

CLIMATE CHANGE AND ITS IMPLICATIONS ON POSTHARVEST LOSSES OF GRAIN IN TROPICAL AND SUBTROPICAL COUNTRIES

Tanzania Post-harvest Management Platform (TPMP) Post-harvest Management Conference:

"Reducing post-harvest losses for food security and industrialization"



Ministry of
Agriculture



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland to Tanzania and Zambia

Swiss Agency for Development
and Cooperation SDC



UDSM-Department of Agricultural Economics and Business



HELVETAS
Swiss Intercooperation

TANZANI



Rashid Suleiman (PhD) and Henry Laswai (Prof)



OUTLINE

- Introduction
- Food Security
- Stored Product Insect Pests
- Molds and Mycotoxin
- Grain Quality
- Conclusions





What is climate change?



- The change in the planet's climate beyond its natural variability

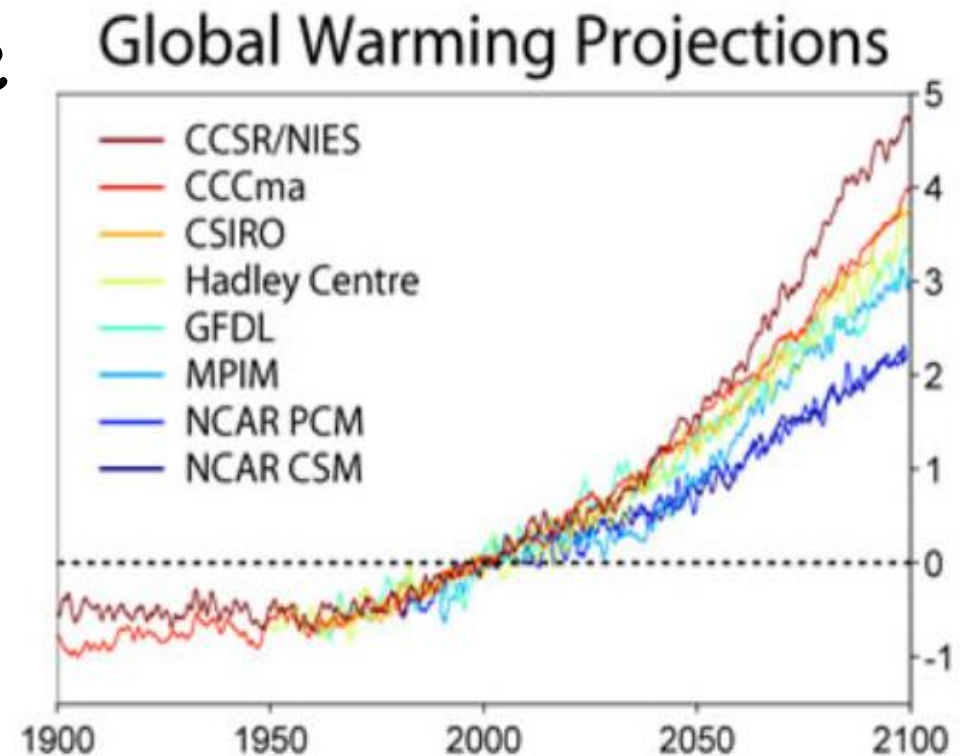
- Climate change is the change in climate over a time period from 10 to 100s of years



- Intergovernmental Panel on Climate Change (IPCC)

