**The University of Jordan**

**Faculty of Agriculture Department of Horticulture and Crop Science**

**Program: PH.D Horticulture an d Crop SC. Academic year: \_\_\_\_\_\_\_\_**

**Course title: Plant Genetic Resources (0631931)**

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| Credit hours | 3 | Level | PhD Course | Pre-requisite |  |
| Coordinator/ Lecturer | Prof. Mahmoud Kasrawi | Office number | 215 | Office phone | 22335 |
| Course website | [Faculty](http://blackboard.ju.edu.jo/webapps/login/) Member Website | E-mail | kasrawi@ju.edu.jo | Place |  |

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| **Office hours** | | | | | |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| **Time** | 10: -11:00 |  | 10: -11:00 |  | 10: -11:00 |

**Course Description:**

This course covers importance, collection, evaluation, conservation, and utilization of plant genetic resources (PGR) and discusses the ex-situ and in-situ collection and conservation strategies. Importance of land races and wild species as plant genetic resources and their economic value to food security are discussed. The relationship between PGR and sustainable agriculture is also studied. The international agreements in plant genetic resources and the policies that govern their collection and utilization are covered

**Course Objectives:**

1. Introduce students to the importance of PGR in Agriculture and Food and the importance of reducing PGR erosion.
2. Understanding of plant genetic resources collection procedures and tools.
3. Foster knowledge of plant genetic resources conservation methods: in-situ and ex-situ.
4. Recognize the International Cooperation and Agreements on PGR and issue and Intellectual Property Right (IPR).

**Learning Outcomes:**

Successful completion of this course should lead to the following learning outcomes:

**A) Knowledge and Understanding: the students should:**

A1- Understand the important concepts of Plant Genetic Resources and the value of preventing their degradation.

A2- Know the relevant methods of survey and collection of PGR; cultivated species and wild types.

A3- Distinguishing between in-situ and ex-situ conservation approaches and their advantages and when and where to be used.

A4- Understand procedures used in evaluation and utilization of PGR and their relation with biodiversity.

A5- Become familiar with the international efforts and agreements in PGR, and the Intellectual Property Right as applied to PGR.

## B) Intellectual Analytical and Cognitive Skills - with ability to:

B1- Identify plant species that are under threat of distinction.

B2- Develop proper strategies to conserve these species.

B3- Employ the knowledge from the course to set a priority for conducting

conservation activities.

B4- Employ the knowledge to prepare a strategy and action plan for PGR in the country.

## C) Subject specific skills – with ability to:

C1- Prepare for collection mission, by conducting agro-ecological survey.

C2 – Assemble proper team for a collection mission.

C3- Implement a collection mission for the priority endangered species.

C4- Know how to handle the collected material.

D) **Transferable Key Skills: The s**tudent is expected to

D1. Interact with national gene bank manager.

D2-Define sites for in situ genebank

D3-Select PGR examples for prebreeding activities

D4. Recommend species for utilization in breeding programs.

D5. Drafting PGR strategy for the country

# ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| **A**. Knowledge and Understanding (**A1-A5**) | Lectures, Discussion of Assignment readings and prepared reports | Exam, Seminars and Reports |
| **B**. Intellectual Analytical and Cognitive Skills (**B1-B4**) | Lectures, Discussion of Assignment readings and prepared reports | Exam, Seminars and Reports |
| **C**. Subject Specific Skills (**C1-C4**) | Lectures, Discussion of Assignment readings and prepared reports | Exam, Seminars and Reports |
| **D**.Transferable Key Skills (**D1-D4**) | Lectures, Discussion of Assignment readings and prepared reports | Exam, Seminars and Reports |

