BIOSAFETY AND ENVIRONMENTAL ISSUES

Muiru, W.M

University of Nairobi

Department of Plant Science & Crop Protection

Definitions

Biosafety

The need to protect human and animal health and environment from the possible adverse effects of the products of modern biotechnology

Environment

The whole complex of climatic, edaphic and biotic factors that act upon an organism or an ecological community and ultimately determines its form and survival

Ecosystem

Plants, animals and microorganisms that live in a defined zone and the physical factors present e.g. soil, water and air

Pesticide

A Pesticide is a chemical used to prevent, destroy or repel pests

Introduction

- Crop pests (plant pathogens, vertebrate and invertebrate crop pests, weeds)
- Cause 30% of crop loss

- Qualitative and quantitative yield losses
- Loss can occur at field level or at post harvest level

- Loss a major challenge to attainment of food security and even food safety

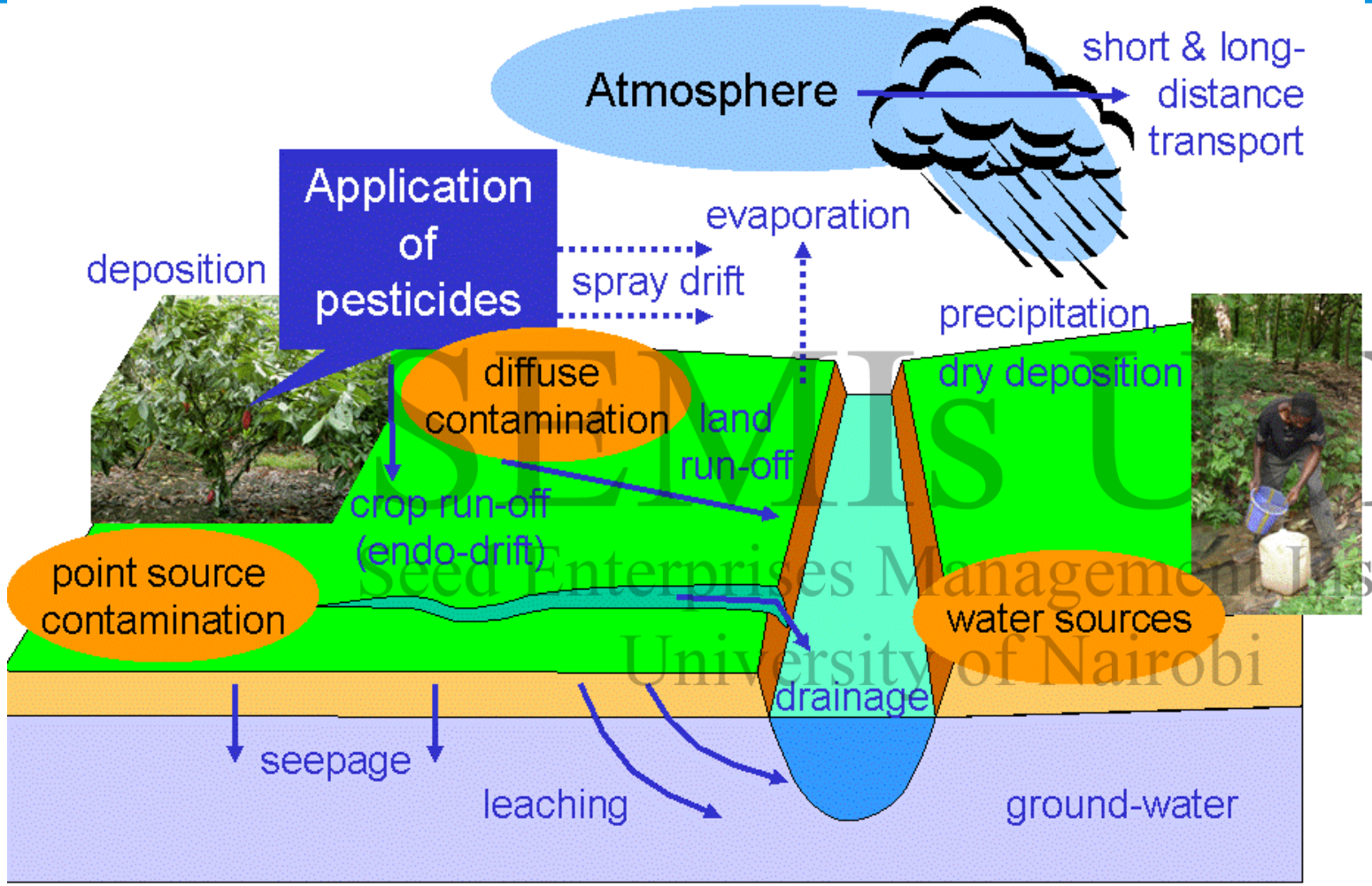
- An adequate, reliable food supply cannot be guaranteed without the use of crop protection products.

