**The University of Jordan Department: Plant Protection**

**Faculty: Agriculture 2017-2018/ 1st Semester**

**Weed Ecophysiology (606972)**

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| Credit hours | 3 LECTURES | Level | Ph.D | Pre-requisite | **Weed Science 606231** |
| Coordinator/ Lecturer | J. R. Qasem | Office number | 151 | Office phone | 22515 |
| Course website |  | E-mail | jrqasem@ju.edu.jo | Place |  |

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| --- | --- | --- | --- | --- | --- |
| Office hours | | | | | |
| Day/Time | Sunday | Monday | Tuesday | Wednesday | Thursday |
|  | 10-12 | 10-12 | 9-11 | 10-12 | 11-1 |

**Course Description**

This course covers weed biology including means of propagation and dissemination, ecological adaptation emphasizing on weedness and persistence, various weed interferences, development of resistance to herbicides, comparative ecophysiology and genetics of weeds and crops, the course includes some literature studies and presentation of research papers where lecturer found it feasible.

**Learning Objectives**

Students learn on weeds and their interaction with their surrounding environment (micro- and macrosites). Responses of weeds and influence of growth factors including nutrients, light, water, CO2 and O2. In addition their interaction and responses to environmental conditions such as temperature and freezing, pH, soil characters…..etc. and their effects on the physiological and biochemical processes of weeds. Students learn weed classification and categories based on their ecology, weed evolution and development. Methods of studying weed-crop competition and estimation or measuring crop losses due to weed competition. Students will be able to predict future weed infestation and how to calculate future weed population and determination of the critical weed period competition. In addition

**Intended Learning Outcomes (ILOs):**

At the end of this course, students are expected to:

* Have an idea on the importance of weeds in agriculture and environment.
* Be able to identify & categorize weeds according to different classification methods, which enable students to know better these species and their role in human and animal health.
* Know the role of different ecological factors on growth and productivity of weeds and their response to agricultural practices and changes occur in their environment.
* Able to predict future weed infestation and plant weed control programs.
* Able to calculate losses caused by weed and calculate the cost of weed control and economic feasibility of their control.
* Know on weed evolution and weed strategies. Weed dominance under different environmental conditions and type of vegetation in such ecological regions.

A**. Knowledge and Understanding: Student is expected to**

* Know on weed ecological classification
* Know weed evolutionary stages and importance
* Role of environmental factors on weed productivity and success in the environment
* Understand the genetic relationship between weeds and cultivated crops and the reflection of this on weed succession, evolution and dominance
* Learn how to predict weed population and future infestation and how to plant successful weed control programs.
* Study methods of study weed competition and estimation of crop yield losses
* Study the role and influence of different growth factors on interrelationship between weed and crops and the influence of competition over these factors on physiological processes and responses of competing species.
* Know about all kinds of interrelation ships between weeds and crop plants including positive and negative interactions.

B. **Intellectual Analytical and Cognitive Skills: Student is expected to**

* Keep up to date with any progress in weed research and recent developments in weed evolution and reaction with ecology and environment methods and herbicides.
* Consult recent published papers or references on the subject
* Interact with the lecturer and discuss any important related issues students think that introduce new knowledge or satisfy student quires on the topic.
* Become familiar with weeds, their ecology, physiology and differences between these and crop plants. The role of ecophysiological factors on weed succession and evolution.
* How knowledge on weed ecophysiological factors can help in their management in the field and in different growing systems

C. **Subject- Specific Skills: Students are expected to:**

* Predict future weed infestation
* Plan weed control programs
* Learn on the ecophysiological interrelationships between weeds and crop plants
* Gain knowledge on all kinds of weed crop interactions including positive and negative interactions
* Gain knowledge on weed dominance in different ecological regions and environments
* Know on weed physiological responses in relation to ecological factors
* Gain knowledge on weed evolutionary success and genetics

**D. Transferable Key Skills: Student is expected to know:**

How to distinguish weed species based on their ecological and physiological factors, how to predict weed infestation, how to design weed\crop competition studies, how to distinguish different groups of weeds based on their habitats and succession stages, how to get familiar with growth patterns, seed and other propagules production, dispersal and importance in maintenance of species under stress conditions, how to calculate losses caused by weeds and manage them, how to use physiological and ecological calculations/equations/terminology and adopt them to weed situation. Know the importance of growth factors and their effects on the outcome of competition and analyse factors affecting the relationship between weeds and crop plants.

