

Ministry of Higher Education and Scientific research



**Department of Forestry
College of Agriculture
Salahaddin University-Erbil**

ADVANCED PLANT GROWTH REGULATORS

**Course Book
For
PhD students**

Assist Prof. Dr. Sirwa Anwar Qadir

2023- 2024

1. Course name	Plant growth regulators
2. Lecturer in charge	PhD Lecturer: Sirwa Anwar Qadir
3. Department/ College	Forestry / Agriculture
4. Contact	e-mail: sirwa.qadir@su.edu.krd Mobile: 096407504701276
5. Time (in hours) per week	Theory: 2
6. Office hours/ week	6 hours/ week
7. Course code	
8. Teacher's academic profile	<p>BSc (Bachelor of Science) from Biology department/ College of Science, at Salahaddin University, Erbil, Iraq in July 1999. At 2000 to 2003 Lab assistant at Plant protection Dept. After obtaining MSc (Master of Science) at the college of Education/ Biology department in July 2006 in Plant Physiology, I cooperated as a lecture in Agriculture college, Salahaddin University for a period of 7 years. I have been received Ph. D in plant physiology in an inter-ship program at both Salahaddin University and Universiti Teknologi Malaysia (UTM) July 2017. I have published 14 journal articles, 1 book chapter, research projects, seminars and broad conference.</p> <p style="text-align: right;">Dr. Sirwa A. Qadir</p> <p>For further information visit: https://sites.google.com/a/su.edu.krd/sirwa-anwar-qadir/</p>
9. Keywords	Plant growth regulators, Auxins, Cytokinin, jasmonic acid
10. Course overview:	<p>Phytohormones are chemical messengers that coordinate cellular activities. This lecture introduces the plant hormones (auxin, cytokinin, gibberellins, brassinosteroids, ethylene, abscisic acid, jasmonates, and salicylates) through their roles, during the plants life, from seed-to-seed. The biosynthesis, transport, perception, signal transduction and downstream effects of each are introduced, as well as a few ways that hormonal signaling pathways intersect.</p>
11. Course objective:	<p>By the end of this course the student should be able to:</p> <ul style="list-style-type: none"> • Identify how plant hormones contribute to their growth, development, reproduction and stress responses • Identify the major plant hormones • Describe the factors contributing to hormone accumulation and response • Describe what is meant by cross-talk in hormone signaling

12. Student's obligation

- All students are required to take notes from lectures throughout the course.
- The attendance and completion of workloads and exam.
- The time and date of exams will not be changed after being fixed by the lecturer and the students' representative.

13. Forms of teaching

Different forms of teaching conducted to gain the objectives of the course, such as:

- Using white board to clarify any related subject
- PowerPoint presentation including video show
- Writing up important notes.
- Necessary video tutorials learning.

14. Assessment scheme

- Workloads (preparing a review paper)
- Seminars and presentations prepared by the student.
- Final exam

15. Student learning outcome:

At the end of the course the students will be realize that:

1. Plants also produce signaling molecules, called hormones that have profound effects on development at vanishingly low concentrations.
2. Hormones interact with specific cellular proteins called receptors.
3. Plant development was thought to be regulated by only five types of hormones: auxins, gibberellins, cytokinins, ethylene, and abscisic acid.
4. There is now compelling evidence for the existence of plant steroid hormones, the brassinosteroids, that have a wide range of morphological effects on plant development. (Brassinosteroids as plant hormones.
5. A variety of other signaling molecules that play roles in resistance to pathogens and defense against herbivores, including jasmonic acid, salicylic acid, and the polypeptide system.

16. Course Reading List and References:

- Buchanan, B. B., W. Gruissem, R. L. Jones. 2000. Biochemistry and Molecular Biology of Plants. Rockville,
- Taiz, L. and Zeiger, E. (2010). Plant physiology; 5th ed; Sinauer Associates.
- Davies, P. J. 2004. Plant Hormones: Biosynthesis, Signal Transduction, Action. Dordrecht: Kluwer Academic Publishers.
- Scott, P (2008). Physiology and Behaviour of Plants, Wiley Ridge, I, Plants, OU Worldwide.
- Hopkins W. G. and N.P A. Huner (2009). Introduction to Plant Physiology. 4th ed John Wiley & Sons, Inc.

17. The Topics:

Week 1:

1.1 PLANT GROWTH AND DEVELOPMENT

- 1.1.1 Stages of Cellular Growth
- 1.1.2 Types of Plant Growth
- 1.1.3 Growth Curve
- 1.1.4 Measurement of Growth
- 1.1.5 Factors Affecting Plant Growth

1.2 THE HORMONE CONCEPT IN PLANTS

- 1.2.1 plant growth hormone
- 1.2.2 plant growth regulators
- 1.2.3 Hormone groups in plants

Week 2:

2. Auxin

- 2.1 Darwin's study of phototropism
- 2.2 Auxin transport
- 2.3 Auxin synthesis
- 2.4 Auxin functions
- 2.5 Auxin signaling

Week 3:

3. Cytokinins

- 3.1 Cytokinin synthesis
- 3.2 Cytokinin functions
- 3.3 Cytokinin signaling

Week 4:

- 4.1 Gibberellins
- 4.2 Synthesis
- 4.3 Gibberellins and green revolution
- 4.4 Gibberellin signaling

Week 5:

5. Brassinosteroids

- 5.1 BR functions
- 5.2 BR signaling

Week 6:

- 6. Strigolactones

Week 7:

- 7.1 Summary: hormones and vegetative development
- 7.2 Hormonal control of reproductive development

Week 8:

- 8.1 Transition to flowering
- 8.2 Flower and fruit development and ripening

Week 9:

9. Ethylene

- 9.1 Ethylene promotes senescence
- 9.2 Ethylene synthesis
- 9.3 Ethylene signaling

Week 10:

10. Abscisic Acid

- 10.1 ABA and seed maturation and dormancy
- 10.2 Gibberellins are required for germination and used in brewing

Week 11:

- 11.1 Summary – hormonal regulation of reproductive development
- 11.2 Hormonal responses to abiotic stress

Week 12:

12 Abscisic Acid

- 12.1 ABA synthesis regulated by stress
- 12.2 ABA induces stress responsive genes
- 12.3 ABA receptor and signaling
- 12.4 ABA and stomatal aperture
- 12.5 Hormonal responses to biotic stress

Week 13:

13 Jasmonates

- 13.1 Jasmonate synthesis
- 13.2 Jasmonates contribute to defense against herbivory
- 13.3 Jasmonate signalling

Week 14:

14. Salicylates

- 14.1 Salicylates are induced upon pathogen attack
- 14.2 Perception and response to pathogens
- 14.3 Cross-talk in defence signalling

Week 15:

- Hormonal crosstalk
- Ongoing research