- world population has doubled in the last 40 years, the area of land devoted to food production has remained virtually constant; crop protection products have enabled farmers to produce higher yields of their crops on more or less the same land

Introduction continued

- Due to the losses growers apply various measures
- Overreliance in the use of chemical pesticides (fast knockdown effect, pressure from agro-chemical firms)
- Lack of alternatives such as access to resistant varieties, biological control agents
- Lack of technical knowhow on the most appropriate management strategies

Pesticide pathways



Safety issues

- Pesticides are poisons
- All pesticides are toxic
- Toxicity depends on the chemical properties, routes of exposure and duration of exposure
- Use of pesticides presents a hazard to the user, consumer, non-target organisms and the environment

(a) **User:**

- Exposure to the pesticide during mixing and application (acute and chronic effects)

Safety issues

(b) **Consumer**

- Exposed to chronic poisoning
- Chemical residues
- (maximum residue levels)
- Acceptable Daily Intake

(c) **Non-target organisms**

- Affects beneficials especially non-selective pesticides e.g. Fumigants
- Pest resurgence and secondary pest outbreak

Safety issues

(d) **Environment**

- Pollution-pesticides degrade the environment
- Effect on environmental pollution depends on toxicity, formulation, persistence
- Various parts of the environment are affected
- Air- due to spraying- pesticide formulations
- Water- Spillage, wash out from the atmosphere, surface run-off
- Land- disposal of empty pesticide containers and unwanted pesticides

crop protection activities with biosafety issues

Use of genetically modified organisms

- Is governed by cartagena protocol on biosafety (1993)
- as a supplement to the convention on biological diversity

- seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology

- ensuring an adequate level of protection in the field of the safe transfer (transboundary movements), handling and use of GMOs

- adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health

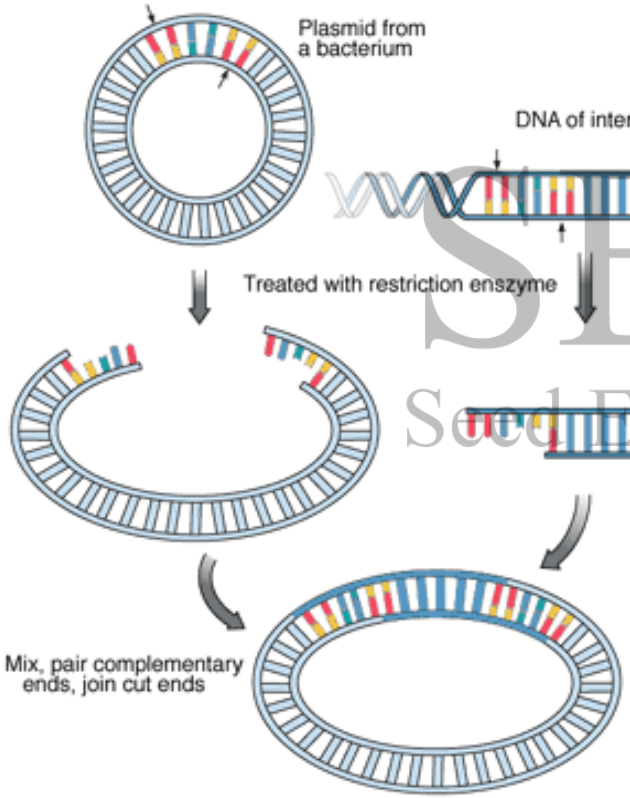
- Basic premises on CPB (Decision on the basis of scientific risk assessment and Precautionary Principle)

Convention of Biodiversity (CBD) [1992]

- Focus on the conservation and sustainable use of biodiversity
- Recognized the potential of modern biotechnology in causing harm to human well being
- Took cognizance that modern biotechnology could have serious effects on environment and health
- Article 8(g) emphasized the need to regulate the risks associated with the use of LMOS.
- Article 19(3) set the stage for a legally binding international instrument about biosafety.

Biosafety issues associated with GMOs

Bisafety issues with GMO relate to environmental, human and animal health consequences



Biosafety issues associated with GMOs

Environmental risks posed by GMOs

- Outcrossing between GMOs and pathogens
- Negative effects on populations of non target organisms

GE technology carries certain inherent unpredictability

- Isolation of a gene from its natural environment and integration into entirely different organism
- Possible transgenic instability due to triggering of the inbuilt defense mechanisms of the host organism leading to inactivation or silencing of foreign genes.

Biosafety issues associated with GMOs

- Hazard to human and animal health by transfer of **toxins and** allergens and by creation of new toxins and allergenic compounds
- Development of aggressive weeds/ wild relatives by transfer of transgenic traits
- Erosion of land races/wild relatives by genetic pollution in centres of origin/ diversity
- Harm to the non-target organisms
- Development of pest resistance by prolonged use
- Monoculture and limitations to farmers' choice in crop management

Mitigation of safety and environmental issues -pesticides

- Adoption of IPM approaches
- Good agricultural practices (GAP) (selection, PHI, safe re-entry intervals)
- Safe use-handling (storage application)
- Ensuring sustainable and safe use of pesticides- avoid routine application but follow threshold levels
- Strengthening regulatory framework of crop protection products (national, regional, and international legislation that helps ensure safety for users, consumers and the environment)
- Education and training programs that relay how products can be used safely and efficiently

Mitigation cont'd

- Regulation on the introduction of GMOs- regulatory framework Needed (In kenya National Biosafety Authority)
- Rigorous Scientific Assessment
- Adoption of precautionary principle
- Prevention of the spread of genetically engineered material outside lab/field--biocontainment

Conclusions

- Pesticides though toxic have a role to play in crop protection
- Judicious use of pesticides is needed to reduce/eliminate harmful effects on the non-target organisms and the environment
- Knowledge on IPM approaches, availability of the various strategies, GAP information integral in the safe use and protection of non-target organisms and the environment
- Goals of responsible pesticide users follow good practices that achieve: effective pest control and little risk to environment

Conclusions cont'd

- Biosafety is integral to modern biotechnology
- The adoption of modern biotech products needs to be balanced with adequate biosafety safeguards
- Case by case scientific risk assessment and cost benefit analysis
- modern biotechnology has potential for improvement of human well being and the environment

Thank you

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