

## **COMMON DISEASES OF CROP PLANT**

### **I. Meaning of Diseases**

- A plant disease may be defined as a departure or deviation of the plant from the normal state of health with marked symptoms or outward visible signs.

### **II. Causes of plant diseases**

#### **A) Biotic factors (or pathogens)**

- (i) Viruses- a microscopic organism that cause infectious disease in plants and animals
- (ii) Bacteria
- (iii) Fungi
- (iv) Nematodes

#### **B) Abiotic factors (No pathogens)**

- (i) Too high temperature e.g. sun scald of fruits
- (ii) Low soil moisture (drought)
- (iii) High soil moisture (water logging)
- (iv) Insufficient light
- (v) Nutrient deficiency

### **III. General effects of diseases on crop production**

Diseases cause lots of damage to crops which usually manifest in any the following effects:

- (i) Diseases generally cause reduction in yield and productivity of crops.
- (ii) They cause reduction in quality
- (iii) They cause malformation of plant parts or the whole plant.
- (iv) They can kill or cause the death of a whole plant.
- (v) They cause reduction in the income of farmer.
- (vi) They increase the cost of production in the course of controlling them.
- (vii) They render vegetable and fruits unattractive and unmarketable.
- (viii) They cause retarded growth in crop plants.

### **IV. General control of diseases of crop plants**

Diseases of crop plants can be controlled by the following methods

- Preventive method
- Cultural method

- Biological method
- Chemical method
- Integrated method

**A. Preventive Control Method**

- (i) Roughing of infested plants
- (ii) Sanitation measures
- (iii) Plant quarantine
- (iv) Use of clean seeds

**B. Cultural control methods**

- (i) Crop rotation
- (ii) Use of resistant varieties
- (iii) Good tillage practices
- (iv) Regular weeding
- (v) Fallow (i.e. leaving a piece of land un-cropped for a period of time).
- (vi) Timely planting
- (vii) Pruning
- (viii) Roughing uprooting and burning of infected plants to control or prevent disease

**C. Biological control**

This involves the use of natural enemies of the disease to reduce or totally eliminate the disease.

**D. Chemical control**

This involves the use of chemical such as fungicides, insecticides and nematicides to dust or spray plants and plant materials in order to prevent or control plant diseases.

**E.** Integrated control: This involves the use of two or more methods

**V. SELECTED DISEASES OF CROPS AND THEIR CONTROL**

**MAIZE**

**Maize smut**

- Caused by a fungus called *Ustilago maydis*
- It is an air-borne disease
- Reduces crop yield

- Forms galls on ears, leaves and tassel which later turn black
- Can be controlled by destroying
  - (i) Disease plants
  - (ii) Use resistant varieties
  - (iii) Use seed treatment with fungicides
  - (iv) Crop rotation management

**(2) Maize Rust**

- Caused by a fungus called *Puccinia polysora*
- It is air-borne
- Cause red spots on leaves
- Reduce crop yield
- Can cause death of crop plants

**Control Measure**

- Early planting
- Crop rotation
- Use of resistant varieties other diseases of maize

**(3) Leaf blight** of maize may be caused by *Helminthosporium maydis* or *Helminthosporium taricum*

**(4) Bacterial wilt** caused by *Bacterium stewarti*

**(5) Brown spot** caused by *Physoderma Zeamaydis*

**(6) *Puccinia sorghi***

Maize dwarf mosaic virus (MDMV) and corm stunt virus (CSV) symptoms are the appearance of faint yellowish strips on plants 6 to 7 weeks old and shortened internodes excessive tiling with many grainless ears may be observed.

Bacterial wilt or stewart's disease caused by *Bacterium stewarti* found especially in sweet corn.

Brown spot caused by the fungus *Physoderma zeamaydis*.

**(7) Downy mildew** caused by *Peronosclerospora sorghi*

(8) **Maize streak virus disease** transmitted by leafhoppers of the *Circulinea sp* for control use resistant varieties TESR, TZESR, DMR-ESR

## VI Rice diseases

### Rice blight

- Caused by fungus *Piricularia oryzae*
- Transmitted through airborne spores on leaves

Symptoms commonly observed include:

- Small longitudinal red spots on leaves which turn grey or brown.
- Reduce yield

Prevention control through:

- The use of clean seeds
- Avoid heavy use of N fertilizers
- Use resistant varieties

