Coping with changes in cropping systems: plant pests and seeds

Vulnerable agro-ecosystems
towards
sustainable agricultural production

M. Allara, S. Kugbei, F. Dusunceli, G. Gbehounou
Plant Production and Protection Division, FAO

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Issues

- Increase productivity through improving efficiencies
- Intensified systems, problems of sustainability
- Urbanization - shift (gender) roles and productive systems
- Biological cycles – agro-ecosystems
- Climate change, new risks in marginal areas
- Additional vulnerabilities in fragile systems

Climate change effects

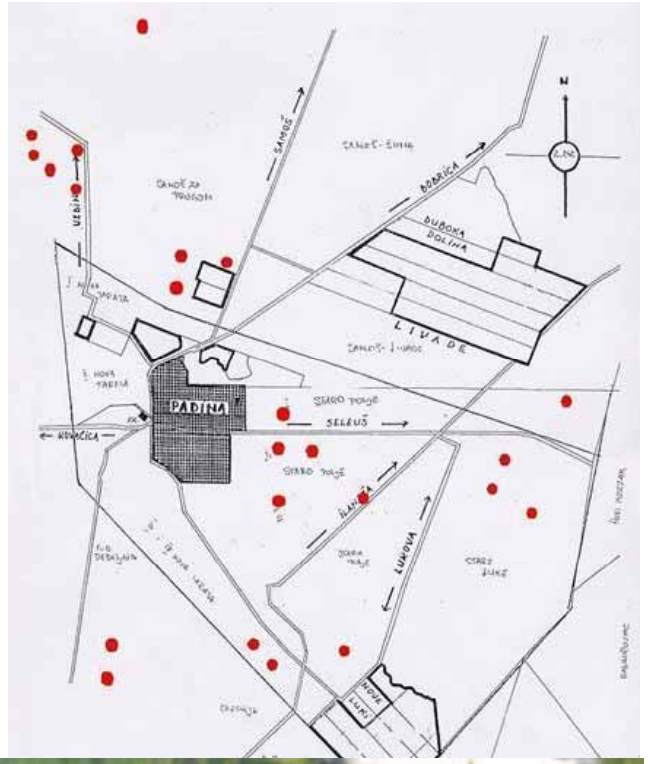
- higher temperatures
- shift of seasons
- rain quantity, distribution and water availability
- extreme natural events, causing disasters
- change in atmospheric gas composition

Influences on biological cycles

- phenological phases of crops
- timing of cropping seasons
- agro-ecological zones shift
- crop performances and shift to alternative crops
- population dynamics of living organisms including pests and Invasive Alien Species

The rate of change in climate might possibly exceed the rate of adaptation of agricultural systems including cropping systems: challenge is to keep a step ahead in adaptation, to ensure food production

Adaptation: farmers and pests



Insects pests

(Kiritani, 2006)

poikilothermic species: internal temperatures vary matching the temperature of the immediate environment

<u>temperature</u> is the single most important environmental factor influencing species behavior, distribution, development, survival and reproduction