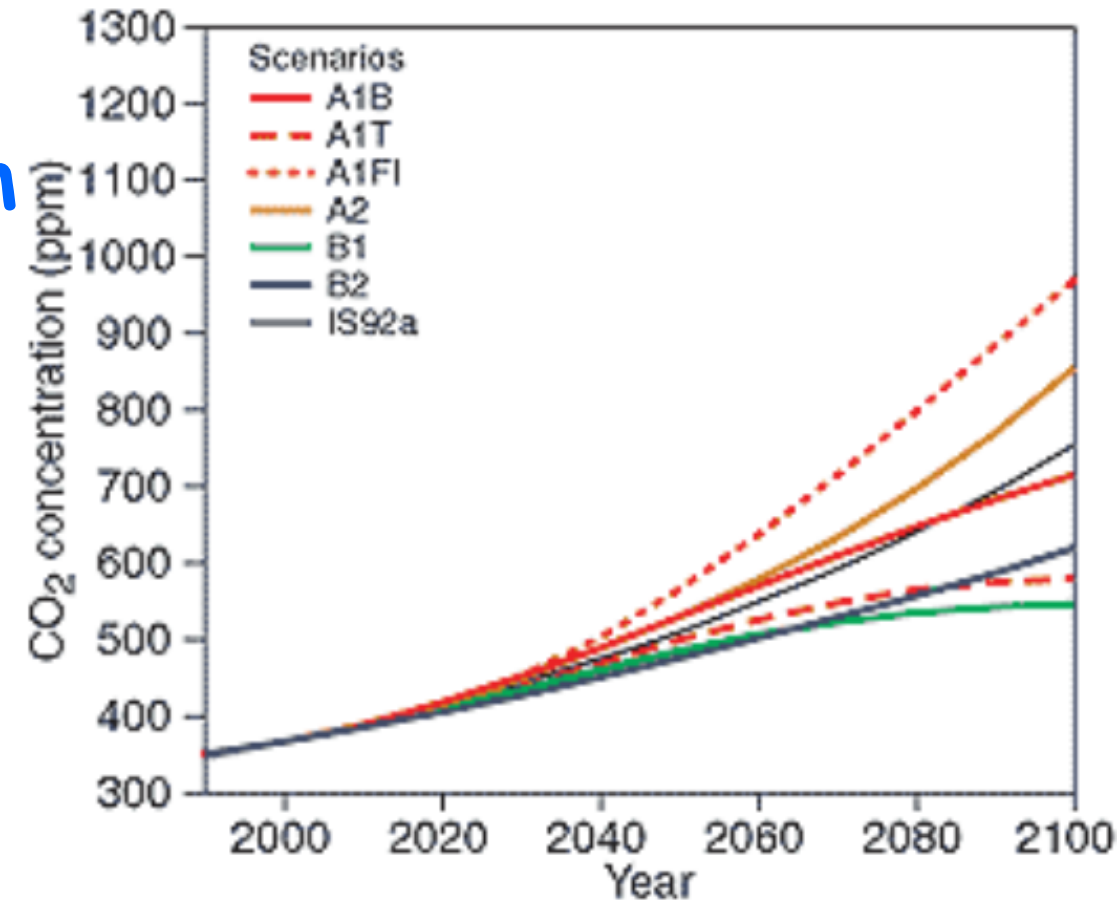
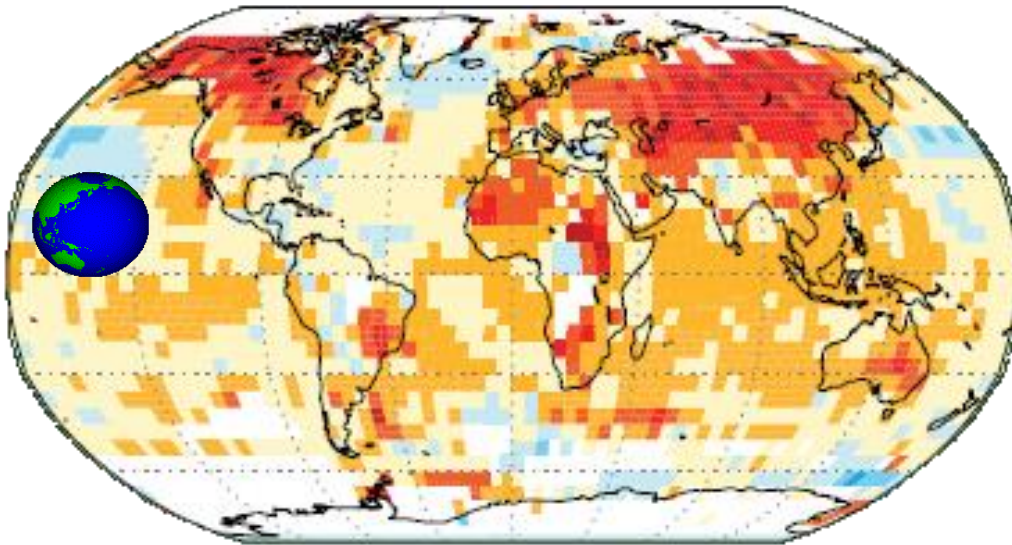
- Global mean surface temperature
+ 0.5°C /100 years

- Projected to increase further
1.1- 4 to 5°C by year 2100



- CO_2 concentration - **double** or **triple**

- **350 - 400** to **800 - 1200 ppm**

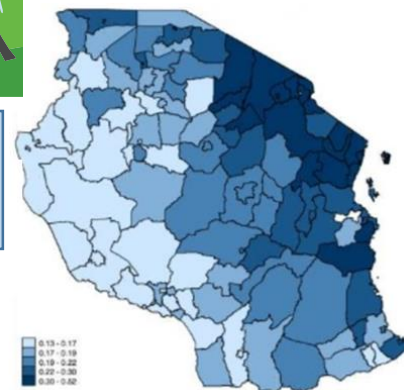


Medina et al. (2015)

