**The University of Jordan**

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

**Program: Master 2017/2018 Semester:**

**Cropping System** **(601723)**

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| Credit hours | 3 | Level | PhD Course | Pre-requisite | 304101 |
| Coordinator/ Lecturer | Prof. R. Sharaiha | Office number | 248 | Office phone | 22351 |
| Course website | [Faculty](http://blackboard.ju.edu.jo/webapps/login/) Member Website | E-mail | ramzik@ju.edu.jo | Place |  |

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| **Office hours** |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| **Time** |  |  |  |  |  |

**Course Description**

####  The course describes the general concepts of cropping systems as related to resource availability, economic yield, sustainability and integration, means of increasing resource use efficiency, low and high input of cropping systems in different regions, the various management aspects of intensive cropping systems and the research methodology that could be adopted. Some meetings will be held as seminars in which students present specific scientific papers for general discussion

##### Course objectives

1. To understand the terms and definitions of cropping systems
2. To explore how the cropping system approach in planning and optimizing yield production

###### To understand the overall effects of competition

1. To evaluate the efficiency of cropping systems

**Intended Learning Outcomes (ILOs):**

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

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

A1. Know the terms and definitions of cropping systems

A2. Distinguish between the interactions in sequential cropping and intercropping systems

A3. Distinguish between cropping systems in rain fed areas and irrigated areas

A4. Measure the different types of competition

A5. Know the effect of certain cropping systems on water use efficiency, pest management and soil fertilization

A6. Evaluate the efficiency of cropping system

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

B1- Able to have an overall view about the effect of various cropping systems on yield.

B2- Able to understand the expected efficiency of each cropping system on soil fertility .

B3- Able to know the role of each cropping system in pest and weed management.

B4- Able to emphasize the importance of cropping systems in water harvest and improving water use efficiency

B5- Familiar with the effective degree of each cropping system on sustainability.

B6- Have ability to know which plants show synergistic or antagonistic action when plants develop sequentially or simultaneously.

**C. Subject- Specific Skills:** Student is expected to:

C1- Analyze the interactive competition of plants under various types of cropping systems.

C2- Detect the degree of benefit on environment by using each cropping system

C3- Determine the quantitative benefit of water by calculating the water use efficiency

C4- Have well idea about the share of each cropping system in improving soil nutritional status.

C5- Evaluate the role of each cropping system in pest and weed management.

1. **Transferable Key Skills:** Student is expected to

D1- Select the right cropping system that suited with dominated environmental and soil characters.

 D2- Select the right mix of spp. where each one shows synergistic but not antagonistic effects towards the other.

D3- Employ the cropping system that that has a direct effect on the quality and quantity of harvested crops.

 D4- Use the cropping system that minimize the use of synthetic fertilizers and pesticides.

D5- Adopt the cropping system that minimize the loss of water and improve the aspects of sustainability.

ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| **A**. Knowledge and Understanding (**A1-A6**) | Lectures and DiscussionsAssignment readings | Exam, Quiz,  |
| **B**. Intellectual Analytical and Cognitive Skills (**B1-B6**) |  Lectures and DiscussionsAssignment readings | Exam, Quiz, |
| **C**. Subject Specific Skills (**C1-C5**) | Lectures and DiscussionsAssignment readings | Exam, Quiz, |
| **D**.Transferable Key Skills (**D1-D5**) | Lectures and DiscussionsAssignment readings | Exam, Quiz, |

