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Microbiology and Disease Management

Unit-2

Disease management:

1. Preventive methods

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CULTURAL METHODS OF DISEASE CONTROL

Cultural methods of disease control aim at reducing insect population or inoculum potential of pathogens; or preventing damage due to pests; encouragement of healthy growth of plants; preventing attack by changing various agronomic practices. The efforts involve adjustment in the cropping system. Operations in these methods are directed towards field sanitation; clean cultivation; crop rotation; adjustment in the dates of sowing and planting distances; water and fertilizer management; tillage practices.

A) Field sanitation

It is an essential measure to reduce the inoculum of the pathogen to minimize the possibilities of the appearances of epiphytotic or epizootic. Measures adopted for field sanitation include: a) destruction of crop residues, stubbles and self-sown tillers; b) use of eradicator sprays where complete destruction of crop residue is not possible; c) eradication of affected parts and plant parts; d) eradication of weeds or other plants serving as alternate hosts in the off-season and growing season; and e) tillage practices which will reduce the inoculum or lead to damage and destruction of resting stages of pathogen or eggs of insects.

a) Destruction of crop residues: Destruction of crop residues like dry leaves, sticks, stubbles, ear head or other plant parts results in the elimination of sites of hibernation and shelter for insects in the off-season. Quite often these plant parts are infected with pests. It has been observed that leaf blight (*Helminthosporium oryzae*) of rice is carried out in the stubbles. Infection of *Sclerotium rolfsii* on jute is carried over in the foot and root in the stubbles of the jute plant. Sugarcane stubbles left over in the field help to carry over red rot fungus. Rice stem borer insect *Scirpophagus incertula* and others are supposed to hibernate in the rice stubbles.

In many cases, diseased planting materials left in the field serve as sources of infection as in the case of late blight of potato where piles of refuses of rejected tubers later become an important source of infection. The proper disposal of straw of *Brassica napus* early in spring results in the infestation of painted bug. Pink roll worm (*Pectinophore gossypiella*) can be destructed by damaging cotton debris. It may be emphasised that crop residues constitute important source of infection and need to be eliminated.

b) Use of eradicant sprays: In the floor of orchards there may be substantial number of leaves. Effective disposal of them is not feasible. They constitute sources of infection in the next season. In such cases the use of an eradicate spray has been found to be useful. For ex. In the scab disease of apple, phenyl mercuric chloride (25gms of mercury/400 liters of water) is sprayed on the fallen leaves to reduce infection of ascospores.

c) Eradication of affected plant parts and plants: eradication schemes have been undertaken in a number of cases to solve the sudden appearance of a disease in an area. Physical removal of entire diseased plant is not the only method of eradication. Removal of affected plant parts may also reduce the inoculums as in canker of apple caused by *Nectria* spp and in similar cases including citrus canker. Removal of smutted inflorescences constitutes an important method of control in whip smut of sugarcane (*Ustilago scitaminae*) and also recommended to corn smut (*U. maydis*). The removal of branches and twigs of mango infected with angiospermic partial parasite *Loranthus* gives good results. Systemic destruction of the affected plant or part in the proper manner to keep down the population is resorted to reduce the damages caused by fruit flies infesting cucurbits, mango, guava, peach etc. and many tissue borers of plants.

d) Destruction of weeds, alternative, alternate or collateral hosts: Weeds or uneconomic unrelated plants harbour the pathogens and insects in the off-season when host plants are not available. Alternate hosts are necessary for completion of life cycle of number of fungi. It may not be possible in all cases to get rid of such uneconomic plants but in some cases good results may be obtained. Destruction of *Malva perviflora*, *Althea rosea*, *Malvastrum* spp during April-June reduces carry over of spotted boll worm of cotton. Eradication of *Sorghum haplense* keeps the population of sugarcane mites low.

