Development of New Technologies in Response to Climate Changes: The local View

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Effects of Climate variability

- Extreme meteorological events such as drought disrupt crop production
- Excessive heat is detrimental to plant growth
- Droughts reduce water supply
- Drought increase the amount of water needed for plant transpiration

Effects of climate change

- Climate change will modify rainfall, evaporation, r and soil moisture storage
- Changes in total precipitation or its pattern of variability are important in the crop life-cycle
- Water stress during flowering and grain filling is harmful to most crops particularly maize
- Increased evaporation from the soil & accelerated transpiration in the plants will cause moisture stress

Effects of climate change

- The demand for irrigation water will rise bringing increased competition between agriculture, industry users& human consumption
- Falling water tables and the resulting increase in the energy required to pump water will make the practice of irrigation more expensive
- Additionally, more water will be required per hectare due to drier conditions
- Intensified evaporation will increase the hazard of salt accumulation in the soil

Soil fertility

- Higher temperatures will also be felt in the soil
- Warmer conditions will speed-up the the natural decomposition of organic matter and increase other processes of soil fertility
- Additional fertilizer is required to counteract these processes
- This might result in burdening the soil with chemicals
- The continual cycling of plant nutrients – carbon nitrogen, phosphorus, potassium, and sulfur in the soil-plant-atmosphere system is also likely to accelerate in warmer conditions, enhancing CO_2 & N_2O green house gas emissions

Soil fertility

- Nitrogen fixation require moisture
- In drier soils, less nitrogen fixation
- Poor root development
- Crop lodging

Pests & Diseases

- Warmer temperatures favor proliferation of insect pests
- Longer growing seasons will enable insects us as grasshoppers to complete more reproductive cycles
- Warmer winters may also allow continuous life cycles e.g. DBM
- Altered wind patterns may change the spread of both wind borne pests & diseases
- Increased pest & disease infestations will bring greater use of pesticides to control them

Anticipated responses of Agro ecosystems to climate change

- C_3 Plants such as wheat & soybeans respond readily to increased CO_2 levels. Absorb more CO_2 and converts it to carbohydrates
- Higher levels of atmospheric CO_2 also induce plants to close the stomata through which CO_2 is taken and water vapour is released
- **Crops may use less water even when they produce more food**
- This effect will improve water use-efficiency in C_3 Plants

Anticipated responses of Agro ecosystems to climate change

- C_4 Plants (Maize, sorghum & millet) tend to be less responsive to enriched CO_2 concentrations
- Increased temperatures may accelerate the rate at which plants release CO_2 in the process of respiration
- **This will result in less than optimal conditions for net growth**
- When temperatures exceed the optimal for biological processes, crops often respond negatively with a steep drop in net growth & yield

Adaptation to climate change – What research has to do!

- Genetic engineering studies to exploit excessive CO_2
- Breeding for heat & drought tolerance
- Breeding for insect & disease resistance
- Develop irrigation methods that will conserve water and improve irrigation efficiency
- Develop appropriate tillage methods that will conserve moisture