- The precipitation in the tropical and subtropical countries
 - **Unreliable** and **unpredictable**
 - **Unevenly** distributed



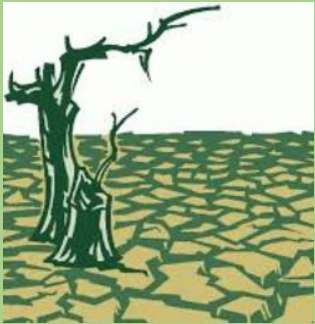
2.8mm/month/decade



World Bank (2017)



- These increments will have detrimental impacts on environment



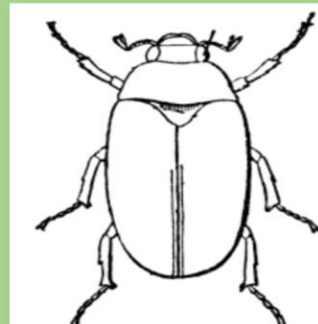
Increase
drought stress



Loss of
productive land



Decrease
crop
productivity



Increase
stored grain
insect pests



Growth
development of
toxigenic fungi



Global
food in
security



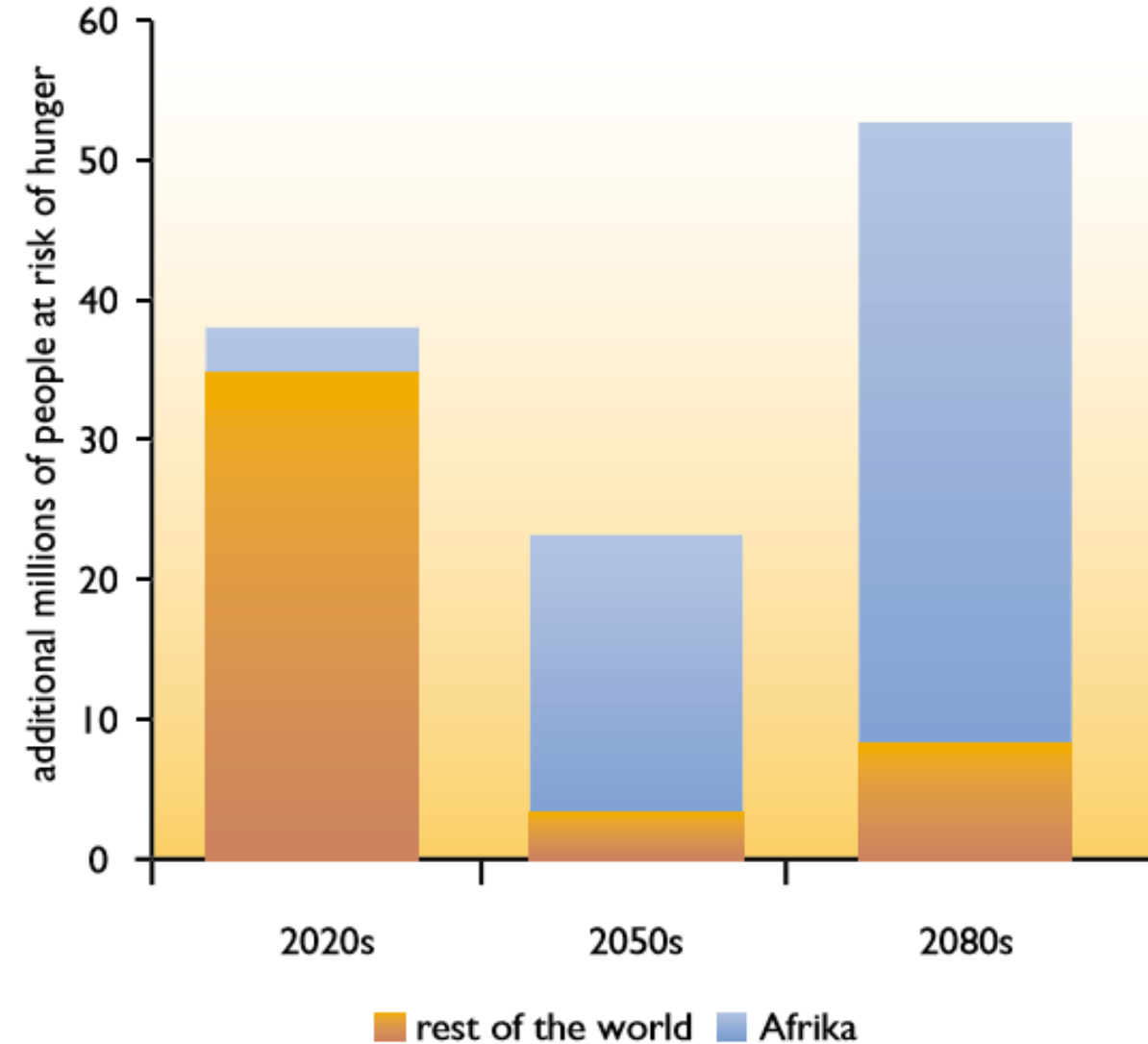
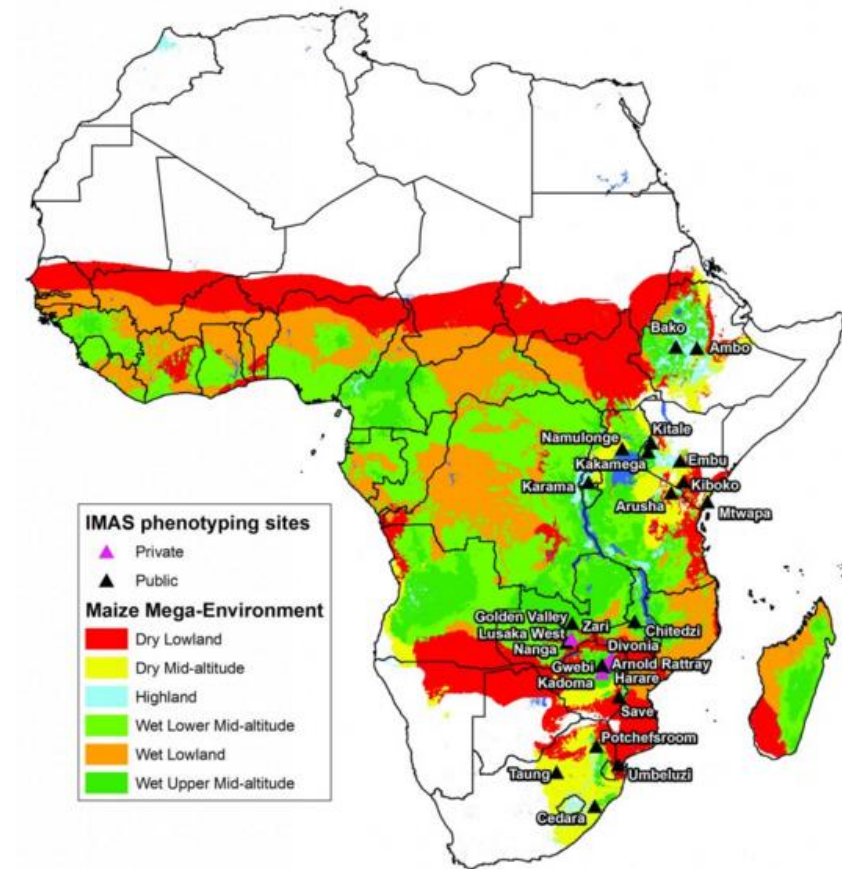
Climate Changes Impacts on Food Security

- Direct links - **climate changes and food security**
- Climate changes in developing countries will result
 - **reduced food supplies**