**Course Contents**

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| **No. of lecture (s) /Week** | **Subject** | **Sources** | **ILOs** |
| 1 (1st wk) | Introduction | Chapter 5 pp. 49-63. in E. Nafziger. 2012. Illinois Agronomy Handbook  | *A1 & A2 & B1& C1& D1* |
| 2, 3, 4, 5 (1st & 2nd wks) | Terms and definitions | Chapter 5 pp. 49-63. in E. Nafziger. 2012. Illinois Agronomy Handbook  | *A1 & A2 & A3 B1& B2 & C1 & C2 & D1* |
| 6, 7, 8, 9(2nd & 3rd wks) | Plant interactions  3.1 Interactions in mixed crop communities 3.2-1 Competition for solar radiation 3.2-2 Competition for soil factors 3.2-3 Other interaction- Allelopathy | E. Mal´ezieux, et al. 2009. Pp 34-62 | *A2 & A3 & A4 & A5 & A6 & B2 & B4 & B5 & B6 & C1 & C3 & C4 & C5 & D1 & D2 &D5* |
| 10, 11, 12 13, 14, 15 16(4th & 5th & 6th wks) | Effect of competition 4.1 Assessment of competition and yield advantages  | Fusuo Zhang1 & Long Li. 2003. Pp.305-312. | *A2 & A3 & A4 & A5 & A6 & B1 & B3 & B6 & C1 & C2 & C5 & D2 & D3 & D5* |
| 17, 18, 19 20(6th & 7th wks) | Interaction in sequential cropping* 1. Solar radiation
	2. Effect of proceeding crop on the following crops
 | B.A. Keating, P.S. Carberry. 1993. Issue 3, Pages 273-301.Karlen et al. 1994. Pp. 149-167. | *A2 & A4 & A5 & A6 & B1 & C1 & C2 & D1 & D2*  |
| 21(7th wk) | First Midterm Exam |  |  |
| 22, 23, 24 25, 26, 27(8th & 9th wks) | Assessment of land use and productivity under multiple cropping systems* 1. Multiple cropping index (MCI)
	2. Simultaneous cropping index (SCI)
 | Dailiang P. et al. 2012. African Journal of Agricultural Research Vol. 7(26), pp. 3828-3838.Chapter 2 in Palaniapan SP. & Sivaraman K. 2nd ed. 1996. Pp.5-44.  | *A1 & A2 & A3 & A4 & A5 & A6 & B1 & B2 & B5 & C1 & C3 & C4 & D1 & D2 & D3 & D5* |
| 28, 29, 30 31, 32, 33 34(10th& 11th& 12th wks) | Cropping systems used  a - Under irrigated  b – Under rain fed areas | Alan J. S. et al. 2012. Proceedings of the 24th Annual Central Plains Irrigation Conference, Colby, Kansas. Pp.31-36.DUIVENBOODEW N. V. et al. 2000. Netherlands Journal of Agricultural Science 48 pp. 213-236  | *A3 & A4 & A5 & A6 & B4 & B5 & C1 & C3 & D1 & D5* |
| 35(12th wk) | Second Midterm Exam |  |  |
| 36, 37, 38 39(12th & 13th wks) | Choice of crops and varieties | Chapter 6 pp. 104-115. in Conservation Agriculture | *A2 & A3 & A4 & B1 & B6 & C1 & C3 & D2 & D3* |
| 40, 41, 42 43, 44, 45 46, 47, 48(14th&15th & 16th wks) | Effect of intercropping system on :1. Soil properties case (case studies)
2. Water management (case studies)
3. Pest management (case studies)
 | Chapter 5 pp. 49-63. in E. Nafziger. 2012. Illinois Agronomy Handbook  | *A3 & A4 & A5 & A6 & B2 & B3 & B4 & B5 & C2 & C3 & C4 & C5 & D1 & D4 & D5* |

**Learning Methodology:**

 The course will be structured in lectures, discussions, assignments and reports. 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.

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| **Evaluation** | **Point %** | **Date** |
| First Midterm Exam  | 20% |  |
| Second Midterm Exams | 20% |  |
| Semester Assessment (Essay) | 20% |  |
| Final Exam  | 40% |  |

**References:**

Emerson Nafziger. 2012. Illinois Agronomy Handbook[**http://extension.cropsciences.illinois.edu/handbook/pdfs/chapter05.pdf**](http://extension.cropsciences.illinois.edu/handbook/pdfs/chapter05.pdf)

E. Mal´ezieux, Y. Crozat, C. Dupraz, M. Laurans, D. Makowski, et al.. Mixing plant species in cropping systems: concepts, tools and models. A review. Agronomy for Sustainable Development, Springer Verlag, 2009, 29 (1), pp.43-62.