In many cases weeds are perennial and too many weeds may be involved and it may not be possible to achieve any significant results. However, a clean cultivation should be aimed at to reduce inoculums and insect population and keep down chances of infection.

e) Tillage: Summer ploughing and upturning of the top layer of soil exposes the soil to summer heat resulting that the fungi and insects in the soil are destroyed to a considerable extent.

B) Use of clean planting materials:

Use of disease and pest free planting material is also an important method of clean cultivation, as many pathogens, nematodes and some insect pests are carried over in seeds and planting materials. In viral diseases, the most important practical measure is the use of virus free planting materials. The absence or presence of a very low level of initial inoculums is definitely helpful in delaying or suppressing the incidence of pests. This can be easily achieved by use of clean planting materials which may be considered as a major sanitation measure.

C) Crop rotation:

Rotation of crops or change in sequence of cropping pattern is in use for a very long time. In many cases this practice results in much less incidence of pests. It is most useful against diseases caused by fungi and nematodes. Crop rotation is essentially a preventive measure and effected mainly on the succeeding crop.

The main object is to disrupt the continuity in the availability of host plant resulting that pathogen will face starvation and decline in their population is caused. Crop rotation is a very effective method of control of root diseases in field crops. In many cases, a break for one year by a non-susceptible host may be sufficient, particularly where the pathogens are soil inhabitant. For crop rotation, knowledge of life history with reference to host range, perennation, longevity of resting structures etc. is essential. The organisms should not be capable of remaining alive in the soil for a number of years and rotation should not include susceptible crop. It can not be practiced where pathogens are typical soil inhabitants and can live for a long time without any host.

D) Trap crops or secondary crops:

In many cases, an early cultivation in small area of a susceptible crop ahead of the main crop to draw the insects and to destroy them to reduce the damage is practiced. The crop is termed as trap or secondary crop which must be highly susceptible to the pests and should be destroyed before the main crop. Instead of growing ahead, they may be grown along with main crop and must be destroyed in time. Bhendi (*Abelmoschus esculantus*) is often sown with cotton to attract cotton jassid and spotted boll worm and the plants should be destroyed before the insect migrate to the cotton. Arhar (*Cajanus cajan*) may be used as a trap crop in mixed cropping with a cotton to remove attack of cotton grey weevil which shows preference to arhar in relation to cotton. Planting of wild beets with sugar beet is useful in reducing attack of beet nematode *Heterodera rostochiensis*.

E) Adjustment of sowing or planting:

Many plants are susceptible to attack of pests during a limited period and serious attack will result if the population or inoculums build-up takes place during that period. Adjustment in date of sowing may be profitably practiced to circumvent attack of pest by avoiding the peak period of attack. This circumvention can be effected in relation to space also. Plants may be grown in areas, where vectors are either absent or not active. This is taken advantage of in obtaining tubers free from virus diseases in growing potato in aphid free areas. Similarly seed multiplication in dry areas is often practiced to have a low level of seed borne infection by pathogenic fungi which are more active in humid areas.

F) Planting distance:

Spacing of plants in the cultivation may affect the intensity of disease incidence. Very close spacing of rice plants results in a more humid microclimatic condition which favours incidence of foliage blights brown plant hopper. Spacing at wider intervals has been found to be beneficial for avoiding attack of pests. Early spread of black rot of cabbage (*Xanthomonas campestris*) takes place by plant to plant contact may be checked by avoiding planting at close distance. In respect to insect attack it has been claimed that in some cases close spacing may be beneficial. A balance has to be maintained between planting distance for maximum yield and consequent effect on microclimatic conditions favouring pests.

G) Tillage practices:

Depth of seedling sometimes affects seedling blight and damping off. Deep ploughing may cause delay in the emergence of seedlings, which may be vulnerable to pre-emergence damping off. Early emergence results in early lignifications of tissues which become resistant to attack of soil borne pathogens. On the other hand deep ploughing has been claimed to be beneficial for control of gram wilt. Deep ploughing may burry insects too deep in the soil for emergence. Many insect pests have been reported to be controlled to a large extent by deep ploughing.

Thank You