**Course Contents**

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| **No. of lecture (s) /Week** | **Subject** | **Sources** | **ILOs** |
| 1, 2  (1st wk) | **Introduction and basic concepts**  Importance, Conservation and Utilization of PGR. |  | *A1 & A2 & A3 A4 & A5& & D1* |
| 3, 4,5, 6  (1st & 2nd wks) | **Plant Genetic Resources importance, distribution and classification**  -The diversity of plant species  -Diversity within species.  - The value of genetic resources and genetic diversity.  - The value of genetic diversity to small farmers.  - The value of plant genetic resources for food and agriculture in modern varieties. - - Indicators of the monetary value of PGRFA to food and agricultural production.  - Genetic vulnerability and erosion. |  | *A1 & A2 & A3 A4 & A5& B1 & B3 & C1 & C2 & C3 &C4 & D1 & D2 & D3* |
| 7,8,9, 10,  (3rd & 4th wks) | **The State of *In-Situ* Conservation:**  - Inventories and surveys  - Conservation of PGRFA in protected areas.  - Ecosystem management for conservation of  PGRFA outside protected areas.  - On-farm conservation.  - Examples of on-farm conservation  - Strengthening on-farm conservation and development.  - Assessment of major needs for *In-Situ*  management of PGRFA |  | *A2 & A3 &A4 & A5& B1 & & B2& B3 & B4 & C1 & C2 & C3 & C4& D2& D3 & D4* |
| 11, 12, 13, 14, 15, 16, 17  (4th & 5th & 6th wks) | **The State of Ex*-Situ* Conservation:**   |  | | --- | | - Collecting and types of collections:  - Crop species covered.  - Types of material stored  - Sources of material in gene banks  - Coverage of collections and remaining gaps  **-** Storage facilities;  - Long, medium and short term seed gene  bank facilities.  - Field gene banks and in vitro facilities  - Security of stored materials  - State of duplication  - The need for regeneration  - Documentation and characterization  - Germplasm movement  - Botanical gardens  - Conservation facilities and statistics  - Documentation and germplasm exchange  **-** Assessment of major *Ex-Situ* needs | |  | *A2 & A3 &A4 & A5& B1 & & B2& B3 & B4 & C1 & C2 & C3 & C4& D2& D3 & D4* |
| 18, 19, 20, 21, 22, 23, 24, 25  (6th & 7th & 8th & 9th  wks) | **Utilization, maintenance and exchange of plant genetic resources**  **-** Distribution and utilization of plant genetic resources  - Constraints to germplasm use  - Evaluation of PGRFA  - Pre-breeding (genetic enhancement)  - Plant breeding and other crop improvement programs  - Seed supply programs  - Marketing and processing  -Deployment of genetic diversity in agricultural production system  - Breeding for resistance to pests and diseases  - Breeding for other traits  **-** Assessment of major needs to improve the utilization of plant genetic resources. |  | *A1 & A2 & A3 A4 & B1 & & B2& B3 & B4 & C1 & C2 & C3 & C4 & D2& D3 & D4* |
| 27  (9th wk) | **One hour exam.** |  |  |
| 28, 29, 30, 31  33  (10th & 11th wks) | **National programs, training and legislation**  National programs  **-** Purpose and basic functions of national programs  - Types of national programs  - Development of national programs  - Funding of national programs  - Role of the public, private and informal sectors  Training programs  Legislation  - Access to genetic resources  - Phytosanitary regulations  - Seed regulations  - Plant breeders’ rights  - Other policies which affect the conservation  and utilization of PGRFA.  Assessment of the major needs for national program development, training and legislation. |  | *A2 & A3 & A4 & A5& B1 & B2 & B3 & C1 & C2 & C3 & C4 & D1 & D2& D3 & D4* |
| 34, 35, 36, 37, 38, 39  (12th & 13th wks) | **Regional and international collaboration**  - Regional and sub-regional networks  - Crop-specific networks  - Regional review of plant genetic resources networks and associated crop networks  - Sub-regional collaboration for ex situ collections  - FAO  - International Agricultural Research Centers  - Other Intergovernmental and International Organizations  - Bilateral programs  - Programs of private foundations and  non-governmental organizations  **International agreements**  - The FAO International Undertaking on  Plant Genetic Resources  - The Convention on Biological Diversity  - Other international agreements  **The global system for the conservation and utilization of PGRFA**  - International Network of Ex Situ collections  - International Code of Conduct for plant  germplasm collecting and transfer  - Draft Code of conduct on biotechnology  - The World Information and early warning system  on Plant Genetic Resources (WIEWS)  **Assessment of the major needs to improve International collaboration.** |  | *A2 & A3 & A4 & A5& B1 & B2 & B3 & C1 & C2 & C3 & C4 & D1 & D2& D3 & D4* |
| 40, 41  (14th wk) | **Access to Plant Genetic Resources. The sharing of benefits derived from their use and realization of farmers rights.**  - Exchange of plant genetic resources from  in situ conditions and ex situ collections  - Exchange of improved crop varieties  - Restrictions on access  - Regulation of access  - Global benefits derived from the conservation  and utilization of PGRFA  - The state of benefit-sharing between countries  - The state of benefit-sharing with regard  to farmers and communities  - Financing PGRFA activities  - Implementation of farmers rights |  | *A1 & A2 & A3 A4 & A5& B1 & B2& B3 & B4 & C1 &C2 & C3 & C4& D1& D2& D3 & D4* |
| 42, 43, 44, 45, 46, 47, 48  (14th & 15th & 16th wks) | Seminars in Special Topics   |  | | --- | | - Surveying and inventorying plant genetic resources  for food and agriculture | | - Supporting on-farm management and improvement of plant genetic resources  for food and agriculture | | - Assisting farmers in disaster situations to restore  crop systems | | - Promoting *in situ* management of crop wild  relatives and wild food plants   |  | | --- | | - Supporting targeted collecting of plant genetic  resources for food and agriculture | | - Sustaining and expanding *ex situ* conservation of  Germplasm | | - Regenerating and multiplying *ex situ* accessions | | - Expanding the characterization, evaluation and  further development of specific subsets of  collections to facilitate use | | - Supporting plant breeding, genetic enhancement and base-broadening efforts | | - Promoting diversification of crop production and  broadening crop diversity for sustainable agriculture | | - Promoting development and commercialization  of all varieties, primarily farmers’ varieties/  landraces and underutilized species | | - Supporting seed production and distribution | | | Scientific Articles | *A1 & A2 & A3 A4 & A5& B1 & B2& B3 & B4 & C1 &C2 & C3 & C4& D1& D2& D3 & D4* |

