COURSE CODE:	WMA 411
COURSE TITLE:	Agrometeorology III
NUMBER OF UNITS:	3 Units
COURSE DURATION:	3 hours per week

COURSE DETAILS:

Course Coordinator: Prof N.J. Bello. B.Sc., M.Sc., PhD
Email: njbello2003@yahoo.com
Office Location: Room B209, COLERM
Other Lecturers:

COURSE CONTENT:

The nature of climate-agriculture relationships and the methods of their investigation. Specific effects of moisture and thermal Agro-meteorological indices on agricultural production. Effects of amount of spatial and temporal variation of precipitation (rainfall, dew, and fog). Insolation and photo-periodism, soil and air temperature, evapo-transpiration, cloud, wind and atmospheric humidity. Micro meteorological research in the boundary layer below plant canopies, crop phenology and microclimate. Quantitative and qualitative effects of solar energy received at the earth's surface, soil heat flux and soil temperature, carbon dioxide balance of the plants environment, wind towers and estimation of boundary layer characteristics. Inter-relationships of wind shelter, moisture conservation and plant growth.
Pre-requisite: WMA 316

COURSE REQUIREMENTS:

This is a required course for students in the Department of Water Resources Management and Agrometeorology (Agrometeology Option). The students are also expected to passed WMA 316 which a=is a basic requirement before auditing WMA 411. As a school regulation, a minimum of 75% attendance is required of the students to enable him/her write the final examination

READING LIST:

- Ayoade J. O (2002) Introduction to Agroclimatology. University Press, Ibadan, Nigeria

- Kemp D. D. (1990) Global Environmental Issues: A Climatological Approach Routledge, London
- Grifiths J. F. (1976) Applied Climatology. Oxford University Press
- Lal, R. and Russell, E. W. (ed) (1981) Tropical Agricultural Hydrology. John Wiley and Sons. Chichester.
- Oguntala A.B. and Okali, D.U.U (1979) Microclimate and Hydrology of the Nigerian Forest Ecosystem. Man and Biosphere, Nigeria
- Smith K. (1975) Principles of Applied Climatology Mc Graw-Hill New York, London.
- Parry, M. (1990) Climate Change and World Agriculture. , Earthscan, London
- Ross Reynolds (2004) Guide to Weather. Bounty Books, London
- Nigerian Meteorological Society,(NMetS) (2010) Climate Change Impacts and Adaptation: Development Issues: Aspecial Book on Climate Change

LECTURE NOTES

INTRODUCTION

AIMS AND METHODS OF AGROMETEOROLOGICAL RESEARCH
Agro meteorology is concerned with the general interrelationships between climate and agriculture.

Among the main aims are
I. Discovering analogous areas for crop introduction.
II. Preparing and disseminating special forecast for rainfall, temperature, drought, flood e.t.c
III. Investigate actual atmospheric condition within a crop i.e. micro-meteorological study of plants climate relationship.
IV. Study of pests and diseases within the plant environment.
V. Analyzing of damage caused by pests and diseases.
VI. Modification of the atmosphere rain making, mulching, and other cultural practices.
VII. Calculation of time of maturity and/or production of crops and animals including the detailed modeling of the plant environmental interaction.
The methods of agrometerological research can be classified into 3 groups:
I. The micro-meteorological studies of plants, climate and relationships.
II. The study of agricultural and climatic data and the use of statiscal techniques to determine the relationship.
III. The study of plants-climate relationship under controlled environment in the case of I&II.

THE CONCEPT OF THE PLANT ENVIRONMENT

The plant environment is made up of four major components:
I. Climatic component
II. Physiographic component
III. Edaphic component
IV. Biotic component

Also climate can influence the indicense and spread of plants pest and diseases.
The plant environment can be classified into three broad groups:
I. The atmospheric environment
II. The root environment
III. The interface between the atmospheric and root environment i.e the landwater surface.

