CRS 3109 CROP PHYSIOLOGY

**2. LECTURER:**

**Prof. D.S.O Osiru**

**PhD (Makerere University)**

3. COURSE TYPE: CORE (B.Sc. Horticulture III)

4. COURSE STRUCTURE

Course Credits: 3 CU i.e. 45 Contact Hours per semester

Course Duration: 15 weeks (45 hours) i.e. 30 LH, 30 PH

5. COURSE DESCRIPTION

Growth and development. Analysis of Growth Curves. Environmental influence on Growth and Development. Interception of PAR and the Concept of LAI and LAD. Plant Population and Spatial Arrangement and the role of Canopy Architecture (Crop Ideotype) in the Interception of PAR. Photosynthesis and Photosynthetic Pathways. Major differences between C3 and C4 plants. .Dry matter production and partitioning. Relative importance of Sink and Source in Yield determination. Techniques for determining the relative importance of sink and source. Respiration (Environmental Influence) and Alternative pathways. Crop/Water Relations. Intercropping and Mixed cropping. Biological Basis for Intercropping. Advantages (resource capture and resource use efficiency). Physiological concepts for increasing yield production. Crop case studies (Cereals, Root and Tuber; Fibre crops Grain Legumes). Introduction to crop growth models.

6. COURSE OBJECTIVES

General objective / aim

Specific objectives

* To equip the students with knowledge on the plants potential growth and interaction with environment.
* To make students understand the relationship between crop growth and yield formation
* To make students understand the contribution of Crop Physiology to Crop Improvement

7. RECOMMENDED REFERENCES FOR READING

* Introduction to Crop Physiology: F.L. MILTHORPE AND J MOORBY
* Introduction to the Physiology of Crop Yield. R.K.M.HAY AND A.J. WALKER
* Utility of basic research in Plant/Crop Physiology in relation to Crop Improvement: a review and a personal account. MABROUK A. EL-SHAKAWY

8. COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED

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| TOPIC | CONTENT | METHOD OF INSTRUCTION / Time allocated | TOOLS / NEEDED |
| 1. Introduction to crop physiology | * Difference between crop physiology, plant physiology and ecology.
* General concepts of crop growth and development.
* Analysis of growth curves.
 | Interactive Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 2. Photosynthesis | * The major phases of photosynthesis and interaction between them.
* Photosynthetic Efficiency
 | Lecture ( 2hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 3. Photosynthetic pathways | * C3 and C4 pathways.
* Basic concepts and the role of the primary acceptors (RUDP and PEP) in the CO2 assimilation.
* Major differences and similarities between C3 and C4 plants.
* Prospects for the plant breeder
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 4. Respiration  | * Variation in the rates of respiration
* Environmental influence
* Alternative pathways
* Wasteful maintenance
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 5. Source and Sink relationship | * Definitions (source strength and sink capacity)
* Dry matter production and partition
* source and sink limitations
* source and sink balance
* Varietal differences in Carbohydrate supply and storage capacity
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk. |
|  | * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 6. Measures of Sink and Source relationship | * Techniques for determining the relative importance of source and sink.
* Prospects for improving sink capacity and carbohydrate supply
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk, |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 7. Plant population and spatial arrangement | * Relationships between crop density and crop yield
* Mathematical equations relating yield and plant density
* Physiological reasons for the decline in yield at higher crop densities
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 8. Crop Water relations | * Theory of crop water requirements
* Evapotranspiration.
* Drought adaptation and Water Use Efficiency.
* Mechanism of Drought Resistance
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 9. Intercropping and mixed cropping | * Definitions and yield advantages.
* Methods for determining yield advantages.
* Resource capture and resource use.
* Improving productivity of intercropping systems
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 10. Crop Case studies (Maize, Zea mays) | * Photosynthetic pathway and the major limitations to grain yield production.
* Physiological concepts for increasing grain yield.
* Factors influencing dry matter production and partitioning.
* Yield components and when determined
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 11. Crop Case Studies (Wheat  | * Photosynthetic pathway and the major differences between wheat and maize.
* Physiological basis for the grain yield production.
* Sink capacity and the role of the flag leaf in carbohydrate supply.
* Yield components
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 12. Crop Case Studies (Cassava Manihot esculenta) | * Photosynthetic pathway
* Varietal differences in LAI, LAD and CGR.
* Dry matter production and partitioning in cassava.
* Distribution of dry matter.
* Relationship between CGR & LAI.
* Varietal differences in response to water stress.
 | Lecture (2 hrs)Field based Practical on uniformity test (6 hrs) | Buckets,Plastic cups,Tape measure,Transport (30 seater) |
|  | * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 13. Crop Case Studies(Potatoes Solanum tuberosum) | * Yield and yield components.
* Relationship between CGR and the Time of Tuber Initiation.
* Tuber Dormancy and the sprouting process.
* Physiological age and tuber yield
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk  |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 14. Crop Case Studies (Cowpeas Vigna unguculata) | * Growth and development.
* Reproductive structures
* Yield and yield components and when determined.
* Influence of growth habits on yield production.
* LAI and dry matter production and partitioning.
* Influence of environmental factors on yield
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |
| 15. Introduction to Crop Growth Models | * Simulating potential production.
* Examples of Crop Growth Models: CERES; CROP GRO;SUBSTOR Models
 | Lecture (2 hrs) | LCD Projector and Screen,BB/Chalk |
| * Field based practicals
 | 3 hrs | NARO/MUARIK |

9. SUMMARY OF TIME NEEDED

Interactive lectures covering theory 30 hrs

Field visits 45 hrs

10. OVERALL COURSE EVALUATION

Course assessment including take assignment 40%

University Examination 60%