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ORGANIC MANAGEMENT OF SOIL BORNE DISEASES

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Introduction-Soils contain diverse communities of microscopic organisms that are capable of damaging plants. A detrimental interaction between a soil organism and plant is often highly specific. The soil organisms that have the potential to be plant pathogens include fungi, bacteria, viruses, nematodes and protozoa. Some pathogens of the above ground parts of plants (leaves, stems) survive in the soil at various stages in their life cycles. Therefore, a soil phase of a plant pathogen may be important, even if the organism does not infect roots. Three important factors needed for affecting soil borne diseases (Agrios, 1988).

- Pathogen (the microorganism that causes the disease.
- A host (our plants).
- The right environmental conditions.

In the case of soil borne diseases, the pathogens can remain in the soil for long periods, waiting for the host - our plants - to come along. The environmental conditions can vary widely. Some pathogens favor damp conditions, some like certain soil pH levels and others target tender, succulent growth.

Types of Soil-borne Pathogens:

(A) Fungi- The pathogens infect the plant's roots and block the uptake and flow of water and nutrients through the plant. Symptoms may include wilting, yellowing, stunting, dieback and eventual death and can be confused with other problems such as drought and nutrient deficiencies Common pathogens to watch out for include: *Phytophthora, Rhizoctonia, Fusarium, Pythium, Verticillium, Macrophomina, Sclerotinia and Sclerotium.*

(B) Bacteria- Less common pathogens and most don't stick around long. Some examples: *Erwinia* (soft rot), *Rhizomonas* (corky root of lettuce) S*treptomyce*s (potato scab, soft rot of sweet potatoes) and *Agrobacterium* (Crown gall).

(C) Viruses- Virus enters a plant cell; it can cause the cell to produce more virus cells. Lettuce necrotic stunt virus affects Romaine lettuce plants, causing stunting and yellowing and sometimes spotting of lower leaves, while newer leaves remain green and thick.

Management methods- The soil borne pathogens different management methods are given below and applied by farmers.

- **Proper selection of the field**: Proper selection of field was help in the management of many diseases, especially the soil borne diseases. Rising of a particular crop year after year in the same field makes the soil sick, where disease incidence and severity may be

more. Ex. Wilt of red gram, late blight of potato (*Phytophthora infestans*), green ear of bajra (*Sclerospora graminicola*), (Singh. 2002) etc.

- **Variety Selection:** The resistant varieties should always be used in combination with other management practices for a complete management program. Grafting can be used to manage soil borne diseases such as bacterial wilt and root knot nematode of solanaceous vegetables and *fusarium* wilt of cucurbits. The causal agents of crop problems are necessary to select appropriate resistant varieties.
- **Crop rotation**: Continuous cultivation of the same crop in the same field helps in the perpetuation of the pathogen in the soil. Soils which are saturated by the pathogen areoften referred as sick soils (Agrios, G. N. 1988). To reduce the incidence and severity of many soil borne diseases, crop rotation is adopted. Crop rotation is applicable to only root inhabitant's and facultative saprophytes, and may not work with soil inhabitants.Ex: Panama wilt of banana (long crop rotation), wheat soil borne mosaic (6 yrs.) and club root of cabbage (6-10 yrs.).
- **Crop sanitation**: Collection and destruction of plant debris from soil will help in the management of soil borne facultative saprophytes as most of these survive in plant debris. Collection and destruction of plant debris is an important method to reduce the primary inoculums (Weinhold *et al*,. 1964).
- **Summer ploughing**: Ploughing the soil during summer months expose soil to hot weather which will eradicate heat sensitive soil borne pathogens.
- **Solarization**: Soil Solarization or slow soil pasteurization is the hydro/thermal soil heating accomplished by covering moist soil with polyethylene sheets as soil mulchduring summer months for 4-6 weeks. Soil Solarization was developed for the first time in Israel (Egley and Katan) for the management of plant pathogenic pests, diseases and weeds.
- **Soil sterilization:** Soil can be sterilized in green houses and sometimes in seed beds byaerated steam or hot water. At about 50^0C, nematodes, some oomycetous fungi and other water molds are killed. At about 60 and 72^0C, most of the plant pathogenic fungi and bacteria are killed. At about 82^0C, most weeds, plant pathogenic bacteria and insects arekilled. Heat tolerant weed seeds and some plant viruses, such as TMV are killed at ornear the boiling point (95-$10^0$0C).
- **Organic Amendments**: Application of organic amendments like saw dust, straw, oil cake, etc., was effectively manage the diseases caused by *Pythium, Phytophthora, Verticillium, Macrophomina*, *Phymatotrichum* and *Aphanomyces* cropping during the transition periods can enhance soil suppressiveness to damping off caused by *Pythium* and *Phytophthora*, The reduction in common scab of potato by green manuring with soybean through prevention of bulid up of innoculum (Weinhold *et al.,* 1964) in addition, although compost amendments applied during transition can improve crop vigor by significantly enhancing soil fertility, their effects on soil borne diseases are not predictable when transitioning to certified organic production. Beneficial micro-organisms increases in soil and helps in suppression of pathogenic microbes. Ex: Application of lime (2500 Kg/ha) reduces the club root of cabbage by increasing soil pH

to 8.5 Ex: Application of Sulphur (900 Kg/ha) to soil brings the soil pH to 5.2 and reduces the incidence of common scab of potato (*Streptomyces scabies*).

- **Biological method:** Biological disease control is an attractive alternative strategy for the control of soil borne diseases. Interactions between antagonists and pathogens may allow us to select and construct the more effective biocontrol agents and to manipulate the soil environment to create a condition for successful biocontrol. Soil application of biocontrol agent like fungal antagonist *Trichoderma,* bacterial antagonist *Pseudomonas* and *Bacillu*s 2.5 kg/ha mixed with 50 kg of FYM or sand for soil application at 30 DAS and 60 DAS interval for after sowing.

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