Unit 1
MODULE
1

THE WORLD POPULATION AND FOOD SUPPLY

I. Introduction

The role of agriculture to life sustenance on earth becomes bigger as the current society advances. With the cutting edge technology in medicine and hygiene today, the mortality rate of man drops sharply leading to a more populated society. In order to feed the current population, the agriculture sector needs to step up their game. Research and development programs were conducted continuously to be able to increase food production and quality nutrition. But most of the crops had already reached their genetic production threshold at its peak leading the researchers to focus in finding a better management practices to limit crop loss and damage.

In this module, we will discuss the role and importance of crop protection in the global food security. We will also introduce an important variable in agriculture called ‘pest’ and its economic importance in terms of its usefulness and the damage it brings along with the various disciplines related to Crop Protection.

II. Learning Objectives

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

1. To explain the importance of crop protection in global food security.
2. To define pest and name its examples.
3. To discuss the economic importance of pests.
4. To recall the various disciplines related to crop protection.

III. Pre-Test

Question

How can you relate the world population and food supply?

Question

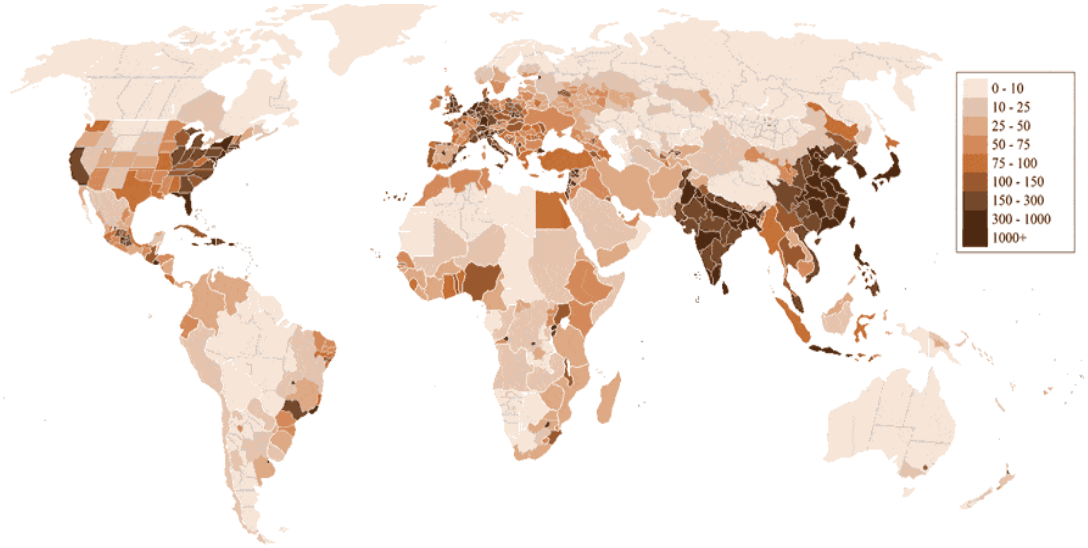
What do you think is the role of crop protection in global food security?

Question

For you, what is a “pest”?

IV. Discussion

The Current World Population and Food Supply



World Population Density (people/km^2)

Population in the world at year 2020 has been growing at a rate of around 1.05% per year. The current average population increase is estimated at 81 million people per year. The current world population or the total number of humans currently living is 7.9 billion as of July 2021 according to the most recent United Nations estimates elaborated by Worldometer.

According to Food and Agriculture Organization (FAO), increasing numbers of people often drive up demand for food, which typically results in additional use of arable land and water. Almost one in seven people around the world are chronically hungry, lacking enough food to be healthy and lead active lives. This is despite the fact that enough food exists for all of the world's people. This is especially true in the absence of adequate food production technology and integrated programs that simultaneously address community needs for food and reproductive health. Agricultural policies, the prices of certain food commodities such as meat and grain and economic development hugely impact food security.

Movement towards Global Food Security

FAO projects that by 2050, population and economic growth will result in a doubling of demand for food globally. Addressing the health needs of families in the developing world, including through increased access to family planning, can help slow rapid population growth, improve the health of families and enhance their food security.

In terms of population, it is estimated that between 720 and 811 million *people in the world faced hunger* in 2020. The numbers show enduring and troubling regional inequalities. About one in five people (21 percent of the population) was facing hunger in Africa in 2020 – more than double the proportion of any other region. This represents an increase of 3 percentage points in one year. This is followed by Latin America and the Caribbean (9.1 percent) and Asia (9.0 percent), with increases of 2.0 and 1.1 percentage points, respectively, between 2019 and 2020.

