16th NATIONAL MONSOON FORUM
MYANMAR

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Agricultural Policies

- To emphasize production and utilization of high yielding and good quality seeds
- To conduct training and education activities for farmer and extension staff to provide advanced agricultural techniques
- To implement research and development activities for sustainable agricultural development
- To encourage transformation from conventional to mechanized agriculture, production of crops appropriated with climate and extension of irrigated area
- To amend existing agricultural laws and regulations in line with current situation.
Priority Areas for Agricultural Development

1. Quality seed production and distribution
2. Systematic and synchronized application of fertilizers
3. Value-added production in agriculture and increase of agro-based industries
4. Conventional farming to mechanized farming
5. Rain-fed conventional farming to irrigated farming
6. Research and development in agriculture
7. Domestic and foreign investment
8. Accuracy of agricultural statistics
9. Sustainable market
10. Agricultural laws and regulations
11. Information and media
Three Main Tasks of Ministry of Agriculture and Irrigation (MOAI)

- Seed Production
- Training and Education
- Research and Development
Major Crops Production in Myanmar

- Paddy
- Maize
- Groundnut
- Sesame
- Sunflower
- Black gram
- Green gram
- Pigeon pea
- Cotton
- Sugarcane
Hybrid Seed Production in Myanmar

Hybrid Rice Seed Production in ShweTaung Farm
Overview Low Emission Agriculture Production System in Myanmar

- Myanmar agriculture is facing challenges from several factors such as increased competition for land, water and labor from non-agricultural sectors and increasing climatic variability.
- The latter, associated with global warming, will result in considerable seasonal / annual fluctuations in food production.
- Droughts, floods, tropical cyclones, heavy precipitation events, hot extremes and heat waves are known to negatively impact agricultural production and farmers’ livelihood.
- A recent meta-analysis of CO₂ enrichment experiments in fields has shown that in field environment, 550 ppm CO₂ leads to a benefit of 8-10% in yield in wheat and rice, up to 15% in soybean, and almost negligible in maize and sorghum.
The possibility of loss of 0.5 million tonnes in rice production with every rise of 1°C temperature throughout the growing period with current land use.

Rice matured earlier by 10-20 days and rice production dropped by more than 0.5 million tonnes in the country.

Losses were also very significant in other crops, such as mustard, peas, tomatoes, onion, garlic, and other vegetable and fruit crops.

Drought of 2005-06 led to reduced area coverage of more than 0.3 million hectares of the rainy-season crops and resulted in a loss of more than 7% in food production.

Result in greater instability in food production and threaten livelihood security of farmers.
Recent simulation analysis indicated that green gram yields in monsoon are projected to be adversely affected due to rise in atmospheric temperature; but increased rainfall can partly offset those loses and the spatio-temporal variations in projected changes in temperature and rainfall are likely to lead to differential impacts in the different regions in Myanmar.

Analysis on maize also indicated that the yield loss due to rise in temperature is likely to be offset by projected increase in rainfall.

However, complete amelioration of yield loss may not be attained even after doubling of rainfall.
Potential Impacts in Myanmar

- In coastal area and delta
  - Cyclone (Storm), flood
  - Change of rainfall pattern and intensity
  - Moving of shore line
  - Sea water intrusion
- Middle part (Central Dry Zone)
  - Drought (non-rainy days, 2-3 weeks)
  - Annual rainfall is less than normal
  - Lesser inflows into the reservoirs
Potential Climate Change Impacts

- Delta Area
  - Flooding
  - Farmland, towns and cities (protected by embankments)
  - Storms (cyclone)
  - Cyclone Mala (2005) and Nargis (2008)

- Dry Zone Area
  - decrease of annual rainfall
  - rising temperature
  - lesser inflows into reservoir
  - water scarcity
Methodology for estimating Low Emission Agriculture in Myanmar

The following inputs were used in the model:

1. Weather data: from Myanmar Meteorological Department at 1º x1º scale for baseline period.
2. Soil data rescaled to grid values from Land Use Division of Department of Agriculture.
3. Crop Management: normal crop practices as followed by the farmers.
4. Genetic coefficients of varieties best suitable for different regions.
The model considers different crop development and growth processes influencing the simulation of yield.

The model requires various varietal coefficients viz. thermal time for phonological stages, potential grain weight, specific leaf area, maximum relative growth rate, maximum radiation use efficiency.

It requires crop management inputs – time of planting, application schedule and amount of fertilizer and irrigation.

Soil input data includes soil pH, soil texture, thickness, bulk density, saturated hydraulic conductivity, soil organic carbon, slope, soil water holding capacity and permanent wilting point. Location-wise daily weather data such as the solar radiation, maximum and minimum temperatures, rainfall, wind speed, vapor pressure are also required simulating crop performance.
The InfoCrop model is well calibrated and validated for wheat, rice, maize, sorghum, potato and mustard crops for the Myanmar region.

These calibrated and validated models were used for simulating the yields during baseline period (1998-2003) and also for assessment of impacts.
In InfoCrop, change in temperature, CO₂ and rainfall are simulated in the following ways:-

1. The total development of a crop is calculated by integrating the temperature-driven development rates of the phases from sowing to seedling emergence, seedling emergence to anthesis and storage organ filling phases.

