IT:

The Department of Soil and Crop Sciences and Department of Horticultural Sciences also will provide technical support for faculty teaching distance courses in this program. The Departments of Soil and Crop Sciences and Horticultural Sciences have adequate hardware and software capabilities to support distance courses as well as IT personnel to assist faculty.

12. Library Services:

Distant graduate students will have access to many of the services of the University library with ever increasing electronic data bases and other electronic services. Distance Plant Breeding degree program students will be informed fully on how to access the TAMU library system and provide initial information about how to access within each syllabus. Off-campus access to electronic holdings is available by NetID and password to currently enrolled students and faculty and staff of Texas A&M University and its affiliated agencies.

Other Student Services can be accessed through the Offices of the Dean of Student Life at <http://studentlife.tamu.edu/contact>.

13. Facilities:

Courses and course materials offered via the Internet, as well as the course professor, can be accessed by students when given the appropriate URL and password.

14. TAMU follows all guideline for off-campus instruction given in the Higher Education Administrative Code. The proposal to allow TAMU to offer its M.S.-TO, M.S.-NTO, and Ph.D. in Plant Breeding via distance is developed to comply with those criteria

- *Provide the THECB Certification form for Distance Education*
- Certification form for electronically delivered and off-campus degree and certificate programs available at <http://www.thecb.state.tx.us/index.cfm?objectid=B996EAAE-9356-09BD-80C46308898CBB45>

B Delivery modes

The M.S. in Plant Breeding Distance will be delivered through the university LMS so that students can have a consistent location to access course materials. Depending on the content in the course, visual and graphical elements will be included. Interactivity and engagement will occur between the students, instructor, and content. Students will be able to download instructional materials to their personal computers. Some desktop or interactive video/audio components will provide real time interaction. Adobe connect, Skype (voice over IP), and sharing of documents will supplement formal course delivery. Many software programs are free to the user to access course materials and facilitate interaction (Microsoft media player, iTunes library, UTube, Adobe Flash, Adobe Acrobat reader, etc).

C Collaborative arrangements

The M.S.-TO in Plant Breeding Distance has the same requirements as on campus delivered M.S.-TO degrees. Primary among these requirements is the original research component. **To achieve this original research component with a true distance delivery as proposed herein requires a Ph.D. scientist located at the distance site where the student is located. This distant Ph.D. scientist must be eligible and made a member of the TAMU Graduate Faculty and then becomes a co-chair of the student's Graduate Advisory Committee. The research agreed to by the committee is then lead by the distant co-chair with additional input by the Graduate Advisory Committee.** Appendix A provides a listing of Graduate Faculty eligible Ph.D. plant breeders located at CGIAR Centers who are potential co-chairs of M.S. Graduate Advisory Committees. Appendix B provides examples of Ph.D. scientists at National/multinational variety development companies and CGIAR Centers who have agreed to participate in the Ph.D. Plant Breeding Distance Program as described herein.

The following national/multinational companies are examples of well respected private organizations that are known to the faculty of Horticultural Sciences and Soil & Crop Sciences to have sufficient facilities and financial ability to support full time employees seeking a Ph.D. in Plant Breeding through this Distance Program: Monsanto, Dow AgriSciences, Bayer CropSciences, Pioneer, Syngenta, Dupont, Avanta, BASF, Agriliant, Illinois Foundation Seed, CERES, Mendel, Driscoll, Campbell, Green Giant, R.J. Reynolds, Dole, Ball Ornamentals, Seminas, and Dupont. Employees of other national, multinational, or international companies with which our faculty do not have a working relationship will be required to provide documentation to a Plant Breeding Distance Coordinating Committee composed of the Associate Heads of the departments eligible to grant the degree and a plant breeding faculty member appointed by the Head of each department eligible to grant the degree. The committee will determine if the company has sufficient facilities, land, equipment, and commitment to support the Ph.D. level research proposed. All CGIAR Centers are known to have outstanding facilities and commitment to the science of plant breeding and the alleviation of world poverty and hunger. All state agricultural experiment stations in the U.S. associate with Land Grant Universities or recognized Agricultural Colleges or Universities will be consider to have sufficient facilities and commitment to participate in this program. All others supporting entities will be vetted through the Plant Breeding Distance Coordinating Committee.