Of the total number of *undernourished people* in 2020 (768 million), more than half (418 million) live in Asia and more than one-third (282 million) in Africa, while Latin America and the Caribbean accounts for about 8 percent (60 million). Compared with 2019, 46 million more people in Africa, almost 57 million more in Asia, and about 14 million more in Latin America and the Caribbean were affected by hunger in 2020.

Moderate or severe food insecurity (based on the Food Insecurity Experience Scale) at the global level has been slowly on the rise, from 22.6 percent in 2014 to 26.6 percent in 2019. Then in 2020, the year the COVID-19 pandemic spread across the globe, it rose nearly as much as in the previous five years combined, to 30.4 percent. Thus, nearly one in three people in the world did not have access to adequate food in 2020 – an increase of 320 million people in just one year, from 2.05 to 2.37 billion. Nearly 40 percent of those people – 11.9 percent of the global population, or almost 928 million – faced food insecurity at severe levels. Close to 148 million more people were severely food insecure in 2020 than in 2019.

Even if FAO is committed to the goal of ending hunger, food insecurity and all forms of malnutrition by 2030, the world is at a critical juncture not only because they have to overcome more significant challenges to ending hunger, food insecurity and all forms of malnutrition, but also because, with the fragility of the world's food systems widely exposed, they have to seize an opportunity to build forward better. The UN Food Systems Summit, to be held later this year, will bring forward a series of concrete actions that people, food system actors

and governments from all over the world can to support a transformation of the world's food systems. Future food systems need to provide decent livelihoods for the people who work within them, in particular for small-scale producers in developing countries – the people who harvest, process, package, and transport and market our food.

Role of Crop Protection in Increasing Food Supply

Food crops must compete with 30,000 species of weeds, 3,000 species of nematodes and 10,000 species of plant-eating insects. We know that despite the use of modern crop protection products 20-40% of potential food production is still lost every year to pests. These losses can occur while the crop is growing in the field, when it is in storage and in the home. In short, an adequate, reliable food supply cannot be guaranteed without the use of crop protection products.

Chemical crop protection products, commonly referred to as pesticides or agrochemical products, play a vital role in controlling the pests and diseases that threaten our food supply. Chemical crop protection products, or "pesticides", help control insects, diseases, weeds, fungi and other undesirable pests. Pesticides comprise a wide range of products for both professional and home applications including insecticides, fungicides, herbicides, sanitizers, growth regulators, rodenticides, and soil fumigants. The use of chemical crop protection in all contexts is highly regulated. The regulatory framework of pesticides encompasses national, regional, and international legislation and conventions that help assure safety for users, consumers and the environment (Crop Life International).

Definition of Pest

Pests are organisms considered harmful or detrimental to humans, his possessions and other human interest. Noxious organisms considered as pests are plants or animals that carry disease, cause disease or destroy crops. They could be nematodes, insects, viruses, bacteria, mollusks, fungi, birds, rodents, herbs, shrubs, mites and annelids.

According to *Florida Department of Agriculture*, a pest is any organism that spreads disease, causes destruction or is otherwise a nuisance.

Tanja Folnovic (2021), an agronomy expert, defined pests as organisms that might compete with or damage crop species. They reduce plant density, cause plant's stunted growth and their death, cause lower production capacity, damage berries and in many other ways reduce the yield or quality of agricultural products.

PESTS CAN BE BROKEN INTO FOUR MAIN CATEGORIES

- *Vertebrate Pests*
    - Have a backbone. Examples: Rodents, birds, reptiles, and other mammals

Rat and Bird Pests

- *Invertebrate Pests*
    - No backbone. Examples: Insects, spiders, ticks, slugs

Golden *Kuhol*, Stemborer, Armyworm, & Greenleaf Hopper

- *Weeds*
    - Any plant growing out of place.

- *Diseases*
    - Fungi, bacteria, viruses, and other microorganisms.

Eleusine Indica

Botrytis cinerea

Xanthomonas euvesicatoria

Economic Importance of Pests

Pests and diseases have continued to affect production of crops and have a serious impact on the economic output of a farm. The latest data as of 2021 according to AGRIVI indicates that pests reduce the yield of agricultural crops in the world for 42% and in Europe for 28%. Approximately one half wastes on weed damage, one quarter on disease, and second quarter on pest damage.

Insect Pests

1. Insect pests destroy crops in the field through their biting, chewing, boring, sucking and defoliation activities.
2. Spots of injuries by insects may predispose crops to disease attack.
3. They increase the cost of production during the course of controlling them as a result of purchasing chemicals and labor incurred it their application.
4. Some are carriers or vectors of diseases e.g. Aphids are vectors of bean common mosaic virus and white flies as vectors of tomato leaf curl virus.
5. They reduce the quality of produce in the field as well as in the store.
6. They render vegetables and fruits unattractive and unmarketable e.g. damage on crucifer leaves by diamond back moth (*Plutella xylostella*).
7. They generally reduce the yield of crops due to their feeding on the leaves and the harvestable parts of the crop.
8. They cause reduction in viability of stored produce.
9. They can also cause total death of crop plants where the whole plant succumbs to the pest damage leading to reduction of profits or total loss. Examples are banana weevil (*Cosmopolites sordidus*) and burrowing nematode.