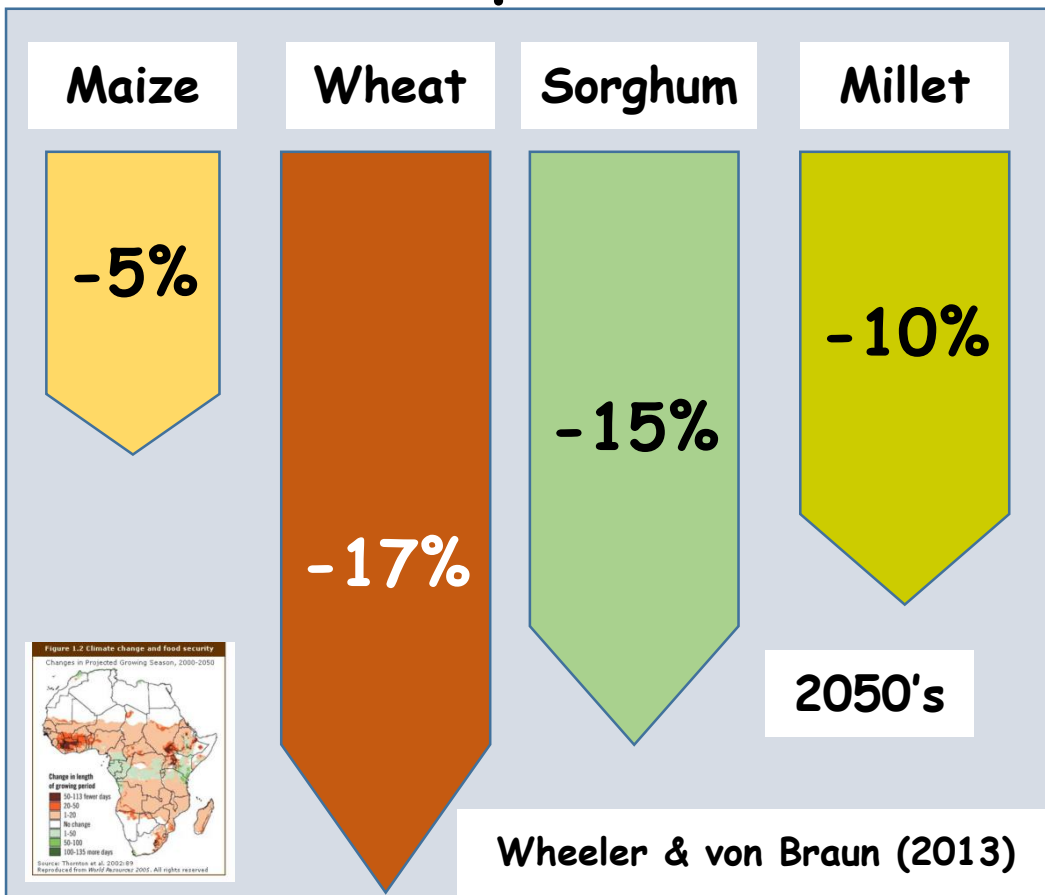
-Increase hunger and malnutrition- *SSA



*SSA=Sub-Saharan Africa

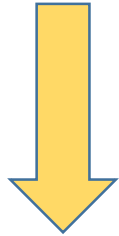
Parry et al. (1999)