All students in this program will be qualified and accepted graduate students at Texas A&M University at College Station. All academic work for the M.S. Plant Breeding Distance degree will be from Texas A&M University at College Station and the degree will be awarded by Texas A&M University at College Station.

D Program differences

There are no differences in any aspect of the application, acceptance, academic rigor, course requirements, thesis or non-thesis option, except that the residency requirement is waived for the M.S. Plant Breeding Distance student.

Needs for special needs students is not expected to be an issue with the M.S. in Plant Breeding Distance Program since all classes are delivered via the internet.

As discussed above, library access, all course materials, and all other instruction material will be made available to the student via the internet. The Evans Library at Texas A&M University is fully internet capable and already supports distance student learning.

E Student interactions

As a graduate degree program, orientation needs should be minimal. Students in this program have experienced collegiate education at one or more campuses, albeit many will have not experienced an American college campus. Instructors will be cautioned that they must make sure that course instructions are explicit and that distance students are given exact URLs along with specific pathways in which to gain access to any documents needed by the student. The Evans Library has instructions, librarians, and experience to aid in this effort.

Students and instructors will interact on a regular basis as described above during the conduct of any particular class. The co-chairs of the student's Graduate Advisor Committee should schedule regular committee meetings to share information and monitor the distant student's progress. This is vital in keeping the distance student engaged and on track and development of the research and development of the thesis document, as well as follow-up publication in research peer reviewed journals.

Residency requirements for M.S. in Plant Breeding Distance Program is waived.

Potential students will be made aware of the program in the following venues:

1. Agronomy Society, Crop Science Society, Horticultural Society announcements.
2. Direct electronic mailings of brochures announcing and describing the program.
3. Direct communications, i.e., word of mouth, between plant breeding scientists at TAMU and fellow scientists with national/multinational variety development companies, CGIAR Centers, etc.
4. Face Book, You Tube, and other electronic society venues.

IX. Evaluation

A Program quality

The Department of Soil and Crop Sciences and the Department of Horticulture will monitor the quality of the M.S. in Plant Breeding Distance Program in the same ways that on-campus classes and programs are monitored. These include but not limited to student evaluations and annual reviews by the Department Head. Distance Learners will have to show mastery of the subject matter in the same manner as on-campus students.

B Participant satisfaction

Through student evaluations and communications within Graduate Advisory Committees.

C Assessment procedures

The Departments of Soil and Crop Sciences and Horticulture have Assessments procedures in place for all majors per the University requirements. In addition, the advancement of distant learners obtaining an M.S. in Plant Breeding Distance within their companies or at NGO organizations such as CGIAR Centers will be monitored.

Student Evaluations will be conducted via the electronic model used by Texas A&M University for all courses. This opportunity mirrors the effort to make this distance delivery program equivalent to on-campus courses and programs. Additional assessments are common to all graduate degrees, i.e., the distant student, just as on-campus students, will interact with their Graduate Advisor Committee in all aspects of the degree program.

Distance Learners will have the same redress opportunities as on-campus graduate students, i.e., availability of Associate Heads for Academic Affairs in any department delivering an on-line course, Department Heads, and the Ombudsperson for the Office of Graduate Studies.

D Use of assessment

The assessment protocols noted above will be used to evaluate and improve the distance delivery of the M.S. in Plant Breeding. Interactions with Graduate Advisory Committees, especially the distance co-chair, will provide feedback on our delivery software and teaching methodology.