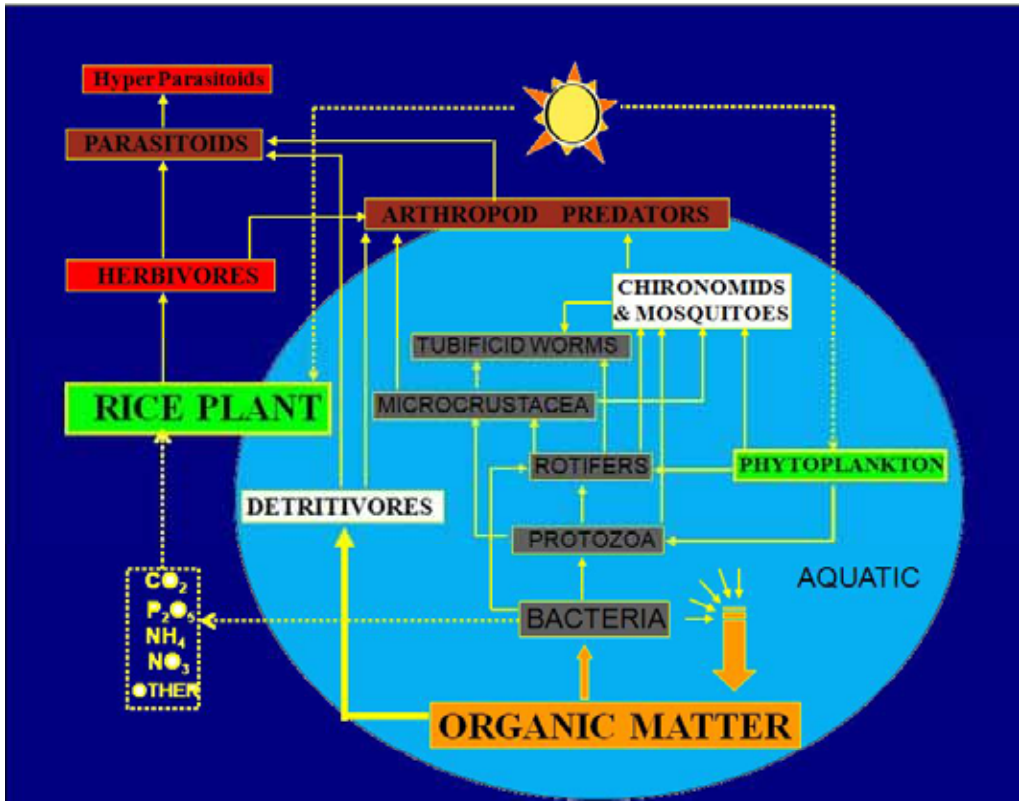
1°C increase in temperature during the last 40 years resulted in

- shift in species distribution range
- reduction of winter mortality
- earlier occurrence in spring
- increased number of annual generations

tropical and subtropical insect species may advance pole-ward continuously

temperate species may expand stepwise

& system interactions...



emergence of <u>new pests</u>, as species may be released from natural control factors

relations within food webs (host, pest, natural enemy) due to changing phenology and their synchronization

BUT new balance may also work
<u>in favor of natural enemy</u>'s population build up, such as *Trichogramma* and egg parasitoids, *Apanteles*, *Cyrtorhinus*, as they may be able to increase number of generations per year <u>earlier</u> than their host species, due to their lower thermal constant

Farmers Field Schools (FFS)
Agro-ecosystem Analysis (AESA)

Stem rust:
new challenge Ug99

Plant diseases

- Temperature changes
- Microclimate changes
- Wind direction
- Rainfall patterns
- Atmospheric gas composition

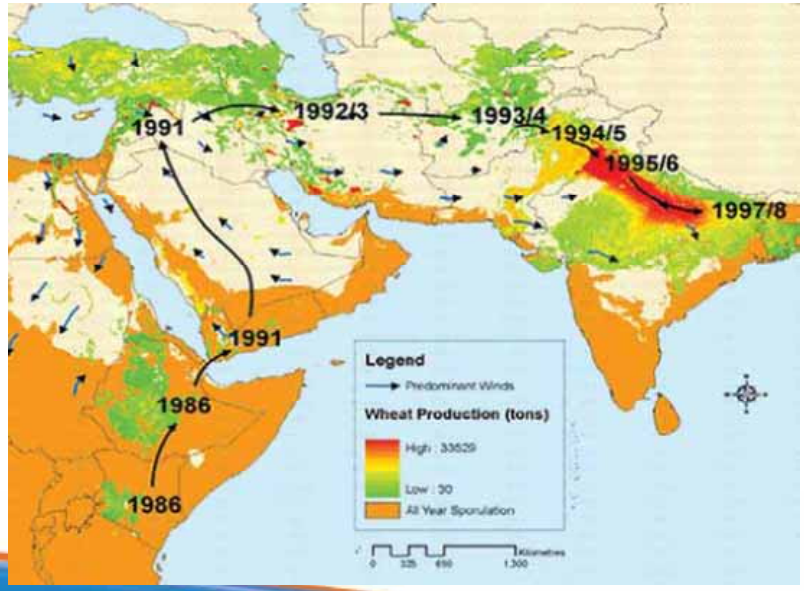
host plant growth and canopy shape/density in favour of disease spread and virulence