Plant Diseases

1. Disease Transmission
2. Complete loss or reduction in seed germination
3. Seed abortion
4. Reduction in seed quality
5. Reduction in yield

Weeds

1. Crop competition to resources and its effect on crop yield and quality of seed
2. Interference with harvesting operations
3. Allelopathic effect
4. Ability of weeds to reproduce in cropping systems
5. Weeds can harbor diseases and pests
6. Seed contamination from parasitic weeds such as striga in maize.

Various Disciplines Involved in Crop Protection

Crop protection is the science and practice of managing plant diseases, weeds and other pests (both vertebrate and invertebrate) that damage agricultural crops and forestry. The different disciplines that are closely related to this field are as follows:

- *Entomology*
    - Entomology (Greek word *entomon* means 'insect') is the scientific study of insects, a branch of zoology. In the past the term "insect" was less specific, and historically the definition of entomology would also include the study of animals in other arthropod groups, such as arachnids, myriapods, and crustaceans. This wider meaning may still be encountered in informal use. It is a taxon-based category; any form of scientific study in which there is a focus on insect-related inquiries is.
- *Plant Pathology*
    - Plant pathology (also phytopathology) is the scientific study of diseases in plants caused by pathogens (infectious organisms) and environmental conditions (physiological factors). Organisms that cause infectious disease include fungi, oomycetes, bacteria, viruses, viroids, virus-like organisms, phytoplasmas, protozoa, nematodes and parasitic plants. It also involves the study of

pathogen identification, disease etiology, disease cycles, economic impact, plant disease epidemiology, plant disease resistance, how plant diseases affect humans and animals, pathosystem genetics, and management of plant diseases.

- *Weed Science*
    - Weed science is the study of vegetation management in agricultural production systems, natural areas, and managed properties in residential and urban areas. It involves the development of knowledge in a variety of areas, including weed biology, taxonomy and ecology, biological control, cropping systems, integrated management systems, conservation tillage, transgenic crop tolerance, precision technology, and herbicides. The development of knowledge of the major mechanisms of weed survival is essential for developing effective methods of weed management.
- *Integrated Pest Management*
    - According to the definition proposed by the United Nations Food and Agriculture Organization (FAO), Integrated Pest Management (IPM) is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides. IPM is an approach-based method for analysis of the agro-ecosystem and the management of its different elements to control pests and keep them at an acceptable level (action threshold) with respect to the economic, health and environmental requirements.

V. Activity

Post-Test

Answer the following questions and choose the letter of the best answer.

1. What the current world population count?
    a. 7.1 billion
    b. 7.9 billion
    c. 7.2 billion
    d. 7.5 billion
2. What does FAO stands for?
    a. Federation of Agriculture Organization
    b. Federation of Agriculture and Organic
    c. Food and Agriculture Organization
    d. Food and Agriculture Organic
3. Which is not considered a pest?
    a. Rodents
    b. Man
    c. Defoliators
    d. Predators
4. What discipline is involved the scientific study of diseases in plant?
    a. Entomology
    b. Plant Pathology
    c. Weed Science
    d. IPM
5. Find what is true about entomology?
    a. Study of weeds
    b. Study of plant diseases
    c. Study of microbes
    d. Study of insects
6. What does IPM stands for?
    a. International Plant Management
    b. Integrated Plant Management
    c. Integrated Pest Management
    d. International Pest Management
7. What is the role of IPM?
    a. To increase insect population in the field.
    b. To avoid post-harvest damage
    c. To plan the right diversity in the field
    d. To control pest population in the field

VI. Summary

- The current 7.9 billion world population needs enough food supply in order to survive. To avoid crop losses and damage during growing, harvesting, and post-harvest handling, the principles of crop protection is applied.
- A pest is anything that threatens the healthy growth and production of a crop. It can be vertebrate mammal, insect, microorganisms, slugs, and other crops that exist in the field unplanned.
- A pest both has benefits and demerits. They are directly related to crops that is the source of food, shelter, and clothing. Their activity can impact the overall supply of crop produce both positively and negatively.
- Crop Protection has different disciplines related to it. These are entomology, phytopathology, weed science, and integrated pest management. They all specialize in scientific study of pests' biological functions, taxonomical classifications, as well as their operation within a field and possible control measures to counter them.

VII. References

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