ANTICIPATED SOURCES OF FUNDING: EXPLANATORY NOTES AND EXAMPLES

I. Formula Income

- A. The first two years of any new program should not draw upon formula income to pay for the program.
- B. For each of Years 3 through 5, enter the smaller of:
 - 1. the new formula income you estimate the program would generate, based on projected enrollments and formula funding rates; or
 - 2. half of the estimated program cost for that year.
- C. Because enrollments are uncertain and programs need institutional support during their start-up phase, it is the Coordinating Board's policy to require institutions to demonstrate that they can provide:
 - 1. sufficient funds to support **all** the costs of the proposed program for the first two years (when no **new** formula funding will be generated); and
 - 2. half of the costs of the new program during years three through five from sources other than state formula funding.
- D. When estimating new formula income, institutions should take into account the fact that students switching programs do not generate additional formula funding to the institution. For example, if a new master's program has ten students, but five of them switched into the program from existing master's programs at the institution, only five of the students will generate new formula income to help defray the costs of the program.

II. Other State Funding

This category could include special item funding appropriated by the legislature, or other sources of funding from the state that do not include formula-generated funds (e.g., HEAF, PUF, etc.).

III. Reallocation of Existing Resources:

If faculty in existing, previously budgeted positions are to be partially or wholly reallocated to the new program, you should explain in the text of your proposal how the institution will fulfill the current teaching obligations of those faculty and include any faculty replacement costs as program costs in the budget.

IV. Federal Funding

Only federal monies from grants or other sources currently *in hand* may be included. Do not include federal funding sought but not secured. If anticipated federal funding is obtained, at that time it can be substituted for funds designated in other funding categories. Make note within the text of the proposal of any anticipated federal funding.

A. Other Funding

This category could include Auxiliary Enterprises, special endowment income, or other extramural funding.

COSTS TO THE INSTITUTION OF THE PROGRAM/ADMINISTRATIVE CHANGE

Note: Use this chart to indicate the dollar costs to the institution that are anticipated from the change requested.

<u>Cost Category</u>	<u>Cost Sub-Category</u>	<u>Before Approval Year*</u>	<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>	<u>5th Year</u>	<u>TOTALS</u>
Faculty Salaries	(New)	0	0	0	0	0	0	0
	(Reallocated)	0	30,000	30,000	30,000	30,000	30,000	150,000***
Program Administration	(New)	0	0	0	0	0	0	0
	(Reassignments)	6,400	6,400	6,400	6,400	6,400	6,400	38,400
Graduate Assistants	(New)	0	30,000	30,000	30,000			90,000
	(Reallocated)	0	0	0	0	0	0	0
Clerical/Staff	(New)	0	20,000	20,000	20,000			60,000
	(Reallocated)	0	5,000	5,000	5,000	10,000	10,000	35,000
Supplies & Materials		0	0	0	0	0	0	0
Library & IT Resources**		0	5,000	0	0	5,000	0	10,000
Equipment		0	10,000	0	0	0	5,000	15,000
Facilities		0	0	0	0	0	0	0
Other (Identify)		0	0	0	0	0	0	0
<u>TOTALS</u>		<u>6,400</u>	<u>106,400</u>	<u>91,400</u>	<u>91,400</u>	<u>51,400</u>	<u>51,400</u>	<u>398,400</u>

* Include costs incurred for three years before the proposal is approved by the Board (e.g., new faculty, library resources, equipment, facilities remodeling, etc.). ** IT = Instructional Technology. *** Assumes 10% of faculty salary in SCSC and HORT as potential Committee Co-chairs

ANTICIPATED SOURCES OF FUNDING

Note: Use this chart to indicate the dollar amounts anticipated from various sources. Use the reverse side of this form to specify as completely as possible each non-formula funding source.

Funding Category	1st Year	2nd Year	3rd Year	4th Year	5th Year	TOTALS
I. Formula Income*			100,249	100,249	100,249	300,746
II. Other State Funding*	74,000	50,000	50,000	0	0	174,000**
III. Reallocation of Existing Resources*	56,400	41,400	41,400	51,400	51,400	242,000
IV. Federal Funding* (In-hand only)	0	0	0	0	0	0
V. Other Funding*	0	0	0	0	0	0
TOTALS	130,400	91,400	191,649	151,649	151,649	716,746

*For more information, please refer to the accompanying *Anticipated Sources of Funding: Explanatory Notes and Examples*.