For example in temperate climate:

- earlier onset of warm temperatures
- earlier threat from plant diseases
- potential for more severe epidemics
- increased need for fungicides

Global Wheat Rust initiative (Yellow, Stem, Leaf rust):

- International cooperation framework
- sustained, collaborative, multi-disciplinary
- coordinated monitoring and surveillance, local and international level
- knowledge and understanding of pathogens in changing environmental conditions



Yellow rust pathway

Weeds

WHY

elevated CO_2 favours

- red rice
- Cheatgrass (*Bromus tectorum*)
- Canada thistle (*Cirsium arvense*)

Better adaptation to stress conditions

- *Prosopis juliflora*

HOW

- higher photosynthesis rate under elevated CO_2
- greater assimilate partitioning towards roots
- extraordinary enlargement in the root mass with rich food reserves
- rapid and robust regeneration after mechanical lopping or after revival of ecological stress conditions such as drought or inundation.
- weed's ability to tolerate climatic extremes high temperature and water scarcity and peak monsoon winter water inundation and flooding

NEED vigilance

- at community level to detect and report emerging weed problems related to climate change and design appropriate management strategies.
- at national level, enabling policy and institutional environments to promote integrated weed management options
- at regional and international levels common regulations and strategic frameworks are needed to limit the impact of invasive plants

Seed system adaptation responses

Seeds carry the genetic potential enabling adaptation of crops to biotic and abiotic stresses associated with climate change – temperature, water stress, plant diseases, etc.

Therefore the system that produces and distributes seeds (seed system) both formally and informally is crucial in responding to climate change.

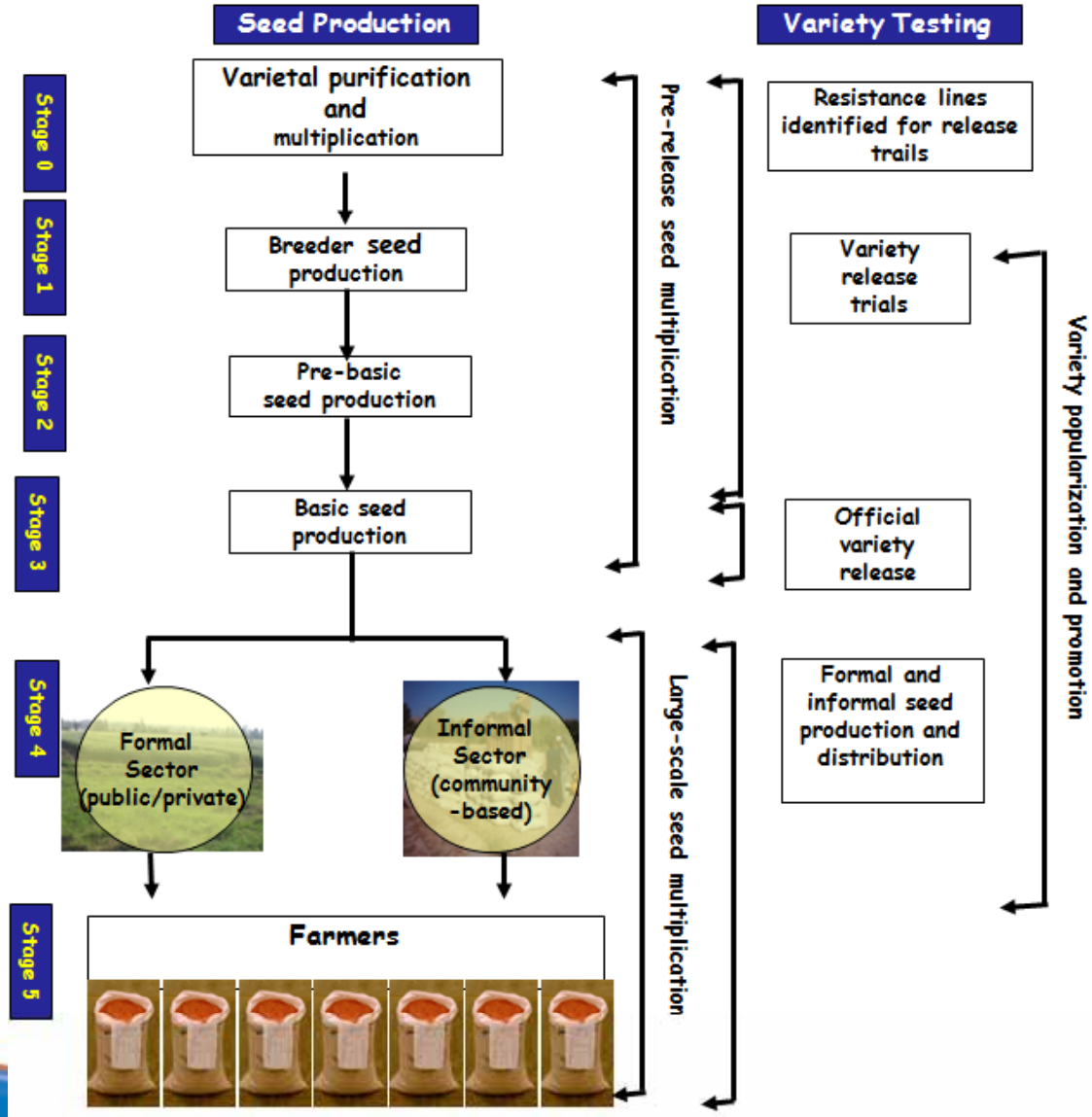
1. Availability of adapted crop varieties