- Climate change likely to decrease yield of maize and other crops



- Declined in crop yields in SSA could trigger

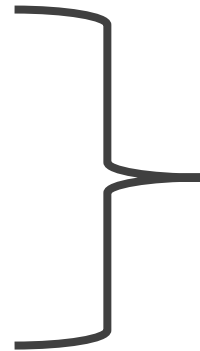
- More agricultural expansion



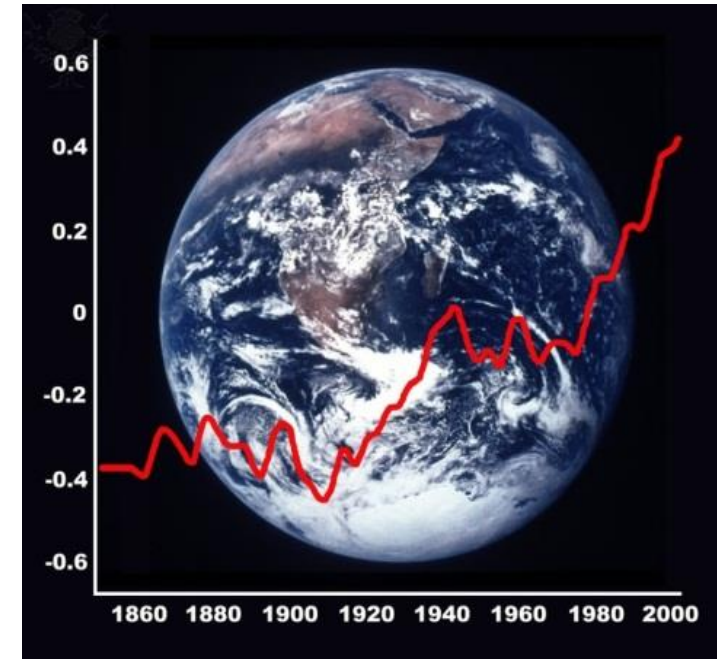
- More deforestation

+

- More CO_2



Global warming



Climate Changes Impacts on Stored Product Insects

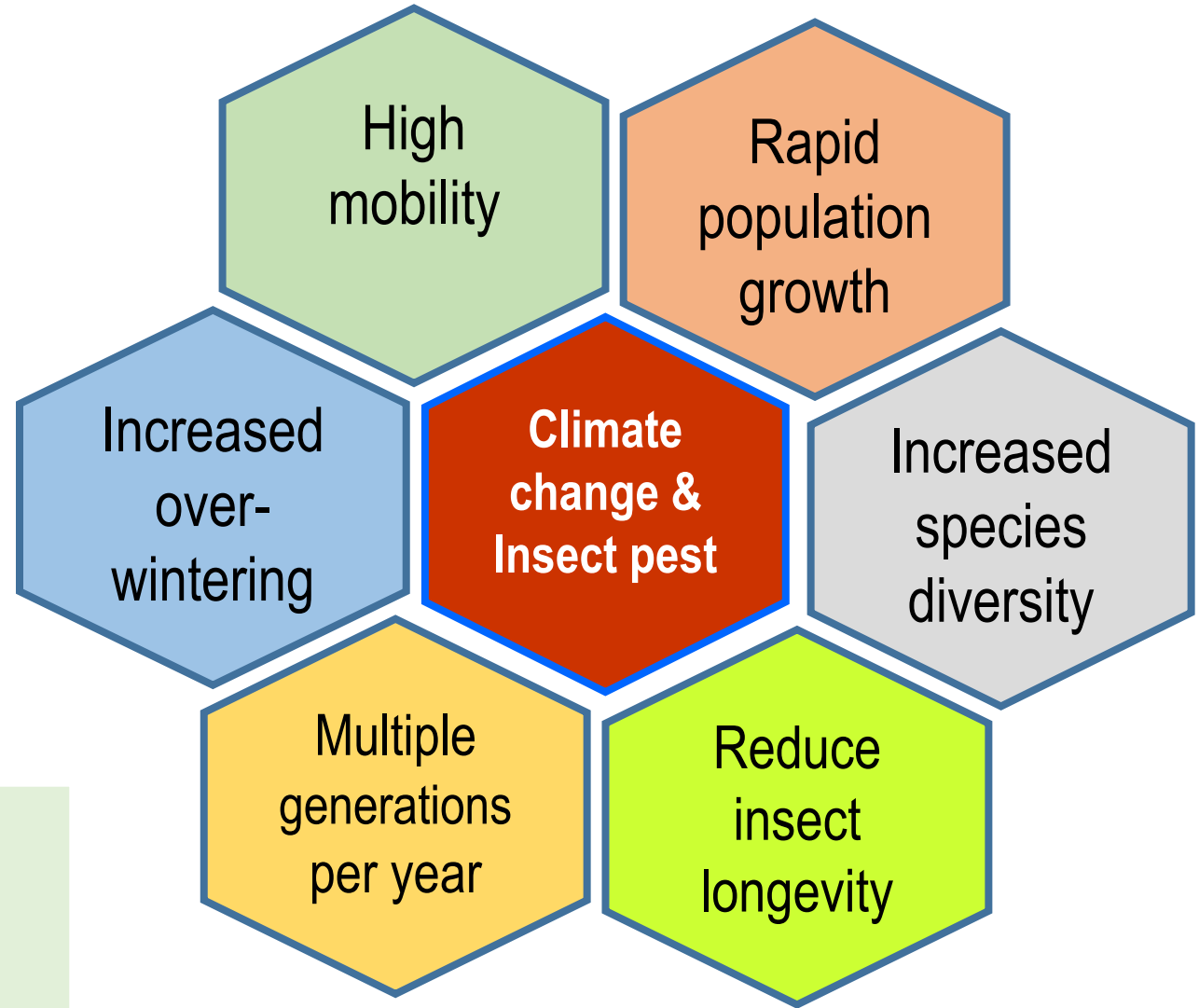
- Climate change are predicted to have a profound effect on
 - geographical distribution,
 - population dynamic, and
 - the status of stored product insect pests





- Hotter climate effects metabolic activities of insect such as
 - biochemical
 - physiological
 - reproductive
 - behavioral

**More infestation
field & storage**

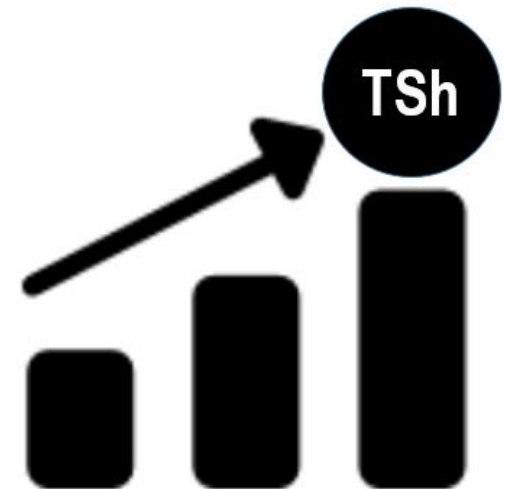




- Climate change also will bring serious challenges - pest management
 - ✓ Reduce efficacy of crop protection technologies
 - ✓ Need of more & new agrochemical
 - ✓ New pest species
 - ✓ Multiple generations of pest per year