NON-FORMULA SOURCES OF FUNDING

Note: Use this form to specify as completely as possible each of the non-formula funding sources for the dollar amounts listed on the reverse side of this form.

Funding Category	Non-Formula Funding Sources
II. Other State Funding *	#1: College of Agriculture and Life Sciences
	#2
III. Reallocation of Existing Resources*	#1 reallocation of 10% of SCSC and HORT Plant Breeding faculty who will teach and serve as graduate committee chairs or co-chairs.
	#2
IV. Federal Funding*	#1
	#2
V. Other Funding *	#1
	#2

*For more information, please refer to the accompanying *Anticipated Sources of Funding: Explanatory Notes and Examples*.

Appendix A

Potential Graduate-Faculty-Eligible Ph.D. Scientists at International CGIAR Centers

CGIAR Center	Country	Scientist	Position	email
CIAT	Colombia	Echeverria, Ruben G.	Director General	ruben.echeverria@cgiar.org
CIAT	Colombia	Beebe, Stephen	Bean Pgm Leader	s.beebe@cgiar.org
CIAT	Colombia	Hershey, Clair	Cassava Pgm Leader	chershey@cgiar.org
CIAT	Colombia	Debouck, Daniel	Genetic Resources Pgm	d.debouck@cgiar.org
CIAT	Colombia	Martinex, Cesar P.	Rice Pgm	c.p.martinez@cgiar.org
CIAT	Colombia	Peters, Michael	Tropical Forages Pgm	m.peters@cgiar.org
CIMMYT	Mexico	Braun, Hans-Joachim	Director, Wheat (breeder)	h.j.braun@cgiar.org
CIMMYT	Mexico	Ammar, Karim	Wheat Breeder	k.ammar@cgiar.org
CIMMYT	Mexico	Baitassov, Arman	Agronomist	a.baitassov@cgiar.org
CIMMYT	Mexico	Bekele, Abeyo	Wheat Pathology	b.abeyo@cgiar.org
CIMMYT	Mexico	Dreisigacker, Susanne	Wheat Molecular Breeding	s.dreisigacker@cgiar.org
CIMMYT	Mexico	Duveiller, Etienne	Associate Director/Wheat Path	e.duveiller@cgiar.org
CIMMYT	Mexico	Govindan, Velu	Wheat Breeder	velu@cgiar.org
CIMMYT	Mexico	He, Zhonghu	Wheat Breeder	z.he@cgiar.org
CIMMYT	Mexico	Herrera-Foessel, Sybil	Wheat Geneticist/Pathology	s.herrera@cgiar.org
CIMMYT	Mexico	Huerta-Espino, Julio	Pathologist	j.huerta@cgiar.org
CIMMYT	Mexico	Joshi, Arun Kumar	Wheat Breeder	a.k.joshi@cgiar.org
CIMMYT	Mexico	Loladze, Alexandre	Wheat Breeder-Durum	a.loladze@cgiar.org
CIMMYT	Mexico	Manes, Yann	Wheat Breeder	y.manes@cgiar.org
CIMMYT	Mexico	Mondal, Suchismita	Wheat Breeder	s.mondal@cgiar.org
CIMMYT	Mexico	Morgunov, Alexei	Wheat Breeder	a.morgunov@cgiar.org
CIMMYT	Mexico	Nicol, Julie Margaret	Wheat Namatology	j.nicol@cgiar.org
CIMMYT	Mexico	Rosewarne, Garry	Wheat Breeder	g.rosewarn@cgiar.org
CIMMYT	Mexico	Sharma, Rajiv	Wheat Improvement	amin_sharifi51@cgiar.org
CIMMYT	Mexico	Singh, Sukhwinder	Wheat Breeder	suk.singh@cgiar.org
CIMMYT	Mexico	Singh, Ravi P.	Wheat Breeder	r.singh@cgiar.org
CIMMYT	Mexico	Singh, Pawan K.	Wheat Pathology/Breeding	pk.singh@cgiar.org
CIMMYT	Mexico	Ward, Richard	Wheat Breeder	r.ward@cgiar.org
CIMMYT	Mexico	Prasanna, Boddupalli M.	Director, Maize Pgm.	b.m.prasanna@cgiar.org
CIMMYT	Mexico	Babu, Raman	Molecular Maize Breeder	r.babu@cgiar.org
CIMMYT	Mexico	Beyene, Yoseph	Maize Breeder	y.beyene@cgiar.org
CIMMYT	Mexico	Ghliwayo, Thanda	Maize Breeder	d.thanda@cgiar.org
CIMMYT	Mexico	Jeffers, Daniel	Maize Breeder	d.jeffers@cgiar.org
CIMMYT	Mexico	K. Nair, Sudha	Maize Gene Mapping	sudha.nair@cgiar.org
CIMMYT	Mexico	Magorokosho, Cosmos	Maize Breeder	c.mogorokosho@cgiar.org
CIMMYT	Mexico	Mahuku, George S.	Pathology	g.mahuku@cgiar.org
CIMMYT	Mexico	Makumbi, Dan	Maize Breeder	d.makumbi@cgiar.org