**Course Contents**

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| --- | --- | --- | --- | --- | --- | --- |
| **Content** | **Reference** | | | **Week** | | **ILO/s** |
| Introduction  Characteristics of weeds | 15, 21, 22 | | | 1 | | A, B, C, D. |
| Worldwide distribution and importance of weedsCrop mimics | 15, 21 | | | 2 | | A, B, C, D. |
| Classification of weeds by  History  Adaptation  Ecology  Negative and positive effects of agrestal weeds  Characteristics of agrestals. | 16, 21, 22 | | | 3 | | A, B, C, D. |
| Environment  Vegetation  Community differentiation  Weeds : Domesticates and wild plants  Patterns of evolutionary development  R and k selection  C, S and R selection  Weeds as strategies | 12, 22 | | | 4 | | A, B, C, D. |
| Competitive ruderals Stress tolerant  Reproduction  Sexual reproduction  Influence of polyploidy, weeds/crops relations | 14, 22 | | | 5 | | A, B, C, D. |
| Vegetative reproduction   * + Bud reserve   + Occurrence of vegetative propagation   + Advantage of vegetative reproduction | 8,14,16, 22 | | | 6 | | A, B, C, D. |
| dispersal  in space  in time  Germination and establishment  Light requirement  Soil seed reserve (seed bank)  Seed longevity and mortality\  Seed longevity and impact on cropping systems   * + Patterns of emergence   + Safe site concept and risk of death | 9, 11, 12, 22 | | | 7, 8 | | A, B, C, D. |
| Midterm Exam | | | | | | |
| Prediction of weed infestation  plant growth and interference  definition  Negative interference  Space and resources  Type of neighbors  Competition versus other types of interference  Competition  Definition  Competition and density  Effect of density on growth  Effect of density on mortality and reproduction | | 14,16, 22, 24 | 9, 10 | | A, B, C, D. | |
| Method of studying competition  Additive design  Substitutive design  Systematic design  Measurement of competition  Aggressivity  Competition index  Relative Competitive ability index | | 22 | 11, 12 | | A, B, C, D. | |
| Critical period of competition  Inter- and intra-specific competition  Predicting crop loss form competition | | 9, 21, 22 | 13 | | A, B, C, D. | |
| Amensalism  Definition  Effect of allelopathy  Techniques in studying allelopathy | | 1, 17, 21, 23 | 13 | | A, B, C, D. | |
| Parasitism  Adaptation for dispersal and germination  Physiology of parasitism  Commensalisms  Proto-cooperation  Mutualism | | 19, 21 | 13 | | A, B, C, D. | |
| Limiting factors and competition  Light  Water and water use efficiency  CO2  Root function and competition  Plant factors and competition | | 9, 11, 12 , 13 | 14 | | A, B, C, D. | |
| competition for nutrients  interaction of nutrients with other resources and plant density  response to high levels of nutrients  response to low levels of nutrients | | 9, 11, 12 , 13, 22 | 14, 15 | | A, B, C, D. | |
| plant growth analysis  Weed/crop dynamics and management | | 16, 22 | 15, 16 | | A, B, C, D. | |
| Impact of herbicides  Herbicide resistance and weed evolution | | 6, 9, 10, 18, 20, 21, | 16 | | A, B, C, D. | |

**Learning Methodology**

## Learning through lectures, papers discussion on recent development on the course topics, literature review, papers collection, journals and term papers.

## Projects and Assignments

Each student is required to submit a review term paper on recent advances in weed ecophysiologcal aspects at the end of the semester.

# Evaluation

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| Exam | Grade% | Date |
| Mid. Term Exam | 30 | 8-9th week |
| Term paper | 30 |  |
| Final Exam | 40 | As scheduled by the university |

**Main Reference/s:**

ALL below collectively

Fitter, A.H. and Hay, R.K.M. (1983). *Environmental Physiology of Plants.* Academic Press, London.

Duke, S.O. (1987). *Weed Physiology*. Vol. 1 & 2. CRC Press Inc. Boca Raton, Florida

Radosevich, S., Holt, J. and Ghersa, C. (1997). *Weed Ecology: Implication for Management* .2nd Edition. John Wiley & Sons Inc. New York.

Grime, J.P. (1986). *Plant Strategies and Vegetation Processes*. John Wiley and Sons, Chichester, England.

