



DISEASE MANAGEMENT IN CROPS

ARCHANA NUNKUMAR

Since the beginning of agriculture, generations of farmers have developed practices for combating the various diseases on crops. Following the discovery of the cause of plant diseases the growing understanding of the interaction of pathogen and host has enabled the development of a wide range of measures for the control of specific plant diseases (Jacobsen, 2001).

The purpose of plant disease control should be to manage the economic impact of the disease, this may entail complete control, or ensuring disease does not exceed a level where farmers lose money. Plant disease management practices rely on anticipating occurrence of disease and attacking vulnerable parts in the pathogen disease cycle (Maloy and Baudoin, 2001). A thorough understanding of the disease cycle, environmental factors and the plants requirements are essential for effective management of plant disease.

This is a general overview of some of the methods, measures and strategies used in the control/management of plant diseases. Disease control methods for specific crops are not included/discussed.

General Principles of Plant Disease Management

- *Exclude the pathogen:*

Prevent inoculum from coming into an area where the pathogen does not occur. This can be done by using the following: seed treatment, eradication of insect vectors and continuous inspection of the field.

- *Avoid the pathogen:*

Avoiding disease by planting at times when or where inoculum (a pathogen or its parts which can cause infection when transferred to a favourable location) is absent or ineffective due to unfavourable environmental conditions. Avoiding the pathogen can be achieved by doing the following: planting area, time of planting, resistant varieties and modification of growing practices.

- *Eradicate the pathogen:*

Reduce, eliminate or destroy inoculum at the source, either from a geographical area or from an infected plant.

- *Resistance:*

This involves the modification of certain physical or physiological characters of the host so that it can resist infection or reduce the rate of disease development to minimize loss caused by the pathogen. These methods are:

- *Cross protection:*

This method is generally used for viral disease control. It is the protection of a plant by inoculating the plant with a mild strain of the virus which induces a degree of resistance against a virulent strain of the same virus that can cause more severe symptoms and damage.

- *Resistant cultivars:*

This method alters the effectiveness of the pathogen by selection or introduction of resistance genes in the plant.

- *Protection:*

Prevents a healthy plant from infection by creating a barrier (chemical, biological or physical) between the host and pathogen.

Methods of Plant Disease Management

1) Cultural Management

- *Crop rotation:*
Rotate (i.e. plant successive other crops before replanting the same crop) with non-host plants that will help to control some of the pathogens.
- *Planting dates:*
Plant if possible when conditions are not conducive for pathogen infection (either plant early or late in the season).
- *Sanitation:*
Remove or reduce sources of inoculum (weeds, alternative hosts and insect vectors). The destruction of infected parts of the plant after harvest of the crop is effective to reduce available inoculum that can infect new growth of the susceptible crop for many plant diseases. Sanitation also includes thorough washing or chemical treatment of machinery, tools, potting equipment, shoes and hands that will come in contact with multiple plants.
- *Depth of planting:*
Seed sown too deep in the soil will be stressed by emergence and be more susceptible to infection. Seed sown to shallow could be moisture stressed or temperature stressed and thereby also made more susceptible.
- *Pruning:*
Remove infected tissue, promote more vigorous growth and increase air circulation.
- *Quarantine:*
The legislative prevention of movement of infected or susceptible plant material across a border between areas where a disease is prevalent and where it is not. This is often applied at national borders at entry points.

2) Physical Management

- *Heat treatment:*
Steam sterilization of soil and equipment, hot air or hot water treatment of seed, seedling trays.
- *Cold treatment:*
Postharvest storage of fruits and vegetables which considerably retards pathogen growth and disease development which are temperature regulated.
- *Controlled atmosphere storage:*
Storage where the atmosphere is altered by means such as reduction of oxygen content often by increasing nitrogen content, or increase of CO₂ content. The term is often used to include temperature control and humidity control.
- *Moisture management:*
Reducing humidity such as drying out of bulbs, tubers etc. for winter storage.

3) Chemical Management

Chemicals are used as a barrier to protect the host plant or to eradicate an existing infection. Chemical methods of plant protection bring about the desired results quickly and for this reason it is a popular practice.

Protectant fungicides are used to protect the plant against pathogen attack. Protectant fungicides are applied before infection, therefore new plant growth emerging after fungicide application is not protected.

Systemic fungicides are those fungicides which act within the plant and prevent the fungus completing its life cycle in the plant. Fungicide application time is crucial. Monitor plants diligently for disease progress and repeat spray applications may be necessary.

Reduce the chance of resistance to fungicides by using an integrated management strategy and alternating the classes of fungicides. Chemicals can be brought about by the reduction in inoculum by the following treatments:

- Seed treatment
- Soil treatment
- Dip treatments for fruit
- Foliar application

disciplinary methodologies in agro-ecosystem management strategies that are practical, effective, economical and protective of both public health and environment. This method integrates various control methods such as timeous use of chemicals, biological control, plant quarantine, seed certification and resistant varieties in a manner where the benefits of each strategy are synergistic.

4) Biological Control Management

- Introduction or activation of saprophytic microorganisms to control pathogenic organisms is known as biological control.
- Fungi such as *Trichoderma spp.* and *Gliocladium spp.* are used to control soil borne pathogens such as *Rhizoctonia spp.*
- Saprophytic bacteria are used to control fungal or bacterial diseases.

5) Resistant Varieties

- The most practical means of disease control is using resistant varieties. For some diseases this is the only feasible means of controlling them.

6) Integrated Disease Management

- It is a conceptual approach, which is based on ecological principles and integrates multi-

References

Jacobsen, B. 2001. Disease Management. Pages 351-356 in Encyclopedia of Plant Pathology, O.C. Maloy and T.D. Murray, eds. Wiley, New York

Maloy, O.C and Baudoin. 2001. Disease Control Principles. Pages 330-332 in: Encyclopedia of Plant Pathology, O.C. Maloy and T.D. Murray, eds. Wiley, New York

Contact

Archana Nunkumar

Professional Scientist: Plant Pathologist

Tele: (033) 343 8094

archana.nunkumar@kzndard.gov.za

KZN Department of Agriculture & Rural Development

Crop Production: Crop Protection, Cedara

Published March 2016