Available online at
www.agrospheresmagazine.vitalbiotech.org

ISSN (E): 2582 – 7022

Agrospheres:e-Newsletter, (2022) *3*(10), 4-6

Article ID: 405

Integrated Plant Disease Management (IDM) – Play A Key Role in "Jaivik Kheti"

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Article History
Received: 22. 09.2022
Revised: 29. 09.2022
Accepted: 10. 10.2022

INTRODUCTION

In the world, continued effort to enhance the food production with help of new high yielding crop varieties and used new techniques for crop and field management. These all approaches are being constantly evolved resulting in a parallel increase in disease and pest occurrence which calls for their efficient management. Terms like IPM (Integrated Pest Management) and IDM (Integrated Disease Management) have different meanings. Various management strategies available for disease management, among all the chemical strategies have so far dominated our thinking. Over emphasis on use of chemicals for controlling of plant diseases has caused serious imbalances in the agro-eco system with serious health hazards.

Strangely, about 60% of the amount of chemicals sprayed on field crops does not stick to the plants. The enormous quantities of chemicals, poisonous to microbial life that fall on earth get mixed up well with soil.Some problems like non-target effects of chemicals as well as androgenic diseases are being experienced. Coupled with these, the increasing awareness of impending pollution; health hazards and development of resistance to control chemicals in microbial pathogens have intensified the search for alternative strategies.

The shift to exploration of non-chemical strategies is likely to correct the imbalance in our approach and subsequently improve the understanding of IDM (Integrated Disease Management). In this article, we discuss some components of IDM which include not only chemical control but an array of other practices like cultural measures, quarantine measures, biological control, field sanitation and genetic engineering. All these could serve to blend strategies for efficient and economic management of diseases in crops.

ISSN (E): 2582 – 7022

Integrated plant disease management can be defined as a decision-based process involving coordinated use of multiple tactics or multiple management approaches for optimizing the control of pathogen in an ecologically and economically. The implications are:

- Simultaneous management of multiple pathogens
- Regular monitoring of pathogen effects, and their natural enemies and antagonists as well
- Use of economic or treatment thresholds when applying chemicals
- Integrated use of multiple management practices.

Principles of Plant Disease Control

1. **Avoidance:** Prevents diseases by selecting a time of the year or a site where there is no pathogens available or where the environment is not favorable for infection.
2. **Exclusion:** Prevents the introduction of new pathogen where not exist already.
3. **Eradication:** Eliminates, destroy, or inactivate the pathogen from field after there introduction.
4. **Protection**—prevents infection by means of a toxicant or some other barrier to infection.
5. **Resistance:** Utilizes cultivars that are resistant to or tolerant of infection.
6. **Therapy:** Cure plants that are already infected..

Avoidance

It involves avoiding disease by planting at time when, or in areas where inoculums is absent or ineffective due to environmental conditions. The major aim is to enable the host to avoid contact with the pathogen or to ensure that the susceptible stage of the plant does not coincide with favourable conditions for the pathogen. The main practices under avoidance are

- choice of geographical area
- selection of the field
- choice of sowing/ planting time
- selection of seed and planting material
- short duration / disease escaping varieties and
- modification of agronomic/cultural practices.

Exp: The potato cultivation at high altitude is relatively free from viruses; as prevailing environmental conditions do not permit the buildup of vector populations. Similarly, early planting of potato or wheat, in indo Gangetic plains may escape late blight or stem rust damage respectively.

Exclusion

It means preventing the inoculum from entering or establishing in a field or area where it does not exist.

- Seed certification
- Crop inspection
- Eradication of inoculums and / or insect vectors, and
- Quarantine measures are some of the means of preventing the spread for pathogens.

Eradication

The process of reducing inactivating eliminating or destroying inoculums at the source, either from a region or from an individual plant in which it is already established is termed as eradication.

Eradication involves eliminating the pathogen from infested areas; the magnitude of the operation involved may vary considerably. The most extensive eradication operations carried out so far was to get rid of the citrus canker (*Xanthomonas axonopodis pv citri*) in the USA during 1927- 35. As many as 4 million citrus trees were cut and burnt at a cost of about 2.5 million dollars to eradicate the pathogen. The practices invariably employed to achieve eradication of inoculums include:

- Eradication of alternate and / or collateral hosts
- Crop rotations

ISSN (E): 2582 – 7022

- ✧ Field sanitation
- ✧ Heat or chemical treatments of plant materials or soil
- ✧ Biological control (use of biocontrol agents such as *Trichoderma* and other biocontrol agents with different organic amendments) etc.

Protection

The protection of infection courts against the inoculums of many fast spreading infectious pathogen, brought by wind from neighboring fields or any other distant place of survival. Principles of avoidance, exclusion and eradication may not be sufficient to prevent the contact of host with pathogen, thus development of the disease is imminent. Measures are necessary to protect host plants from invading inoculum s. It can be achieved by creating toxic barrier between the plant surface and the inoculums. Methods employed to achieve such results are chemical sprays, dusts, modification of environment, and modification of host nutrition.

Host resistance

It utilizes in – built mechanism to resist various activities of pathogen. The infection or subsequent damage by pathogen can be rendered ineffective through genetic manipulation or by chemotherapy. The host resistance can also be induced by use of certain biotic and abiotic factors. The discovery of Mendelian laws of inheritance and developments in plant breeding techniques have helped in developing crop varieties resistant to specific pathogen or group pf pathogens. The classical breeding techniques include selection, mutation and hybridization. Use of biotechnological tools such as tissue culture, genetic engineering and protoplast fusion are being used to develop resistant cultivars of various economically important crops.

Therapy

It is the treatment of infected host plant, which is attempted in case of economically important horticulture plants. As a principle of plant disease control, it provides an opportunity to cure or rejuvenate the diseased host plant by use of physical or chemical agents. The first five principles are mainly preventive (prophylactic) and constitute the major components of plant disease management. They are applied to the population of plants before infection takes place. Therapy is a curative procedure and is applied to individuals after infection has taken place.

Under the concept of disease management these principles have been classified into following five categories:

1. Management of physical environment (cultural control).
2. Management of associated micro biota (biological antagonism).
3. Management of host genes (host resistance).
4. Management with chemicals (Chemical control).

Management with therapy (Physical, chemical etc).