Unit 1
MODULE
3

ECONOMIC IMPORTANCE OF PLANT DISEASES

I. Introduction

The study of plant diseases is important as they cause loss to the plant as well as plant produce. The various types of losses occur in the field, in storage or any time between sowing and consumption of produce. The diseases are responsible for direct monitory loss and material loss.

This module covers the major economic cases related to plant diseases in history and also the types of crop losses and physiological processes of plant affected by them.

II. Learning Objectives

At the end of this module, the students are expected to:

1. Recall the major plant disease economic cases recorded in history.
2. List the different types of economic losses.
3. Identify the different vital processes of plant affected by plant diseases.
4. Discuss the economic importance of plant diseases.

III. Pre-Test

Question

Why do you think that it is important to study the different plant diseases?

V. Discussion

The economic importance of plant diseases

It has been said that men and animals exist on earth as guests of the plant kingdom because only the green plant can convert the energy from the sun into food. We depend on plants not only for food but also for our clothing and shelter needs and for numerous luxuries. When diseases kill plant, all other form of life on earth is adversely affected.

Plant disease epidemics have caused human sufferings, deaths and upheavals:

- Potato late blight disease (1845 – 1846)
    - Caused famine and death of more than a million people in Ireland
- Coffee rust in Ceylon (now Sri Lanka)
    - Destroyed vast coffee plantations
- Ergot poisoning in Europe (874 AD)
    - Acquired from eating bread from infected rye grains; caused by the fungus *Caviceps purpurea* which produces *sclerotia* containing alkaloids that impede blood circulation.

Diseases that had caused enormous economic losses

The following are examples of plant diseases in the Philippines that have caused enormous economic losses:

- Cadang-cadang disease of coconut
    - first observed in 1918; have caused the country a loss of over $200M.
- Downy mildew of corn
    - the nemesis of corn; loss can be as high 95% amounting to over P170M annually; now controlled by chemical seed treatment using metalaxy, discovered in 1978; caused by the fungus *Peronosclerospora philippinensis (weston) shaw.*
- Rice tungro disease
    - affected 70,000 has in 1971; 1.22M cavans rough rice lost valued at P30,357,000
- Coffee rust
    - destroyed the coffee industry in Batangas province
- Citrus decline
    - destroyed citrus plantations in Batangas

Types of Crop Losses

- Reduction in yield
    - Leaf spots/blight reduce photosynthetic capacity of plants
    - Root pathogens
    - Fruit rots and fruit spots – reduce quantity of harvestable and marketable fruits
- Losses from deterioration during storage, marketing or transport
    - The amount of lost food daily is enough to feed the world's population
- Reduction in quality of produce
    - Citrus fruits with scabs
    - Moldy cereals and other commodities
    - Reduced strength and undesirable discoloration in wood pulp
    - Poor germination of infected seeds

Losses from produce contaminated with toxins that cause various disorders and/or death to animals including man.

- Aflatoxin
    - Produced by *Aspergillus flavus*; carcinogenic to animals and man; commonly found in stored corn, sorghum, copra, root crops etc.
- Ochratoxin
    - A mycotoxin produced by *A. ochraceous* causes cancer of the liver.
- Yellow rice toxins
    - Formed by *Penicillium spp.;* caused several deaths in Japan.
- Estrogenic factor in corn
    - Produced by *Fusarium graminearum*; causes testes of young male swine to have atrophy and to have uterus of female pigs to enlarge and abort.
- Fumonisins
    - Formed by *Fusaruim spp.* In corn grains; caused esophageal cancer in man and toxic to animals like horses.

Losses due to predisposition of host to attack by other pathogens

Example:

- Nematode injuries on roots serve as point of entry to other pathogens.
- Leaf pathogens weaken plants which can become a host susceptible to root-rotting pathogens.

- Severely defoliated trees can be readily attacked *Armillaria mellea* and other fungi.

Losses from increased cost of production and handling

- Cost of disease control is an added cost.
- Cost of culling disease commodities for marketing and processing.
- Infected and stained wood chips need longer time to bleach to obtain white paper product.

Vital Processes Affected

- root absorption
- uptake of water and minerals
- photosynthesis
- respiration
- transport of photosynthates
- reproduction

Importance of Plant Diseases

Plant diseases damage plants and plant products therefore it is directly related to importance of plant as:

- Food
- Shelter
- Clothing
- Medicine
- Aesthetics
- Improving environment
- Luxuries

Negative Impact of Plant Diseases

- Plant diseases endanger food supply
- Reduce the quantity and quality of plant produce
- Cause financial losses
- Limits the kind of plants and industries in an area
- Make plants poisonous to human
- Increase cost of production due to control measures

V. Activity

I. Answer the following questions. Choose the letter of the correct answer.

1. Which of the major plant disease cases caused impede blood circulation from eating bread from infected rye grains; caused by the fungus *Caviceps purpurea*?
    a. Potato late blight disease
    b. Coffee rust in Ceylon
    c. Ergot poisoning in Europe
2. What type of damage did the potato late blight disease caused mankind in 1845-1846?
    a. Food poisoning
    b. Destruction of plantations
    c. Famine and death
3. How much economic loss did the Philippines suffered from rice tungro disease in 1971?
    a. $200M. b. P170M c. P30,357,000
4. In what province did the coffee rust and citrus decline pestered heavily?
    a. Ilocos b. Isabella c. Batangas
5. What fungus caused the downey mildew of corn in 1978?
    a. *Caviceps purpurea*
    b. *Peronosclerospora philippinensis*
    c. *Aspergillus flavus*

II. Enumerate the following items asked.

1-3. What are the types of crop loss under reduction in yield?

4-7. What are the types of losses under reduction of quality produce?

8-12. What are the toxins that contaminates crop produce leading to losses?

13-20. Give 7 importance and uses of plants.

III. Essay. In your own words, give an explanation of minimum of 5 sentences in the question asked below. (5pts)

1. What are the negative impacts of plant diseases?

VI. Summary

- The importance of plant diseases is directly related to the importance of plants. Since plants are the main producers of the food for all living things on earth, any disease that affects their production impacts its supply in the economic market affecting the fluctuations of food and raw material prices.
- Some of the major plant disease cases in the history that brought human sufferings are the potato late blight disease in Ireland (1845 – 1846), coffee rust in Ceylon (now Sri Lanka), and ergot poisoning in Europe (874 AD).
- The major cases of economic loss due to plant diseases in the history of the Philippines are the cadang-cadang disease of coconut in 1918, downy mildew of corn in 1978, rice tungro disease in 1971, and the coffee rust and citrus decline in Batangas.
- The different types of crop losses caused by plant diseases are the reduction in yield, losses from deterioration during storage, marketing or transport, reduction in quality of produce, losses from produce contaminated with toxins, losses due to predisposition of host to attack by other pathogens, and losses from increased cost of production and handling.
- The vital processes of plants affected by diseases are root absorption, uptake of water and minerals, photosynthesis, respiration, transport of photosynthates, and reproduction.

VII. References

https://www.sciencedirect.com/topics/medicine-and-dentistry/plant-disease

https://casfs.ucsc.edu/documents/Teaching%20Organic%20Farming/1.9_Pathogens.pdf

https://www.britannica.com/science/plant-disease