- Conservation and utilization of plant genetic resources
- Developing new stress tolerant varieties in the formal sector

  (e.g., Ug99 stem rust wheat varieties, drought tolerant varieties and shorter duration varieties)
- Identification and maintenance of existing traditional varieties with valuable adaptation attributes

2. Developing seed delivery systems

- Formal system for quick injection and diffusion of new varieties (organized methods including private enterprises)
- Informal system for farmer to farmer diffusion of new and local varieties (community-based methods, seed fairs, etc.)



3. Other responses (normative)

- Preparation of appropriate seed policies and laws recognizing the appropriate roles of seed industries in responding to climate change
- Harmonizing seed policies and regulations to facilitate exchange and international seed trade
- Promoting crop diversification
- Enhancing seed science and technology capacity
- Market promotion for seed
- Other forms of capacity building for technicians, enterprises, policy makers and farmers

Coping with change: a learning process

Need

1. good understanding of practical implications of changes occurring at local and national level
2. enhance adaptive capacities of rural communities, researchers and national policy-makers
3. getting stakeholders better connected as changes occur

Climate Field Schools (CFS)

- Indonesia, Indramayu District, West Java (rice): weather forecast, water management, alternative crops
- West Africa, Mali (cereals): drought tolerant varieties, water management, soil fertility management, moisture retention capacities

Save and Grow

Promotes Sustainable Crop Production Intensification

- SCPI aims to increase crop production efficiency, taking into consideration all relevant factors affecting the productivity and sustainability at farmer, technical and policy levels

Integrated approaches:

- seed systems for enhanced genetic resources
- healthy soils – e.g. Conservation Agriculture
- ecosystem services - pollination, natural enemies for IPM
- intensification of knowledge

http://www.fao.org/ag/save-and-grow/

Focus on resilience

- Ability of a system to return to balance after a stress and to regain the capacity to produce important services
- Fundamental feature of natural systems - allows them to cope with changes
- Those who make decisions need to understand resilience, from the field to the national and global levels, as an essential pre-requisite to management

In “memorable moments” from FAO/OECD workshop 2010:

- Resilience is broader than the ability to adopt specific changes; it is the capacity to adapt to unforeseen changes quickly
- Farmers like to learn from other farmers

Conclusions

Synergy of challenges:

- climate change
- intensification in agriculture
- more frequent and intense global exchanges

Demand for:

- shift in thinking on scope and priorities to achieve sustainability in agricultural production
- focus on stability and resilience of local agro-ecosystems
- concerted action among main stakeholders, both at local and global level

Farmers are the experts

Thank you