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Major disease of potato and their management

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1. Late Blight

This disease is caused by a fungus *Phytophthora infestans*. The average annual losses due to this disease have been estimated to 15% of total production in the country. Late blight affects all plant parts especially leaves, stems and tubers. The initial symptoms appear on lower leaves as pale green water-soaked spots (2-10 mm) mostly on the margin and tips. In moist weather, spots may appear anywhere on the leaves, enlarge rapidly and turn necrotic and black, killing the entire leaf instantly. On the corresponding lower side of the leaves, whitish cottony growth forms around the dead areas. On stem, light brown lesions develop which elongates and encircles the stem and petioles breaking them and killing the plant/leaves instantly. Stem infection is more severe under high temperature and relative humidity conditions. The temperature between 10-22°C for two-three consecutive days with relative humidity above 80 per cent coupled with cloudy weather and intermittent rain are most congenial conditions for the fast spread of the disease.

Management –

- Select well drained soils for potato cultivation, do proper irrigation and make high ridges at the time of earthing up to prevent exposure of tubers to the disease.
- Cultivars with a moderate to high level of late blight resistance. Kufri Kanchan, Kufri Girdhari, Kufri Himalini and Kufri Megha.
- As soon as the weather conditions become congenial for late blight, irrigation should be stopped. Only light irrigation may be given later, if required.

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- As a prophylactic measure, spray the crop with contact fungicides like mancozeb 75%WP (0.25%), propineb 70% WP (0.25%) or chlorothalonil (0.25%) as soon as the weather conditions become congenial for late blight, or about a week in advance of canopy closure, whichever is earlier.
- Destroy and remove the haulms from the field when the disease severity reaches >80% to reduce tuber infection.

2. Early Blight and Leaf Spots

Early blight caused by *Alternaria solani* appears regularly in central India, plateau of Bihar, Madhya Pradesh and Maharashtra. The disease has been reported to cause significant losses (up to 20%) in *Kharif* crops in Ranchi and adjoining plateau region. The symptoms of early blight mainly appear on leaves and tubers. Initially the symptoms occur on the lower and older leaves in the form of small (1-2mm), circular to oval, brown spots. The tuber symptoms comprise brown, circular to irregular and depressed lesions with underneath flesh turning dry, brown and corky. Lesions tend to enlarge during storage and affected tubers later become shrivelled. Leaf spots are caused by *Phoma exigua, P. sorghina, Alternaria alternata,* and *Cercospora solani-tuberosi*. Depending upon the severity, these leaf spots may cause significant yield losses.

Management–

- Always use only disease-free seed tubers for raising the crop.
- Cultivation of solanaceous crops, being collateral hosts, in nearby potato fields must be avoided.
- Spray the crop three to four times with a 10 days intervals with 0.3% mancozeb, 0.1% bavistin, or 0.2% chlorothalonil when intermittent rains occur in dry weather.
- Apply recommended dose of fertilizers especially nitrogen.

3. Black Scurf

Black scurf (*Rhizoctonia solani*) is prevalent both in the plains and hills. The affected tubers look shabby, unattractive and fetch less price in market. The disease affects tubers, sprouts, stems and stolons. The most common symptom is black-scurf comprising dark brown to black irregular lumps sticking on the tuber surface. These are sclerotia of the

pathogen which adhere close to the tuber surface and do not wash off easily. The size of sclerotia may vary from pin-head to pea-seed. The pathogen often causes sprout injury both in storage and in fields after planting. Such affected plants show upward rolling of leaves with pinkish or purplish margin. Often small, green or reddish aerial tubers are also formed in the axils. The roots and developing stolons also get infected. Soil temperature of 18-20°C and high moisture is conducive for the development of the disease, whereas high soil temperature (28-32°C) and high soil moisture favour the development of sclerotia on tubers.

Management

- The disease can be managed by following proper cultural practices together with seed disinfestation. Use of healthy seed free from sclerotia of the pathogen helps in disease management. Growing maize or 'dhaincha' (*Sesbania aegyptiaca*) or brassicas for green manure as rotation crop also checks the inoculum and disease build up.
- Hot weather deep ploughing, twice at an interval of 20 days, has been found highly effective in reducing the inoculum levels in the fields. Tuber treatment with boric acid (@3.0% as tuber dip for 30 minutes or as spray) and drying under shade before cold storage or pencycuron (@ 0.25%) spray on tubers before planting has been identified effective for the control of black scurf.
- The progeny tubers of such treated seeds are usually free from black scurf. A continuous use of treated seed for 2-3 crop seasons has been found to completely check the disease. Wherever possible, crop rotation of 1-2 years may be followed.

4. Dry Rot

Fusarium dry rot is an important post-harvest disease of potato tubers. It causes significant losses in storage and during transit of both seed and table potatoes.The losses caused due to dry rot in plains and hills range between 5-23%. As many as fourteen species of *Fusarium* have been reported to cause dry rot of potatoes. The skin of the dry rot infected tubers first becomes brown, then turns darker and develops wrinkles. These wrinkles are

often arranged in irregular concentric circles. In the later stage of infection, a hole may be observed in the centre of ring with whitish or pinkish growth of fungal mycelium. On cutting these affected tubers, whitish or brownish tissues are seen with one or more cavities. Eventually the infected tubers lose much water and become dry, hard and shrivelled. Store temperature ranging from 15-28^{o}C are congenial for development of dry rot. Dry rot of tubers is aggravated by 5-6 months of storage.

