UNIVERSITY OF SARGODHA

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES, UNIVERSITY COLLEGE OF AGRICULTURE

COURSE OUTLINE SPRING 2020

Course Title: Soil Fertility and Fertilizers

Course Code: SES-304

Credit Hours: 3(2-1)

Instructor: Dr. Mukkram Ali Tahir

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| **DESCRIPTION & OBJECTIVES** |

**Aims of the course**: In the agricultural sciences, soil fertility and plant nutrition played an important role during the twentieth century in increasing crop yields. In the twenty-first century, the importance of this field is expected to increase due to limited natural resources (land and water), the need for more sustainable agricultural systems, and concern about environmental pollution.

**Objectives of the course**: The objective of this course is to provide students with a comprehensive understanding of soil fertility, plant nutrition and nutrient management to develop an understanding of the:

1. Mineral nutrients: Determinations, concentrations, behaviors, forms, functions and requirements in plants and their effect on plant growth.
2. Diagnosis of nutrient status in plants (Symptoms of deficiency and excess).
3. Soil fertility and productivity, role of soil in supplying nutrients to as per plant demand.
4. Beneficial nutrient elements: their presence in plants, beneficial effects and how they are toxic to animals and human health.
5. Identification of soil fertility (Soil Analysis) by new and innovative approaches.

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| **READINGS** |

1. Ahmad, N. and M. Rashid.2003. Fertilizer and their uses in Pakistan.: An extension guide. Planning commission, National Fertilizer Development Centre, Islamabad, Pakistan
2. Havlin, J.L., J.D. Beaton, S.L. Tisdale and W.L Nelson. 2005. Soil fertility and Fertilizers: An introduction to Nutrient Management. 7th ed. Pearson Education, Prentice Hall, Upper Saddle River, NJ, USA.
3. Mengel, K. and E.A Kirkby. 2001. Principles of plant nutrition. 5th Ed. International Potash Inst., Bern, Switzerland.
4. Elsworth, L. and W.O. Relay (eds.). 2009. Fertilizers: Properties, Applications and Effects. Nova Science. Publ. Inc., NY, USA.
5. Allen V. Barker, and David J. Pilbeam.2006. Handbook of Plant Nutrition . Taylor and Francis Group , CRC Press, NY, USA.
6. Gupta P.K 2004. A Handbook of Soil, Fertilizer and Manure. Agrobios. pess. Kota, India.
7. Fageria N.K. , Virupax C. B. and A.J.Charles..2011. 3rd edition , Growth and Mineral Nutrition of Field Crops. Taylor and Francis Group , CRC Press, NY, USA.

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| **CONTENTS** |

**Theory**

1. Crop growth and factors affecting
2. Essential plant nutrients: functions, deficiency and toxicity
3. Movement of nutrients to roots and uptake by plants
4. Nitrogen: gains and losses in soil
5. N-fertilizers and their fate in soil
6. Phosphorous: Forms in soil
7. P-fertilizers and their behavior in soil; crop responses; factors affecting and residual effects
8. Potassium: Forms, amount, exchange equilibrium and factors affecting
9. Soil status of calcium, magnesium and sulphur and factors affecting
10. Integrated plant nutrient management: organic and inorganic sources
11. Nutrients behavior in submerged soils

**Practical**

1. Fertilizers: identification and composition
2. Fertilizer requirement calculation
3. Fertilizer analyses: urea, CAN, DAP, SOP
4. Determination of available P and K in soil
5. Plant analysis for N, P and K
6. Visit to fertilizer factories, soil fertility institutes and demonstration trials