- Climate change also will:
 - add extra burdens to the supply chain
 - increased postharvest losses during storage
 - high postharvest prevention costs





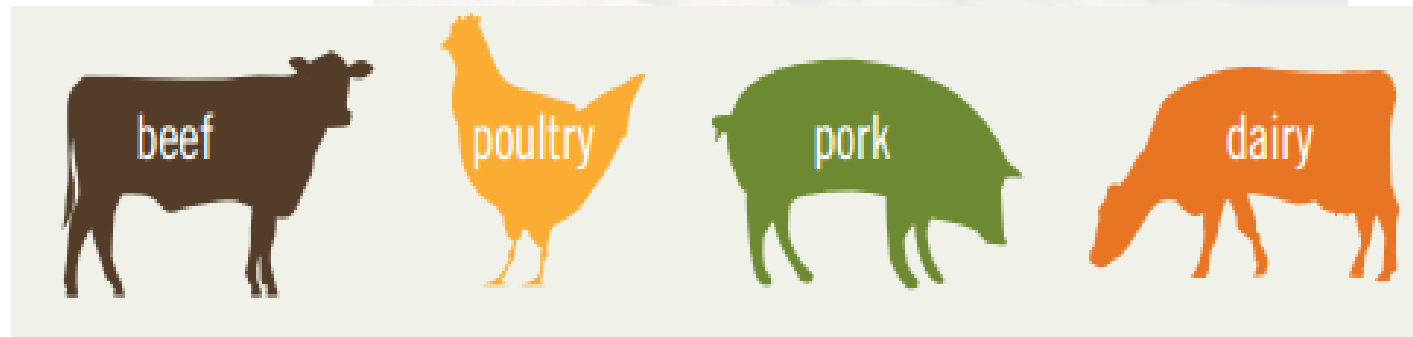
Climate Changes Impacts on Moulds and Mycotoxin

- One of the most important biotic factors - growth and development of moulds
- In warm and humid climates, some of these moulds are known to produce **mycotoxins**
- Toxic secondary metabolites





- Attracts worldwide attention
 - huge economic losses
 - impact on human
 - domestic animals
 - trade



- The effect of climate change on fungal infections and mycotoxins production is extremely complex

- temperature
- relative humidity
- insect attack
- plant stress
- elevated CO_2



- drought stress
- reduction of plant phytoimmunity



Climate changes impacts on grain storage and quality

- For long storage and maintained grain quality environmental factors such as **temperature** and **moisture content** should be controlled



- The main factors that greatly affect the storability of grain are



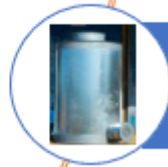
Temperature



Moisture of grain



Initial conditions of grain



Types of storage structure

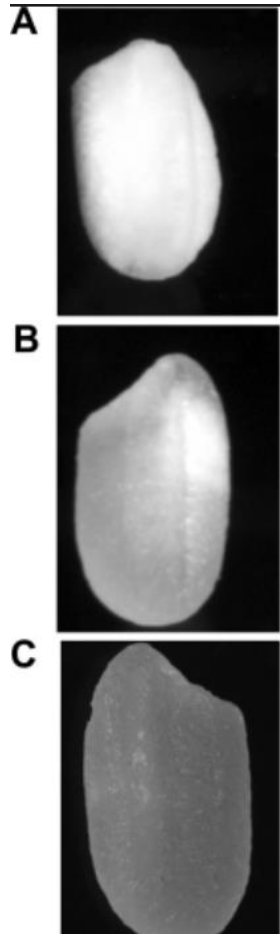


Insect infestation & mold contamination



- Of these, **increasing temperature** is the **major concern** and it is directly linked to **climate change**
- Raising temperature and periodic drought, are likely to
 - ✓ **influence growth and development of crops**
 - ✓ **Reduce grain yield & possible grain quality**

- For instance, when the temperature increased to above 27°C after heading resulted in
 - decreased rice head yields
 - increased chalkiness
 - decreased grain dimensions