[**https://hal.archives-ouvertes.fr/hal-00886426/document**](https://hal.archives-ouvertes.fr/hal-00886426/document)

Fusuo Zhang1 & Long Li. 2003. Using competitive and facilitative interactions in intercropping systems enhances crop productivity and nutrient-use efficiency. Plant and Soil 248: 305–312.

[**http://www.plantstress.com/Articles/min\_deficiency\_m/intercropping.pdf**](http://www.plantstress.com/Articles/min_deficiency_m/intercropping.pdf)

B.A. Keating, P.S. Carberry. 1993. Resource capture and use in intercropping: solar radiation. Field Crops Research, Volume 34, Issue 3, Pages 273-301.
<http://www.sciencedirect.com/science/article/pii/0378429093901187>

D.L. Karlen, N.C. Wollenhaupt , D.C. Erbach , E.C. Berry , J.B. Swan , N.S. Eash , J.L. Jordahl. 1994. Crop residue effects on soil quality following 10- years of no-till corn. Soil & Tillage Research. 31. 149-167.

<http://naldc.nal.usda.gov/download/12213/PDF>

Dailiang P., Cunjun L., Jingfeng H., Bin Z., and Xiaohua Y. 2012. Crop monitoring using a Multiple Cropping Index based on multi-temporal MODIS data. African Journal of Agricultural Research Vol. 7(26), pp. 3828-3838.

<http://www.academicjournals.org/article/article1380876979_Peng%20et%20al.pdf>

Palaniapan SP. & Sivaraman K. 1996. Cropping Systems in Tropics. Principles and Management. 2nd ed. New Age International Publisher. Pp.5-44.

[**https://books.google.jo/books?id=TzZ3ZXTW\_dwC&pg=PA43&lpg=PA43&dq=Simultaneous+cropping+index+(SCI)&source=bl&ots=kb\_LggRG3M&sig=YvswUeUd\_Ed\_f1ccL5xZCQySjgg&hl=ar&sa=X&ved=0ahUKEwjMnN-QzsDJAhXEuw8KHbWQAQMQ6AEINzAD#v=onepage&q=Simultaneous%20cropping%20index%20(SCI)&f=false**](https://books.google.jo/books?id=TzZ3ZXTW_dwC&pg=PA43&lpg=PA43&dq=Simultaneous+cropping+index+(SCI)&source=bl&ots=kb_LggRG3M&sig=YvswUeUd_Ed_f1ccL5xZCQySjgg&hl=ar&sa=X&ved=0ahUKEwjMnN-QzsDJAhXEuw8KHbWQAQMQ6AEINzAD#v=onepage&q=Simultaneous%20cropping%20index%20(SCI)&f=false)

Alan J. S., Loyd R. S., Troy J. D. & Freddie R. L. 2012. OPTIMIZING CROPPING SYSTEMS UNDER LIMITED IRRIGATION CONDITIONS. Proceedings of the 24th Annual Central Plains Irrigation Conference, Colby, Kansas, February 21-22. Pp. 31-36.

[**https://www.ksre.k-state.edu/irrigate/oow/p12/Schlegel12LIC.pdf**](https://www.ksre.k-state.edu/irrigate/oow/p12/Schlegel12LIC.pdf)

DUIVENBOODEW N. V., M. PALN, C. STUDER, C.L. BIELDERS4 AND D.l. BEUKES. 2000. Cropping systems and crop complementarity in dry land agriculture to increase soil water use efficiency: a review. Netherlands Journal of Agricultural Science V. 48. pp. 213-236.

[**http://www.sciencedirect.com/science/article/pii/S1573521400800159**](http://www.sciencedirect.com/science/article/pii/S1573521400800159)

Chapter 6 (Crops and cropping systems) in Conservation Agriculture. Pp. 104-115.

[**http://www.fao.org/ag/ca/AfricaTrainingManualCD/PDF%20Files/06CROP1.PDF**](http://www.fao.org/ag/ca/AfricaTrainingManualCD/PDF%20Files/06CROP1.PDF)

**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>