(ii) Seedling blight caused by *Sclerotium rolfsii*

(iii) Brown leaf spot caused by *Helminthosporium oryzae*

(vi) Rice blast (or rotten neck) caused by *Piricularia oryzae*

(vi) Stem rot caused by the fungus *Magraparthe salvinii*

### Cassava

(i) Cassava mosaic disease caused by a virus transmitted by piercing and sucking insect (whitefly) *Bemisia nigerrensis* with symptoms which include:

- Mosaic pattern on leaves
- Stem/leaf distortion
- Stunted plant
- Reduction in yield

Prevention and control by

- Use of resistant varieties
- Uproot and burn infected plants
- Spray insecticides to kill vector

- Use disease free stem
- Farm sanitation

(2) Leaf blight of cassava caused by a bacterium called *Xanthomonas manihotis*

Symptoms include

- Wilting of plant
- Falling off of leaves
- Reduced yield
- Canker of stem – die back of stem

Prevention and Control

- Use resistant varieties
- Use disease-free cuttings
- Early planting
- Practice crop rotation

### **Cocoa Black Pod Disease**

- Caused by fungus *Phytophthora palmivora*

Symptoms include

- Brown spot on pod
- Rotting of pods
- Entire pod turns black
- Low yield

### **Prevention and control measures**

- Remove and destroy infected pods
- Regular weeding
- Spray with fungicides e.g. Bordeaux mixture
- Avoid overcrowding of cocoa plants.

### **Tomato**

Root knot of tomato caused by:

- Nematode, it is soil borne

Symptoms include:

- Galling of roots
- Retarded growth
- Early death of plant
- Reduction in yield

Prevention and control by:

- Soil sterilization
- Crop rotation
- Use resistant varieties
- Uproot and burn infected plants

### **Disease of Tomato**

Bacteria wilt (*Pseudomonas solanaceus*)

Collar rot (*Sclerotium rolfsii*)

Early blight (*Acternaria solani*)

Grey leaf spot (*Stemphiflium solani*)

Late blight (*Phytophthora infestions*)

Leaf mould (*Cladosporium fulvum*)

Septoriia leaf spot (*Septoria lycopersici*)

Target leaf spot (*Corynespora cassicola*)

Tomato wilt (*Fugarium oxyporum*)

### **Cowpea**

Leaf spot of cowpea caused by a fungus *Cercopora*

Symptoms include:

- Reddish brown spot on leaves
- Lesion on leaves
- Chlorosis
- Dropping of leaves

Prevention and control by

- Spray with fungicides

- Crop rotation
- Use resistant varieties

## WEEDS AND THEIR CONTROL

### Definition of a Weed:

A weed is a plant out of place or a plant growing where it is not wanted. A plant is regarded as a weed either because it interferes with human activity / welfare or because it occurs spontaneously in human-disturbed habitats. Weeds are generally undesirable and may be prolific, persistent, competitive, harmful or even poisonous.

### Characteristics of Weeds

1. *It is harmful to humans, animals and crops.* It may contain poisonous alkaloids e.g leaves of stinging nettle (*Fleurya aestuans*), pods of *Mucuna pruriens*, high level of nitrates in *Amaranthus* is poisonous to animal, parasitic crop (*Striga spp*)

2. *Wild and rank (too thickly) growth.* It is wild and rank in growth habitat. E.g *Chromolaena odorata*, *Andropogon spp*. They grow rapidly, branch or tiller profusely and cover extensive areas.

3. *They are persistent and resistant to control or eradication* e.g purple and yellow nutsedge (*Cyperus rotundus*), *C. esculentus* have well developed tubers and viable seeds, *Imperata cylindrica* has extensive rhizome systems and seeds, *Bryophyllum pinnatum* spreads by seed and leaf bulbil (It is resistant to dessication)

4. *They have high reproductive capacity.* Some weeds produce large quantities of seeds e.g *Amaranthus spinosus* (235,00 seeds per plant)

5. *Ability to exhibit seed dormancy.* A condition in which a seed fails to germinate in the presence of environmental condition that are normally optimal or seed germination. The forms of dormancy so exhibited by weed species include induced dormancy, enforced dormancy and innate dormancy.

**Induced dormancy** = inability of a mature viable seed to germinate because of an after ripening experience(exposure to high CO<sub>2</sub> level, hard seed coat or allelochemicals)

**Enforced dormancy**= result of exposure of mature viable seeds to adverse environmental condition e.g low moisture or high temperature and poor aeration.

**Innate dormancy**= occurs if a viable mature seed fails to germinate when exposed to environmental conditions that are favorable to vegetative growth because of immature embryo or the presence of inhibitor chemicals either in the seed coat in the fruit.