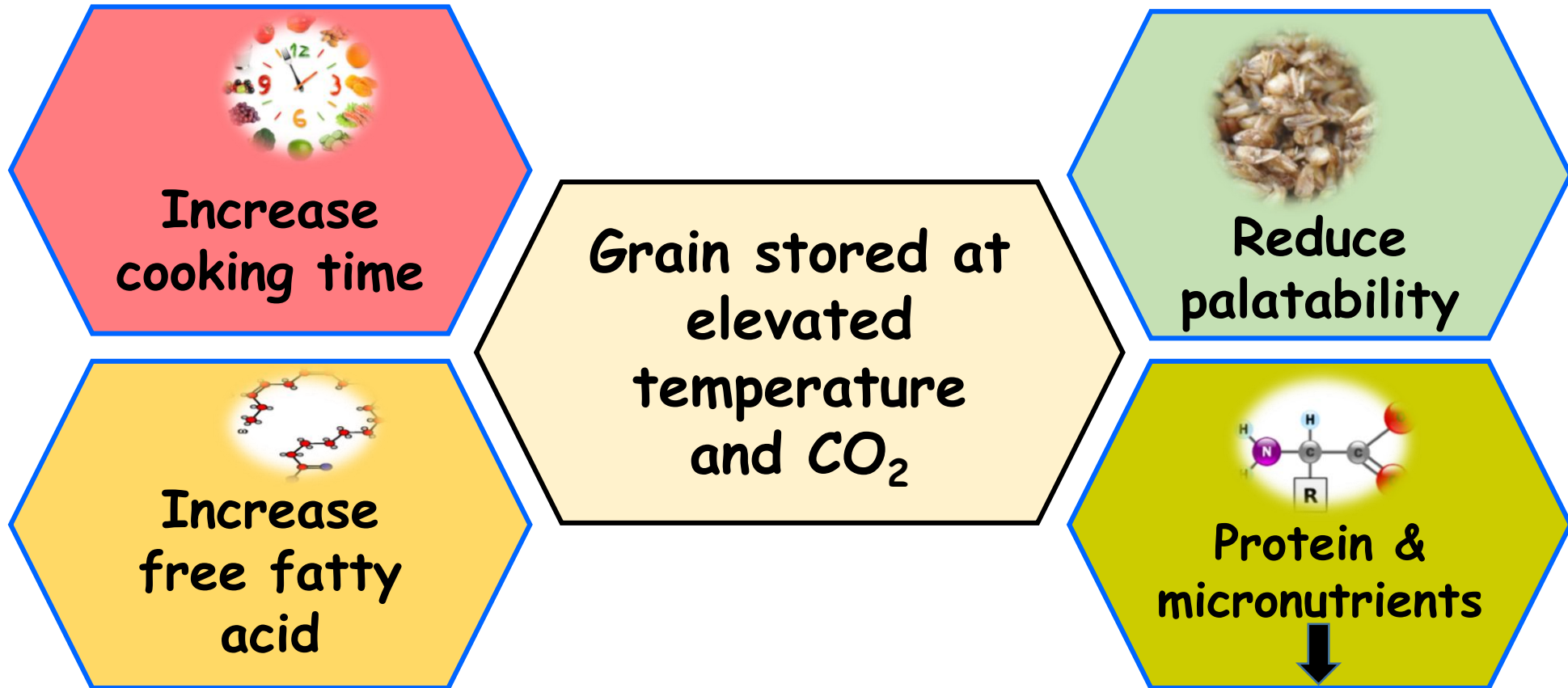




- lowered amylase content of rice
- reduce rice flavor & hardness
- reduce overall quality of rice



Wakamatsu et al. (2007) and Meullenet et al. (2000)



- As levels of CO_2 increase, plant growth will spike- but nutritional value may fall
- Studies show - protein concentrations in



Wheat



Rice



Potato



Barley

6 to 15%





- Protein concentration may be replaced with elevated levels of **carbohydrates** (**starch** and **sugars**)
- Cereal and staple crops will likely have lower concentration of many nutrients - including **iron**, **zinc**, **calcium**, **magnesium**, **copper**, **sulfur** and **phosphorous**



Conclusions

Climate change

Food Security

- Declined crop yield
- Reduce food supply
- Increase hunger
- Increase malnutrition

Insect pests

- Rapid population growth
- High mobility
- Increased over-wintering
- Increased species diversity

Mold & mycotoxins

- Temperature
- Relative humidity
- Reduce phytoimmunity
- Insect attack

Grain quality

- Reduce palatability
- Increase cooking time
- Increase FFA
- Reduce proteins

More potential effects on postharvest losses



SOKOINE UNIVERSITY OF AGRICULTURE

Dept. of Food Technology, Nutrition and Consumer Sciences

Thanks you

ANY



QUESTIONS