Management

- Use only clean and healthy seed tubers.
- Tuber damage and injury must be avoided during harvest, transport, storage etc.
- Tuber washing followed by drying under shade substantially reduces the infection.
- Tuber treatment with boric acid boric acid (@3.0% as tuber dip for 30 minutes or as spray) before storage is effective.
- Tubers should be stored in cold stores in plains. In country stores, tubers must be examined periodically and rotting tubers be sorted out.
- Avoid seed cutting, if possible. Otherwise, seed pieces may be treatedwith mancozeb (0.2%) for 10 minutes and dried for 24-48 hrs before planting.

5. Bacterial Wilt and Brown Rot

Bacterial wilt or brown rot is one of the most damaging diseases of potato worldwide. In India, the disease is prevalent in all potato growing areas except north western plains comprising of Rajasthan, Punjab and Haryana, north central part of Uttar Pradesh and north western high hills (above 2000 masl, except the Kumaon hills). Losses up to 80 per cent have been recorded under extreme conditions. The earliest symptom is slight wilting of leaves on top branch during clear sunny days. The leaves show drooping due to loss of turgidity followed by total unrecoverable wilt. In advanced stages of wilt, the basal cut end of the stem may show dull white ooze on squeezing. A temperature of 28-30oC is favourable for disease development. Mean soil temperature below 15oC and above 35oC do not favour disease development. Do not cut seed tubers; only use healthy, certified seed tubers. Pathogen spreads even to healthy tubers when they are cut.

Management

- While planting, sprinkle stable bleaching powder (12 kg/ha) mixed with fertiliser in the furrows. It cuts the incidence of wilt by 80%.
- Plant pathogens can enter through damaged roots or other openings. Injuries of this nature cannot be prevented during cross-cultural operations. Reduce tillage to a minimum as a result, and full earthing-up is advised after planting.
- Many weeds and crops have root systems where the disease can survive. Clear the field of weeds and any remaining roots or foliage, and burn or deeply bury them.
- After harvest in the summer, deep plough the fields twice at 20–30 day intervals.

6. Common Scab

There are numerous Streptomyces species that produce common scab. On the surface of the tuber, there are superficial corky lesions that have an impact on the produce's quality. The unattractive appearance of the afflicted tubers and the fact that deeper peeling is necessary before consumption result in poor market prices for them. Scab lesions on tubers can take the form of 3 to 4 mm deep pits encircled by hard corky tissue or shallow, elevated, rough, and corky pustules. The pathogen can be spread through soil and seeds. It may endure infested soil and plant debris for a number of years. The pathogen is significantly impacted by soil conditions. pH values between 5.2 and 8.0 or higher, temperatures between 20 and 30 oC, and low soil moisture are all favourable conditions.

Management

- Use only disease-free seed tubers. Treat tubers with boric acid (3% for 30 min.) and dry them under shade before storing them in the cold. Irrigate often to maintain moisture levels close to field capacity from tuber initiation until the tubers are 1 cm in diameter.
- Rotate crops such as wheat, pea, oats, barley, lupin, soybean, sorghum, and bajra; use green manuring; and maintain high moisture in ridges for at least a few weeks during the early tuberization phase.
- In the summer, deep-plow the fields twice at intervals of 20 to 30 days.

7. Soft Rot

Depending on the value of the crop and the intensity of the attack, soft rot of potatoes results in very substantial losses in storage. When potatoes are transported over long distances in train waggons during the summer, the losses could reach 80%. Around the lenticels or the stolon attachment site, a small portion of the tuber tissue initially becomes wet and pliable. The earliest soft rot lesions may become dry and sunken in conditions of low humidity. Lesions may develop and spread to a broader region in conditions of excessive humidity. When tubers reach an advanced state of decay, other species typically penetrate them, and the decomposing tissue becomes slimy and smelly. The tuber skin is still present, and occasionally the rotting tubers swell from gas formation. At harvest many small rotted tubers with intact skin can be seen. The infected seed tubers rot before emergence resulting in poor stand of the crop. *Pectobacterium atrosepticum* is the primary enterobacteria causing soft rots. Soft rot bacteria may survive in soil, on tuber surface, lenticels, periderm, cortex, ground tissue and vascular tissue.

Management

- Avoid excess irrigation, provide proper drainage and restrict nitrogen dose to minimum (150 kg/ha).
- Adjust the planting time to avoid hot weather during plant emergence. Harvest the crop before soil temperature rises above 28°C.
- Harvest the crop only when the tuber skin is fully cured.
- Avoid injury to tubers and sorting out bruised/injured tubers.
- Treat tubers meant for seed purpose with 3% boric acid for 30 minutes and dry under shade before storage.
- Store the produce either in well-ventilated cool stores or cold stores.