**Learning Methodology:**

The course will be structured in lectures, seminars, reports and discussions. The course comprises overviews, from general understanding to expert knowledge on key topics, and learning is based mainly on lectures as well as independent learning through assignments and hold seminars.

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| **Evaluation** | **Point %** | **Date** |
| One hour Exam | 25% |  |
| Students presentations and reports | 20% |  |
| Term Paper | 15% |  |
| Final Exam | 40% |  |
| Total | 100% |  |

**Supporting references:**

1- Mba C., E. P. Guimaraes and Kakoli G. 2012. Re-orienting crop improvement for the changing climatic conditions of the 21st century. Agriculture & Food Security , 1:7. 1-17.

2- Malik S.S. and S.P. Singh. 2006. Role of plant genetic resources in sustainable agriculture. *Indian J. Crop Science*, 1(1-2): 21-28.

3- FAO. Plant genetic resources use them or lose them. <http://www.fao.org/nr/cgrfa/cthemes/plants/en/>

4- Guarino, L., V. Ramanatha Rao and R. Reid. (Editors). 1995. Collecting Plant Genetic Diversity. Technical Guidelines. CAB International.

5- Hadgkin, T., A.H.D. Brown, Th. J.L. Van Hitum and E.A.V. Morales (Editors). 1995. Core Collection of Plant Genetic Resources. John Wiley & Sons. New York.

6- Hawkes, J.G., N. Maxted and B.V. Ford-LIoyd. 2000. The *Ex-Situ*  Conservation of Plant Genetic Resources. Kluwer Academic Publisher. UK.

7- Maxted, N., B.V. Ford-LIoyd and J.G. Hawkes (Editors). 1997. Plant Genetic Conservation. The *In-Situ* Approach. Champan & Hall. London.

8- <http://www.cgiar/ipgri/>

9- Treuren, R. van, J. M. M. Engels, R. Hoekstra and Th. J. L. van Hintum. 2009. Optimization of the composition of crop collections for ex situ conservation. *Plant Genetic Resources*: *Characterization and Utilization,* 7(2); 185–193.