CIMMYT	Mexico	Mduruma, Zubeda	Maize Breeder	zmduruma@cgiar.org
CIMMYT	Mexico	Mugo, Stephen	Maize Breeder	s.mugo@cgiar.org
CIMMYT	Mexico	Narro Leon, Luis Alberto	Maize Breeder	ciat-maize@cgiar.org
CIMMYT	Mexico	Ortiz-Ferrara, Guillermo	Cereal Breeder	oferrara@cgiar.org
CIMMYT	Mexico	Rojas Stutz, Marc Christian	Maize Consortium Leader	mc.rojas@cgiar.org
CIMMYT	Mexico	San Vicente, Felix	Maize Breeder	f.san_vicente@cgiar.org
CIMMYT	Mexico	Setimela, Peter	Maize Breeder	p.setimela@cgiar.org
CIMMYT	Mexico	Tarekegne, Amsal	Maize Breeder	a.terekegne@cgiar.org
CIMMYT	Mexico	Twumasi-Afriyie, Strafford	Maize Breeder	t.afriye@cgiar.org
CIMMYT	Mexico	Vivek, Bindiganavile	Maize Breeder	b.vivek@cgiar.org
CIMMYT	Mexico	Zaidi, Pervez	Maize Breeder	phzaidi@cgiar.org
CIP	Peru			cip@cgiar.org
ICARDA	Syria	Solh, Mahmoud	Director General	m.solh@cgiar.org
ICARDA	Syria	van Ginkel, Ir Maarten	Deputy Director-Research	m.vanginkel@cgiar.org
ICARDA	Syria	Baum, Michael	Director-Project Development	m.baum@cgiar.org
ICARDA	Syria	El Nour, Osman Abdalla	Wheat Breeder	o.abdalla@cgiar.org
ICARDA	Syria	Nachit, Miloudi	Wheat Breeder	m.nachit@cgiar.org
ICARDA	Syria	Sarker, Ashutosh	Lentil Breeder	a.sarker@cgiar.org
ICARDA	Syria	Capettini, Flavio	Barley Breeder	f.capettini@cgiar.org
ICARDA	Syria	Imtiaz, Muhammad	Chickpea Breeder	m.imtiaz@cgiar.org
ICARDA	Syria	Kemal, Seid-Ahmed	Pulse Pathologist	s.a.kemal@cgiar.org
ICARDA	Syria	Agrawal, Shiv Kumar	Lentil Breeder	sk.agrawal@cgiar.org
ICARDA	Syria	Udupa, Sripada M.	Geneticist	s.udupa@cgiar.org
ICARDA	Syria	Ceccarelli, Salvatore	Barley Breeder	s.ceccarelli@cgiar.org
ICARDA	Syria	Malhotra, Rajinder	Chickpea Breeder	r.malhotra@cgiar.org
ICARDA	Syria	Bejiga, Geletu	Lentil Breeder	g.bejiga@cgiar.org
ICARDA	Syria	Maalouf, Fouad	Faba Bean Breeder	f.maalouf@cgiar.org
ICARDA	Syria	Al-Yassin, Adnan	Barley Breeder	a.al-yassin@cgiar.org
ICARDA	Syria	Tahir, Izzat Sidahmed Ali	Wheat Breeder	i.tahir@cgiar.org
ICARDA	Syria	Degu, Wuletaw Tadesse	Wheat Breeder	w.tadesse@cgiar.org
ICARDA	Syria	Amri, Ahmed	Deputy Director-Genetics	a.amri@cgiar.org
ICARDA	Syria	Street, Kenneth	Legume GP Curator	k.street@cgiar.org
ICARDA	Syria	Bari, Abdullah	Geneticist	a.bari@cgiar.org
ICARDA	Syria	Khalikulov, Zakir	Geneticist	z.khalikulov@cgiar.org
ICARDA	Syria	Rajaram, Sanjaya	Wheat Breeder	s.rajaram@cgiar.org
ICRISAT	India	Dar, William D.	Director General	icrisat@cgiar.org
ICRISAT	India	Hoisington, David A.	Deputy Director-Research	icrisat@cgiar.org
ICRISAT	India	Hash, C.T.	Breeder	icrisat@cgiar.org
ICRISAT	India	Reddy, Belum V.S.	Breeder	icrisat@cgiar.org
ICRISAT	India	Rao, P. Srinivasa	Sorghum Breeder	icrisat@cgiar.org
ICRISAT	India	Gupta, S.K.	Pearl Millet Breeder	icrisat@cgiar.org
ICRISAT	India	Kumar, A. Ashok	Sorghum Breeder	icrisat@cgiar.org
ICRISAT	India	Srivatsava, Rakesh KI.	Molecular Breeder	icrisat@cgiar.org