2. Dry matter production is a function of Radiation Use Efficiency (RUE), photosynthetically active radiation, total Leaf Area Index (LAI), and a crop/ cultivar specific light interception coefficient. RUE is further governed by a crop-specific response of photosynthesis to temperature, water, nitrogen availability and other biotic factors. Carbon dioxide concentration has no direct influence on photosynthesis as maize is a C4 crop. But under water-stressed conditions, increase in CO₂ does indirectly increase photosynthesis and yield by reducing water use and delaying drought stress via reduction in stomatal conductance and transpiration rate.
In InfoCrop, change in temperature, CO₂ and rainfall are simulated in the following ways:-

3. The net dry matter available each day for crop growth is partitioned as a crop-specific function of development stage, which as mentioned earlier, is affected by temperature.

4. In the initial stages of crop growth, leaf area formation is controlled by temperature. Senescence of leaves is also dependent on temperature.

5. Temperature influences potential evapotranspiration. Water stress is determined as the ratio of actual water uptake and potential transpiration. It accelerates phonological development, decreases gross photosynthesis, alters the allocation pattern of assimilates to different organs and accelerates rate of senescence.
In InfoCrop, change in temperature, CO₂ and rainfall are simulated in the following ways:

6. Adverse temperatures during meiosis stage could significantly increase sterility. In crops, a part of the storage organ becomes sterile if either maximum or minimum temperatures of the day deviate from their respective threshold values during a short period between anthesis and a few days afterwards. This reduces the number of storage organs available subsequently for accumulating weight. The storage organs start filling up shortly after anthesis with a rate depending upon temperature, potential filling rate and the level of dry matter available for their growth.

7. Influence of rainfall is operated in the model through soil water balance.
Food insecurity, malnutrition and poverty

Poverty

Food insecurity, hunger and malnutrition

Low productivity

Poor physical and cognitive development
Key Structural Adjustments

- Strengthening of research and extension system
- Efficient and sustainable land utilization
- Reform in land and water taxation
- Strengthening agricultural financing
- Favorable policies for private investment
Adaptation

- Delta and Coastal Region
  - To reserve wet land and mangrove forest
  - To restore the watershed
  - To introduce emergency spillway

- Dry Zone Region
  - To launch greening project (JICA, NGOs, helping)
  - Afforestation in watershed
  - Introducing modulating dams upstream
  - Natural disaster warning system
  - Worked out emergency preparedness plan
Environmental Characterization

- Crop model together with GIS can greatly facilitate demarcation of homologous zone at mega-, macro-, meso-, as well as micro level depending upon the availability of data and objectives.

- These tools have been used to determine the potential and attainable yields for a given level of inputs for various crops.

- Estimate of such yield of different varieties can establish a reference point for site quality and remove the confounding effects associated with large climate variation.
Optimizing Crop Management

- Once potential yields have been quantified, these can be converted to attainable yields to determine magnitudes of yield gap.
- Crop growth modeling can be used to match agro-technology with the farmers’ resources and analyzing the precise reason for yield gap.
- Simulation models can help fine tune of Nitrogen fertilizer application recommendation in irrigated rice.
Pest and Disease Management

- At a regional level, GIS, requisite environmental data coupled with epidemic simulation models further provide geographic delineation of disease and insect pest risk zone.
- Historical climate data from sites have been shown to be useful for characterizing the conduciveness of a site to specific diseases.
- Attempts are also being made to integrate disease predictive systems with online weather and weather – interpolation systems.
- Yield losses studies have been conventionally quantified the relation between nitrogen application rate, disease severity, season and grain yield.
Pest and Disease Management

- This has resulted in a qualitative understanding of the host-pathogen-environment interaction and in disease management recommendations. However, validity of such recommendations is limited, as they are strongly influenced by disease on set, disease spreading rate, farm management practices, environmental conditions and their interactions. Physiologically based simulation models can be applied to understand the damage mechanisms and analyze their effect on crop growth and yield of rice.
Principal Climate Change Drivers in Agriculture in Myanmar

- reduction in crop yield and agricultural productivity where temperature constrains crop development (changes in diurnal fluctuation are as important as overall trends);
- reduced availability of water in regions affected by falling annual or seasonal precipitation
- exacerbation of climate variability in places where it is already highest
- reduced storage of precipitation as snow, and earlier melting of winter snow, leading to shifts in peak runoff away from the summer season where demand is high
- inundation and increased damage in low-lying coastal areas affected by sea-level rise, with storm surges and increased saline intrusion into vulnerable freshwater aquifers
- generally increased evaporative demand from crops as a result of higher temperature.
Expectations from the training course/future collaboration

- One of the issue still unresolved is the undue credit which is the modelers are generally accused of taking from the data generators.
- It is need to do collaboration with the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan on the following development activities:
  - Systematic low emission agriculture modeling zone for climate change
  - Proven technology for low emission agriculture and impact of climate change on agricultural production
  - Development of research works on low emission agriculture and impact of climate change on agriculture
  - Other aspects of technical collaboration with the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan
Conclusion

❖ A number of opportunities are now available for the use of low emission agriculture modeling for quantifying the effect of various factors including weather on agriculture.

❖ The key areas are biophysical characterization of agro-environments, evaluation of impact of climate change, optimizing crop, pests and diseases management and increasing the efficiency of multi-environment testing, forecast yield, etc.

❖ The response of standard cultivars to environment can be predicted with confident. In future, the system approach, with its well developed analytical framework, data bases and powerful simulation models, will be handy to provide answers to many to the current agricultural issues in a relatively shorter time frame.

❖ To do this more effectively, greater efforts should be made to develop models that can integrate the effect of all important factors operating in the field environment, for instance, weather, edaphic conditions, management, incidence and effect of pests and socio-economics.
THANK YOU FOR YOUR KIND ATTENTION!