WATER AND PLANT GROWTH

Three groups of plants have been identified on the basis of their water relationships. They are
I. Hydrophytes
II. Mesophytes &
III. Xerophytes
It appears water is very critical to plant growth and in particular, specific rules of water in plants are that water is:
I. The major constituent of physiological active part of plant tissue.
II. A re-agent in photosynthesis and hydrological process such as starch digestion.
III. The solvent in which salt, sugar and other solutes move from cell to cell.
IV. An essential element for the maintenance of plants turgidity as well as necessary for cell enlargement and growth.

WATER AVAILABILITY IN THE PLANT ENVIRONMENT

Water is available in the plant environment either by rain or irrigation.
Availability of soil water can vary strongly
I. Extreme conditions of saturation (field capacity).
II. A condition in which it is reduced to microscopic around individual soil particles.
III. These conditions are unfavorable for plant growth.

SOIL PROPERTIES AND AVAILABILITY OF SOIL WATER TO PLANTS

I. The acceptance of rainfall by the soil.
II. The retention of water by the soil in competition with the plants.
III. The storage capacity of water- holding capacities of the soil within the root zone.
IV. The movement of water in thin soil.
V. Volume of soil accessible to plant roots.

MOISTURE RETENTION AND THE STORAGE CAPACITY OF THE SOIL

It is the function of the surface area of the particle and the sizes of the soil pores that are present.

MOVEMENT OF WATER IN THE SOIL

In furor irrigation for instance, it is often the soil suction gradient which causes the water to move to the root zone.

EVAPOTRANSPIRATION AND GROWTH

Evapotranspiration is the combination of evaporation and transpiration.
Evaporation is the defined as the loss of water from either soil or water as it changes from liquid to vapour state in the air, when life vegetation is involve then an extra process known as transpiration contributes to a further water loss

EVAPORATION MEASUREMENT

The high evaporative demand in the tropics and importance of water resources make accurate assessment of the potential of an area, lengths of growing season, periods of excess, deficit and irrigation needs.
In meteorological observations, the actual evaporation from a given water or soil surface is faced with many problems. The problems arise from the complex set of factors influencing evaporation rates. These variables include additions by precipitations, stream flow, ground water and losses by runoff and sea page. In tropics, sparse meteorological networks, manpower and financial limitations increase the problem.

METHODS OF ASSESSMENT

I. Direct measurement using evaporation pans, atmometers and
lysimeters.
II. Indirect assessment using meteorological formulae such as
a) Aerodynamic methods
b) Energy budget methods
c) Combination methods involving a & b above
d) Empirical formulae
III. Moisture/water budget methods.

INSTALLATION OF THE LYSIMETER

First, the lysimeter should be fairly large and deep to reduce the boundary effect and avoid restricting root development.
Secondly, the physical conditions within the lysimeter must be comparable to those outside.
Thirdly, a lysimeter will not be representative of the surrounding area.
Fourthly, each lysimeter should have a “guard ring” area around it maintained under the same crop and moisture conditions in order to minimize clothesline effect. The guard ring may be more than 12 acres.

PENMANS METHOD OF ESTIMATING EVAPOTRANSPIRATION

Penman uses the combined influence of turbulent transfer and the energy budget. His derived equation for the determination of evapotranspiration uses vapor pressure, net radiation, and the drying power of air at a given temperature.

EVAPORATION SUPPRESSION

In dry sub-humid or tropics net and dry climate where moisture is limited or moisture supply seasonal, evaporation poses problems concerning the national utilization of the resource.

SOLAR RADIATION AND AGRICULTURE

The relations between solar radiation and agriculture are primarily in photosynthesis. In this process, the plants use the visible portion of the solar radiation to produce carbohydrates (dry matter) in the form of starch, sugar and cellulose. This process is so fundamental that exploitation of solar energy.

Another effect of solar radiation on plants in tropical agriculture is the response of plant development to the time relations between day and night.

TEMPERATURE AND HUMIDITY CONDITIONS

Measurement of different environmental component using wet or dry bulb etc