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| **COURSE SCHEDULE** | | | | | |
| **Week** | **Topics and Readings**: *Give Reading No from your list of readings above and its Page Nos. relevant to the topic(s) covered each week* | | | | **Dates** |
| **Lecture** | **Topics** | **Pages** | **Book** |
| 1 | 1 | Detailed course contents and  names of relevant books | Chapter No. 18  286, 287 | A handbook of soil fertilizer and manure | **13-01-2020**  **to**  **17-01-2020** |
| 2 | Models of plant nutrition and yield of crops  Spill man model, Leibig law of minimum |
| 3 | Quadratic equation of nutrition |
| 4 | Mineral fertilizers importance and its use in Agriculture | Chapter No.17  Page 269-273 |
| 2 | 1 | Plant mineral nutrition, nutrient behavior in soil system | Chapter No. 1  3-13 | Handbook of plant nutrition | **20-01-2020**  **to**  **24-01-2020** |
| 2 | Essential plant nutrients | Chapter No.2  22-25 |
| 3 | Nitrogen as plant nutrient |
| 4 | Nature and composition of fertilizers | Chapter No. 20  294-296 | A handbook of soil fertilizer and manure |
| 3 | 1 | Nitrogen in soil and plants | Chapter No.2  28-35  26,27  35-38 | Handbook of plant nutrition | **27-01-2020**  **to**  **31-01-2020** |
| 2 | Deficiency and excess of nitrogen in plants |
| 3 | Stage of nitrogen analysis |
| 4 | Fertilizers contribution in IPNs | Chapter No. 19  289 | A handbook of soil fertilizer and manure |
| 4 | 1 | Nitrogen interaction for Plant health | Chapter No.2  25 | Handbook of plant  nutrition | **03-02-2020**  **to**  **07-02-2020** |
| 2 | Nitrogen over supply/photo-toxicity to plants | Chapter No.2  27 |
| 3 | Pakistan Day |
| 4 | Fertilizer requirement for primary nutrients | Chapter No.2  28-36 | Fertilizer Manual |
| 5 | 1 | Nitrogen Fertilizer | Chapter No.2  39-43 | Handbook of plant  nutrition | **10-02-2020**  **to**  **14-02-2020** |
| 2 | Urea Fertilizer |
| 3 | Ammonium fertilizer |
| 4 | Fertilizer requirement of micronutrients | Chapter No.16  265-268 | A handbook of soil fertilizer and manure |
| 6 | 1 | Smart N fertilizers | Chapter No. 14  241-256 | **17-02-2020**  **to**  **21-02-2020** |
| 2 | New chemistry of nitrogen+ organic nitrogen |
| 3 | Phosphorous fertilizers |
| 4 | Fertilizer Analysis of Urea | Chapter No. 13  225-230 |
| 7 | 1 | Phosphorous as plant nutrient | Chapter No. 3  51-54  75-79 | Handbook of plant nutrition | **24-02-2020**  **to**  **28-02-2020** |
| 2 | Factors of phosphorous availability |
| 3 | Phosphorous fertilizers |
| 4 | Fertilizer Analysis of CAN | Chapter No.13  232,233 | A handbook of soil fertilizer and manure |
| 8 | 1 | Lab visit | Chapter No. 3  81,82  53,54 | Handbook of plant nutrition | **02-03-2020**  **to**  **06-03-2020** |
| 2 | Phosphorous application mode |
| 3 | Phosphorous cycle in agriculture |
|  |  |  |  |
| 4 | Fertilizer Analysis of DAP | Chapter No. 14  248,249 | A handbook of soil fertilizer and manure |
|  | **Mid term exam** | | | | **09-03-2020**  **to**  **13-03-2020** |
| 9 | 1 |  | Chapter No. 4  93-98  92 | Handbook of plant nutrition | **16-03-2020**  **to**  **20-03-2020** |
| 2 | Potassium function in plant |
| 3 | Potassium as plant nutrient |
| 4 | Fertilizer Analysis of SOP | Chapter No. 15  424,426,427 | Fertilizer Manual |
| 10 | 1 | Potassium fraction in soil | Chapter No. 4  107,108 | Handbook of plant nutrition | **23-03-2020**  **to**  **27-03-2020** |
| 2 | Presentation on N,P,K |
| 3 | Presentation on N,P,K |
| 4 | Determination of available Phosphorous | Chapter No. 3  71-74 |
| 11 | 1 | Secondary essential plant nutrient | Chapter No. 5  121,122 | Handbook of plant nutrition | **30-03-2020**  **to**  **03-04-2020** |
| 2 | Assignment on deficiency symptoms of crops |
| 3 | Calcium as plant nutrient+ Calcium in soil |
| 4 | Determination of available Potassium | Chapter No. 4  107,110 |
| 12 | 1 | Calcium role in plants health | Chapter No. 5  122-125  126,127 | **06-04-2020**  **to**  **10-04-2020** |
| 2 | Calcium fertilizer sources and deficiency |
| 3 | Assignment on impact of nutrients on crop health |
| 4 | Plant analysis for Nitrogen | Chapter No. 9  256 |
| Fertilizer Manual |
| 13 | 1 | Magnesium as plant nutrient | Chapter No. 6  146 | Handbook of plant nutrition | **13-04-2020**  **to**  **17-04-2020** |
| 2 | Sulphur role in agriculture | Chapter No. 7 183,184,198,199,200 |
| 3 | Zinc as TE in plant growth | Chapter No. 15  411 |
| 4 | Plant analysis for Phosphorous | Chapter No. 14  400 | Fertilizer Manual |
| 14 | 1 | Zincate plant fertilizers | Chapter No. 8  242-244 | Handbook of plant nutrition | **20-04-2020**  **to**  **24-04-2020** |
| 2 | Assignment on iron |
| 3 | Boron as essential plant nutrient |
| 4 | Plant analysis for Potassium | Chapter No.14  416 | Fertilizer Manual |  |
| 15 | 1 | Silicon | Chapter No. 19  551,552  554-557 | Handbook of plant nutrition | **27-04-2020**  **to**  **01-05-2020** |
| 2 | Silicate cycle in plants |
| 3 | Selenium as trace elements+Role of trace element for quality food | Chapter No. 18  515,516 |
| 4 | Fertilizer Requirement calculation |  | Fertilizer Manual |
| 16 | 1 | Nutrient and carbon fluxes in terrestrial agroecosystems | Chapter No.10  (114-116) | The green world (Plant Nutrition) | **04-05-2020**  **to**  **08-05-2020** |
| 2 | Organic soil amendment | 116 |
| 3 | Livestock mediated nutrient fluxes | 120 |
| 4 | Nutrient from natural organic waste | 124 |

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| **RESEARCH PROJECT** |

Short research projects and laboratory assignments will be assigned to the students during the semester

Climate smart agriculture by implementation for nutrient stewardship model in major field crops.

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| **ASSIGNMENT CRITERIA** |

Sessional: 08 (project, presentation, participation)

Project: 04

Presentation: 02

Participation: 02

Mid exam: 12

Practical exam: 20

Final exam: 20

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| **RULES AND REGULATIONS** |

75% attendance is mandatory for the students to appear in the final examination.

No class assignments after due date will be entertained.