ICRISAT	India	Gowda, C.L.L.	Pgm. Director-Grain Legumes Res	c.gowda@cgiar.org
ICRISAT	India	Saxena, K.B.	Breeder	icrisat@cgiar.org
ICRISAT	India	Gaur, Pooran M.	Breeder	icrisat@cgiar.org
ICRISAT	India	Nigam, S.N.	Breeder	s.nigam@cgiar.org
ICRISAT	India	Gnanesh, B. Nanjappa	Breeder	icrisat@cgiar.org
ICRISAT	India	Jukanti, Aravind Kumar	Breeder	icrisat@cgiar.org
ICRISAT	India	Janila, P.	Groundnut Breeder	icrisat@cgiar.org
ICRISAT	India	Upadhyaya, H.D.	Head Genetic Resources	h.d.upadhyaya@cgiar.org
ICRISAT	India	Sillim, Said N.	Director	icrisat-nairobi@cgiar.org
ICRISAT	India	Mgonja, Mary A.	Breeder	icrisat-nairobi@cgiar.org
ICRISAT	India	Rao, NVPR Ganga	Breeder	icrisat-nairobi@cgiar.org
ICRISAT	India	Ojulong, Henry Fred	Breeder	icrisat-nairobi@cgiar.org
ICRISAT	India	Monyo, E.S.	Grain Legumes Breeder	icrisat-malawi@cgiar.org
ICRISAT	India	Wallyar, Farid	Director-WCA	icrisat-w-mali@cgiar.org
ICRISAT	India	Rattunde, Eva W.	Sorghum Breeder	icrisat-w-mali@cgiar.org
ICRISAT	India	Rattunde, H.F.W.	Sorghum Breeder	icrisat-w-mali@cgiar.org
ICRISAT	India	Gandah, Mahamadou	Project Coordinator	icrisatsc@cgiar.org
ICRISAT	India	Hausmann, Bettina	Pearl Millet Breeder	icrisatsc@cgiar.org
IITA	Nigeria	Aboubakar, Yacoubou	Regional Adm	y.aboubaker@cgiar.org
IITA	Nigeria	Kanju, Edward	Cassava Breeder	e.kanju@cgiar.org
IITA	Nigeria	Manyony, Victor	Director	v.manyong@cgiar.org
IITA	Nigeria	Dumet, Dominique	Head, Genetic Resources	d.dumet@cgiar.org
IITA	Nigeria	Gedil, Melaku	Cassava Geneticist	m.gedil@cgiar.org
IITA	Nigeria	Vroh, Bi Irie	Breeder	b.vroh@cgiar.org
IITA	Nigeria	Zum Felde, Alexandra	Banana/Plantain Agronomist	a.zumfeld@cgiar.org
IITA	Nigeria	Ajala, Oyewole	Maize Breeder	o.ajala@cgiar.org
IITA	Nigeria	Badu-Apraku, Baffour Lopez-Montes, Antonio-Jose	Maize Breeder	b.badu-apraku@cgiar.org
IITA	Nigeria	Jose	Yam Breeder	a.lopez-montes@cgiar.org
IITA	Nigeria	Menkir, Abede	Maize Breeder	a.menkir@cgiar.org
IITA	Nigeria	Watson, David	Director, Pgm. Development	d.j.watson@cgiar.org
IITA	Nigeria	Asiedu, Robert	Director and Yam Breeder	r.asiedu@cgiar.org
IITA	Nigeria	Hartmann	Director General	hartmann@cgiar.org
IITA	Nigeria	Kulakow, Peter	Cassava Breeder	p.kulakow@cgiar.org
IITA	Nigeria	Maroya, Norbert	Cassava Breeder	n.maroya@cgiar.org
IITA	Nigeria	Tessema, Gezahegn	Clonal Crop Field Bank	g.tessema@cgiar.org
IITA	Nigeria	Boukar, Ousmane	Cowpea Breeder	o.boukar@cgiar.org
IITA	Nigeria	Ferguson, Morag	Cassava Geneticist	m.ferguson@cgiar.org
IITA	Nigeria	Kim, Dong-jin	Biotechnologist	d.kim@cgiar.org
IITA	Nigeria	Tefera, Hailu	Soybean Breeder	h.tefera@cgiar.org
IITA	Nigeria	Lorenzen, James	Banana Breeder	j.lorenzen@cgiar.org