10- Martin M. Sachs. 2009. Cereal Germplasm Resources Plant Physiol. Vol. 149, 148-151.

11- Jonathan Robinson. 2009. Pre-breeding to build capacity for more effective use of plant genetic resources for food and agriculture. *GIPB/FAO and Bioversity International.* 18 pages.

12- Lars Hein, Franz Gatzweiler. 2006. The economic value of coffee (Coffea arabica) genetic resources. *Ecological Economics,* 6 0. 1 7 6 –1 8 5.

14- Kelly D. R., P. Heisey, R. Shoemaker, J. Sullivan and G. Frisvold. 2005. Crop Genetic Resources. An Economic Appraisal. 41 pages.

15- Tania C.C. V., N. Maxted, M. Scholten and Brian F.-Lloyd. 2006. Defining and identifying crop landraces. Plant Genetic Resources 3(3); 373–384.

16- FAO. SECOND GLOBAL PLAN OF ACTION FOR PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE. 322 pges.

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| |  | | --- | | 17- FAO. 2009. International Treaty on Plant Genetic Resources for Food and Agriculture. 55 pages. |   18- R. von Bothmer and O. Seberg. 2011. Book: COLLECTING PLANT GENETIC DIVERSITY: TECHNICAL GUIDELINES, Chapter 6: STRATEGIES FOR THE COLLECTING OF WILD SPECIES. 9 pages.  19- Singh M, Bisht IS, Kumar S, Dutta M, Bansal KC, et al. (2014) Global Wild Annual Lens Collection: A Potential Resource for Lentil Genetic Base Broadening and Yield Enhancement. PLoS ONE 9(9): e107781. doi:10.1371/journal.pone.0107781. 18 pages.  20- DAVID H., M. KHAIRALLAH, T. REEVES, J. MARCEL RIBAUT, B. SKOVMAND, S.TABA AND M. WARBURTON. 1999. Plant genetic resources: What can they contribute toward increased crop productivity?. *Proc. Natl. Acad. Sci. USA.* Vol. 96, pp. 5937–5943.  21- Paul Gepts. 2006. Plant Genetic Resources Conservation and Utilization: The Accomplishments and Future of a Societal Insurance Policy. Golden Anniversary Symposium. Published in Crop Sci. 46:2278–2292.  22- Abdullah A. Jaradat. Wheat Landraces: Genetic Resources for Sustenance and Sustainability. *USDA-ARS, 803 Iowa Ave., Morris, MN 56267 USA. 20 pages.*  23- Upadhyaya HD, Gowda CLL and Sastry DVSSR. 2008. Plant genetic resources management: collection, characterization, conservation and utilization. Journal of SAT Agricultural Research V. 6. 1-16.  24- Danny Hunter and Vernon Heywood. 2011. Crop Wild Relatives: A Manual of *in situ* Conservation. Published by Earthscan in association with Bioversity International. 414 pages. |

**11May 2005**

**Intended Grading Scale (Optional)**

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| **From** | **To** | **Scale** | **Mark** | **Result** |
| 0 | 67 | 2 | C | Fail |
| 68 | 70 | 2.5 | C+ | Good |
| 71 | 73 | 2.75 | B- | Good |
| 74 | 79 | 3 | B | Very Good |
| 80 | 82 | 3.5 | B+ | Very Good |
| 83 | 85 | 3.75 | A¯ | Excellent |
| 86 | 100 | 4 | A | Excellent |

**Notes:**

* Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.

**Important Regulations:**

* 1. Attendance and departure of students on time to have full 50 minute lecture.
  2. check the frequency of students regularly and at the beginning of the lecture, if number of absent lectures for any student comes close to max. then the is reminded.
  3. Not allowed for students to speak together during the running of lecture but to ask the instructor.
  4. Close of the Mobile
  5. The instructor is ready to answer any question out of office hours if presented in the office.
  6. Reminding of Exams dates one week before.
* For more details on University regulations please visit:

<http://www.ju.edu.jo/rules/index.htm>