# References:

1. Ahshapanek, D.C. (1962). *Ecological Studies on Plant Inhibition by* Solanum rostratum. Ph.D. Dissertation, University of Oklahoma, Norman.
2. Aldrich, R.J. (1984). *Weed Crop Ecology. Principles in Weed Management.* Breton Publisher, MA.
3. Aldrich, R.J. and Kremer, R.J. (1997). *Principles in Weed Management*. 2nd Edition. lowa State University Press. Ames, Iowa.
4. Bridges, D.C. (1995). Ecology of Weeds. In: *Handbook of Weed Management Systems*, ed. A.E. Smith. Marcel Dekker, New York, pp. 19-34.
5. Buhler, D.D. (ed.). (1999). *Expanding the Context of Weed Management*. The Haworth Press Inc. New York.
6. Caseley, J.C., Cussans, G.W. and Atkin, R.K.(eds.). (1991). *Herbicide Resistance in Weeds and Crops*. Butterworth-Heinemann, Oxford, England.
7. Charudattan, R. and Walker, H.L. (eds.). (1982). *Biological Control of Weeds with Plant Pathogens*. John Wiley & Sons. New York.
8. Cousens, R. and Mortimer, A.M. (1995). *Dynamics of Weed Populations*. Cambridge University Press, Cambridge, UK.
9. Duke, S.O. (1987). *Weed Physiology*. Vol. 1 & 2. CRC Press Inc. Boca Raton, Florida.
10. Duke, S.O. (1996). *Herbicide-Resistant Crops. Agricultural*, *Environmental, Economic, Regulatory, and Technical Aspects*. CRC Press, Boca Raton, Florida.
11. Egley, G.H. and Duke, S.O. (1985). Physiology of weed seed dormancy and germination. Pages 28-64 In: *Weed Physiology*, ed. S.O. Duke, CRC Press, Boca Raton, Florida.
12. Fitter, A.H. and Hay, R.K.M. (1983). *Environmental Physiology of Plants.* Academic Press, London.
13. Grace, J.B. and Tilman, D. (eds.) (1990). *Perspectives on Plant Competition*. Academic Press Inc. London.
14. Grime, J.P. (1986). *Plant Strategies and Vegetation Processes*. John Wiley and Sons, Chichester, England.
15. Holm, L.G., Plucknett, D.L., Pancho, J.V. and Herberger, J.P. (1977). *The World’s Worst Weeds: Distribution and Biology*. University of Hawaii, Honolulu. USA.
16. Holzner, W. and Numata, M. (eds.). (1982). *Biology and Ecology of Weeds*. Dr. W. Junk Publishers. The Hague-Boston-London.
17. Inderjit, Dakshini, K.M.M. and Foy, C. L. (eds.). (1999). *Principles and Practices in Plant Ecology*. *Allelochemical Interaction*. CRC Press LLC. London.
18. LeBaron, H.M. and Gressel, J. (eds.). (1982). *Herbicide Resistance in Plants*. John Wiley & Sons. New York, USA.
19. Parker, C. and Riches, C.R. (1993). *Parasitic Weeds of the World: Biology and Control*. CAB International. Wallingford, UK.
20. Powles, S.B. and Holtum, J.A.M. (eds.). (1994). *Herbicide Resistance in Plants. Biology and Biochemistry*. Lewis Publishers, Boca Raton, Florida.
21. Qasem, J.R. (2003). *Weeds & Their Control*. Deanship of Academic Research, University of Jordan, Amman, Jordan. 628 PP.
22. Radosevich, S., Holt, J. and Ghersa, C. (1997). *Weed Ecology: Implication for Management* .2nd Edition. John Wiley & Sons Inc. New York.
23. Rice, E.L. (1985). *Allelopathy*. 2nd Edition. Academic Press, INC. London.
24. Silvertown, J.W. and Doust J.L. (1993). Intreoduction to Plant Population Biology. Blackwell Science, Ltd.
25. Van Rign, P.J. (2000). *Weed Management in Humid and Sub-Humid Tropics*. Royal Tropical Institute, KIT Press, Amesterdam.

Symposium Proceedings

Weed Research

Weed Science

Weed Technology

Weed Abstracts

Other related papers and journals

**Intended Grading Scale (Optional)**

65-70 C+

71-75 B-

76-81 B

82-87 B+

88-93 A-

94 -100 A

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.
* For more details on University regulations please visit:

[**http://www.ju.edu.jo/rules/index.htm**](http://www.ju.edu.jo/rules/index.htm)