IITA	Nigeria	Fatokun, C.	Cowpea Breeder	c.fatokun@cgiar.org
IRRI	Philippines	Bouman, Bas	Head, Crop/Environmental Div.	b.bouman@cgiar.org
IRRI	Philippines	Brar, Darshan	Head Plant Breeding/Genetics	d.brar@cgiar.org
IRRI	Philippines	Henry, Amelia	Drough Physiology	a.henry@cgiar.org
IRRI	Philippines	Kumar, Arvind	Rice Breeder	a.kumar@cgiar.org
IRRI	Philippines	Dobermann, Achim	Deputy Director	a.dobermann@cgiar.org

Appendix B

Potential Graduate-Faculty-Eligible Ph.D. Scientists at selected Variety Development Companies

Company	Scientist	Position	email
BayerCropScience	Steve Calhoun	International Cotton & Rice Breeding Manager	steve.calhoun@bayer.com
Monsanto	Brian Gardunia	Breeder (corn) U.S. Regional and International	brian.w.gardunia@monsanto.com
Monsanto	Cindy Green	Breeding Lead	cynthia.green@monsanto.com
Monsanto	Darren Jones	Breeder (Cotton)	darren_jones@bellsouth.net
Harris Moran Seed Co.	Ray Kennett	Breeder (Tomato)	r.kettett@hmclause.com
Pioneer	Polly Longenberger	Breeder (Corn)	polly.longenberger@pioneer.com

the 1990s, the number of people in the world who are under 15 years of age is expected to increase from 1.2 billion to 1.5 billion.

As a result of the demographic changes, the number of people in the world who are aged 65 and over is expected to increase from 200 million in 1990 to 400 million in 2020. This increase is expected to be particularly rapid in the developed countries.

The demographic changes are expected to have a significant impact on the world's economy and society.

One of the main challenges facing the world is how to provide for the needs of the growing population.

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