6. *Weeds may grow in an undesirable location.* They can be found in cultivated fields, tennis courts or recreational sites and cracks of concrete.

7. *Weeds have large populations.* E. g *Euphorbia heterophylla*, *Ageratum conyzoides*, *Aspilia africana*. They are able to compete better with crops because of this numerical superiority.

8. *Humans often find them useless, unwanted, undesirable.* Many weeds have some morphological features such as thorns, prickles etc which make them objectionable e.g *Amaranthus spinosus*.

9. *Spontaneous growth, appearing without being sown.* Such weeds have small, obscured seeds that are buried in soil e.g *Amaranthus spinosus*, *Talinum triangulare*.

10. *Aggressiveness:* Many weeds rapid seedling growth and wide tolerance to edaphic and environmental factors. Some are very competitive and deep roots and have the ability to form canopy over associated crops e.g *Euphorbia heterophylla*.

11. *Unightly.* Many weeds have unattractive flowers and foliage and tend to disfigure the landscape e.g *Panicum spp*, *Aandropogon spp* and *Pennisetum spp*.

## **Economic Importance of Weeds**

### **Direct Losses by weeds**

1. Weeds cause reduction in crop yield through competition for light, nutrient, water and space. They can also reduce the yield of crop through the release of toxic substances or exudates which inhibit crop growth. This is called **allelopathy**. Uncontrolled weed infestation can lead to 95% yield loss in cassava, 40% in maize, 53% in cowpea, soyabean and pigeon pea.

2. Weeds can reduce the quality of harvested agricultural products.

3. Weeds interfere with harvest operations and increase the cost of harvesting in both small holder and large scale farms.

4. Weeds may poison animals e.g *Amaranthus spp* can adversely affect livestock because of the high nitrate content of the shoots.

5. The cost of controlling weeds is high.

6. The presence of weeds can impede water flow in irrigation canals.

7. The presence of weeds in lakes and reservoir can increase loss of water by transpiration.

### **Indirect Losses caused by weeds**

1. Weeds serve as alternate hosts to many plant diseases and animal pests e.g insects, rodents, birds etc that attack crops.

2. The presence of weeds imposes a limit on farm size.

3. The presence of weeds can also reduce the economic value of lakes by preventing or limiting fishing activities.



4. Weeds such as *Imperata cylindrica* become fire hazards in the dry season throughout the savanna vegetation zone.

### **Non Agricultural Losses**

1. Weeds affect health of humans, stinging nettle can cause skin rashes and the flowers of some other weeds can be associated with allergies in humans
2. Weeds impair visibility along roads and railway lines.
3. Uncontrolled weed growth reduces the value of real estates.
4. In situations where farmers depend on human labour for weeding, children have to miss school at peak of weeding periods. This reduces the quality of education that these children can get during their early years.

### **Beneficial Effects of Weeds**

1. Weeds provide a vegetative cover that protects the soil surface against erosive action of rain and wind.
2. Weeds play an important part in nutrient recycling. Roots of weeds tap nutrients from the lower soil depths and return these to the soil surface as litter when the weeds shed their leaves or when the entire plant plants dies and decays.
3. Weeds add organic matter to the soil both from the roots and from the above ground parts.
4. Many plants that are designated weeds are used as potherbs e.g *Talinum triangulare*.
5. Weeds are sources of pesticides e.g *Chrysanthemum cinerariifolium* which provides insecticide pyrethrum.
6. Weeds provide food and cover for animal. Wildlife generally depend on weeds for survival as food and shelter.
7. Weeds serve as an important source of genetic materials for crop improvement such as breeding for resistance to pests and diseases which are made possible by genetic materials provided by wild species of the crop plants.
8. Weeds serve as hosts beneficial insects, and at the same time provide nectar for bees.
9. Many weeds help to beautify the landscape. E.g a good ground cover of *Cynodon dactylon* beautifies the home.

## Classification of Weeds

Weeds can be classified based on:

1. *Morphology*
2. *Life cycle( ontogeny)*
3. *Growth habit*
4. *Botanical consideration*
5. *Habitat*

### *Classification Based on Morphology of weeds*

The criterion defines classification on the basis of leaf shape.

**(a) Grasses:** the leaf lamina in relation to the breadth is very high e.g *Panicum maximum*, *Andropogon gayanus*, *Eleusine indica*

**(b) Broadleaves:** the ratio of leaf lamina to the breadth is smaller e.g *Sida acuta*, *Talinum triangulare*, *Euphorbia heterophylla*, *Ageratum conyzoides*

**(c) Sedges :** all the leaves tend to arise from the same point e.g *Cyperus rotundus*, *Cyperus esculentus*, *Mariscus alternifolius*.

### *Classification based on Life cycle*

- Ephemerals e.g *Euphorbia*, *Digitaria*, *Eluesine*, *Spigelia anthelmia*.
- Annuals e.g. *Pennisetum spp*, *Rottboelia cochinchinensis*,
- Biennial e.g *Taraxacum officinale*
- Perennials e.g *Imperata cylindrica*, *Sida acuta*.

### *Classification based on Growth habit*

- Free living weeds e.g Siam weed
- Parasitic weeds e.g *Sruga spp*

### *Classification based on Habitat*

- Terrestrial weeds or upland weeds e.g *Imperata cylindrica*, *Euphorbia heterophylla*.
- Aquatic weeds e.g. water hyacinth, water lily.

### **Weed Control Methods**

Weed control involves any action that seeks to restrict the spread of weeds and destroys or reduce their population in a given location.

Generally weeds can be controlled using the following methods:

1. *Preventive Weed control*
2. *Cultural Weed control*
3. *Biological Weed control*
4. *Chemical Weed control*
5. *Integrated Weed control*

#### ***Preventive Weed control***

Preventive weed control refers those measures necessary to prevent the introduction of new weed species into a given geographical area as well as the multiplication and spread of existing weed species.

Preventive weed control includes the following:

- Use of clean crop seeds for planting
- Fallowing
- Preventing weeds from setting seeds
- Use of clean machinery
- Controlled movement of livestock
- Screening of irrigated canals to prevent weeds from being transported from infested field to clean areas
- Quarantine laws and services to prevent accidental introduction of exotic plants or their propagules.

## Cultural Weed Control

This involves all aspect of good crop husbandry used by farmer to minimize weed interference with crop or any practice adopted by the farmers which aid in weed suppression.

This method include:

- Hand weeding. This can be done by using hand pulling, hand hoeing, handslashing or push type weeders.
- Mechanical weeding: This can be done with animal drawn weeders or machine-powered weeders.
- Tillage
- Burning
- Flooding
- Mulching
- Crop rotation

## Biological Weed Control

This refers to the control or suppression of weeds by the action of one or more organisms through natural means or by manipulation of the weed, organism or environment. This involves the use of the following:

- **Live mulch:** This is a crop production system in which a food crop is planted directly in the living cover of an established cover crop without destruction of the fallow vegetation.
- **Biological control with invetebate animals** e.g the use of insects to control weeds; use of *cactoblastis* moth on *Opuntia* (Prickly pear) in India; the use of grasshoppers(*Paulina acuminata*) to control *Salvinia molesta* in Zambia.
- **Biological control with vertebrate animal** e.g. goats to graze down woody weeds; ducks and fish for control of aquatic weeds.
- **Microbial weed control** . This involves the use of microorganisms such as fungi, bacterial, bacteria, nematodes and viruses. E.g. of microbial weed control is the use of soil borne fungi ( *Phytophthora palmivora*) now sold as mycoherbicides – sevine to control strangler vine (*Morrenia odorata*). **Mycoherbicides** is the use of plant pathogens to control weeds. The use of aerial fungus

*Collectotrichum gloeosporoides* (sold as mycoherbicides- collego) for the control northern jointvetch in paddy rice.

- **Allelopathy**; This is the detrimental effect of chemical or exudates produced by one living plant species on the germination, growth or development of another plant species, or microorganisms sharing the same habitat.
- **Plant canopy**: The major effect of plant canopy is to shade the understory plants and limit their ability to synthesize carbohydrates.

### **Chemical Weed Control**

The practice whereby undesirable vegetation (weeds) is killed with herbicide is called chemical weed control

A chemical used to control, suppress or kill plants or to severely interrupt their normal growth process is called **herbicides**.

Herbicides can be *selective or non-selective*

**Selective herbicides** are those that have the ability to suppress certain member of weeds species and leave others unhurt. Eg. Atrazine, propanil, dalapon etc

**Non selective herbicides** are those that are generally toxic to all plants (they destroy any weeds that come their way) e.g glyphosate, paraquat.

### **Integrated Weed Management**

This is a form of weed management that involves the combination of two or more weed control methods at low inputs to obtain a level of weed suppression superior to the ordinarily obtained when one weed management system is used. e.g.

Chemical +cultural method

Herbicide + organic mulch

Biological +Chemical +Cultural method