

Potato

Diseases

Wart (*Synchytrium endobioticum*):

It is one of the most dreaded diseases of potato. The most favourable conditions for the development of the disease are periodic flooding followed by lack of proper drainage and aeration. The disease is characterised by 'cauliflower-like' warty growths on tubers, stolons and stem bases but not roots. Under wet conditions, it may be seen in the form of greenish-yellow crust on the stems and leaves at or near the soil level. All the tubers on diseased plant do not necessarily develop warts. Diseased tubers may show formation of either one or more tumours. Such tubers sometimes are completely transformed into warty mass. The tumors may turn brown to black with age.

Control: Wart affected tubers used as seed are the chief means of the disease spread. The disease may also spread through seed of wart immune varieties grown in wart infested land, contaminated soil carried on the feet of men, animals or farm implements, and manure containing diseased material.

Control of the disease is possible only by cultivation of immune varieties.

No effective treatments are available and cannot be applied on large field scale. However preventive measures like practicing long crop rotation (5 years or more), using disease free potatoes as seed material and burning of wart affected lumps and potato peelings are effective in checking the spread of the disease.

Soft Rot (*Erwinia. carotovora subsp carotovora*):

This disease causes very high losses in storage. Excessive moisture, high temperature excess nitrogen, tuber injuries and poor ventilation during storage are the important factors helping in disease development. Initially a small area of tuber tissue around lenticel or stolon attachment point becomes water soaked and soft. Under low humidity, the initial soft rot lesions become dark and sunken. Under high humidity, the lesion may enlarge and spread to larger area. Tubers in advanced stages of decay are usually invaded by other organisms and the decaying tissue becomes slimy with foul smell and brown liquid ooze. The tuber skin remains intact and sometimes the rotted tubers are swollen due to gas formation. At harvest, many small rotted tubers with intact skin can be seen. The infected seed tubers rot before emergence resulting in gaps. The symptoms appear as water soaked lesions on the stem, leaves and petioles. The affected parts turn black and rot leading to toppling of the stem and leaves.

Control: In the field, avoiding excess irrigation and nitrogen, providing proper and drainage prevents the spread of the disease.

Cultural methods such as adjust planting time to avoid hot weather during plant emergence and harvesting the crop before soil temperature rises above 28° C is recommended. The crop should be harvested only when the tuber skin is fully cured. Care should be taken to avoid injury to tubers and bruised injured tubers are sorted out. Treating the tubers with 3% boric acid for 30 min and drying them under shade minimizes infection in the storage. The treated tubers should be stored in either in well-ventilated cool stores or cold stores.

Charcoal Rot (*Macrophomina phaseolina*):

The disease infects the tubers in the soil through proliferated lenticels and injuries. Black spots appear around the lenticels and eyes which enlarge into patches extending deep into the tuber flesh. The pathogen infects through lenticels, eyes, stolons and wounds made by larvae of the tuber moth to cause black sunken lesions and later blackening of internal tissues.

Control: Harvesting the crop early before the soil temperature reaches 28°C can check the disease.

Bacterial Wilt or Brown Rot (*Pseudomonas solanacearum*):



Brown rot or bacterial wilt is a destructive disease of the potato. It causes losses in two ways: (i) premature wilting and death of the plants leading to total loss of yield, and (ii) rotting of the tubers in transit or storage.

The earliest symptom is slight wilting of the top, which is soon followed, by total wilting. In advanced stage, if the base of the stem of the affected plants is cut transversely and squeezed, the bacterial mass is seen to ooze out as a dull white slimy mass on the cut surface.

Two types of symptoms are produced in tubers, viz. vascular rot and pitted lesions. In vascular rot, the vascular tissues look like a water soaked circle, which subsequently may turn brown.

The lesions on tuber are produced due to infection through lenticels (skin pores). Initially water soaked spots develop which enlarge forming pitted lesions.

Control: The infected seed tubers including apparently healthy seed tubers from diseased crop are important in spread and carry over of the disease. Hence, disease free seed tubers obtained from disease free areas should be used for planting. Splitting of the tubers at the time of the planting should be avoided as splitting spreads the disease even to health tubers. Application of stable bleaching powder (12kg/ha) mixed with fertilizer in furrows while planting reduces wilt incidence by 80%. Practicing crop rotation for 2-3 years with crops like maize, finger millet, cereals, garlic, lupin, and onion cabbage can reduce the disease inoculum.

Black Scurf and Stem Canker (*Rhizoctonia solani*):



The disease commonly affects the tubers, sprouts, stems and stolons. The most common symptom is black scurf comprising of dark brown to black irregular lumps sticking on the surface of tubers. These irregular lumps are closely adhered to the tuber surface and do not wash off easily. Other symptoms on the tuber include skin cracks, crater like depressions, pitting, stem-end necrosis and shape deformity.

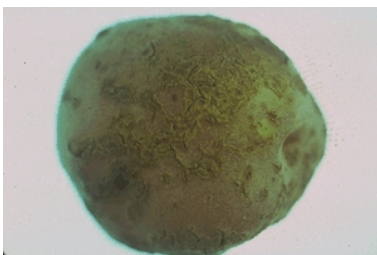
The disease often causes sprout injury both in storage and in fields after planting. The affected sprouts show discoloration of tissue. The heavily infected sprouts cannot emerge from soil leading to gappy germination.

The emerging sprouts when infected later develop cankers causing girdling of stem bases. 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 infection also spreads to roots and developing stolons resulting in rotting of cortical tissues. Such infected roots later shed away hence infected plants have poor root system. Infected stolons give rise to deformed tubers.

Control: Combination of tuber disinfection and improved cultural practices successfully checks the incidence and severity of black scurf. In the hills tuber treatment with an organomercurial compound & soil application of PCNB @ 30kg/ha is most effective. In the North India plains, treatment of the diseased seed with Thiabendazole, TBZ + 8 Hydroxyquinoline, acetic acid +zinc Sulphate, Carbendazim and Boric Acid effectively controls the disease. The progeny tubers of such treated seeds are usually free from black scurf. A continuous use of treated seed for 2-3 crop seasons is found to completely check the disease. Crop rotation with maize or 'dhaincha' (*Sesbania aegyptiaca*) for green manure also checks the disease build up.

Common Scab (*Streptomyces spp.*):



The disease does not cause yield losses but disfigures the tubers, thereby reducing the market value and increasing peeling losses. The disease mainly affects potato tubers causing any of the following symptoms viz., mere abrasion of skin (russetting); corky lesions around lenticels which may be star shaped or irregularly circular; irregular concentric corky rings around lenticels; raised rough corky pustules and 3-4 mm deep pits surrounded by hard corky tissues. In case of severe

attack, dark brown lesions may develop on roots and stolons.

Control: The pathogen is difficult to control because of long survival both on seed tubers and in soils. However using disease free seed tubers could minimize the disease incidence. Before planting the seed tubers are treated with organomercurial compounds (0.015% for 20 minutes) or Boric Acid (3% for 30 minutes) and dries in shade. The same treatment is repeated before the storage of the tubers. Maintaining high moisture in ridge atleast for a few weeks during the initial tuber formation phase creates adverse conditions for the development of the disease. Following crop rotations with wheat, pea, oats, barley, lupin, soybean, sorghum and bajra checks the disease development.

Dry Rot (*Fusarium spp.*):



The dry rot is an important disease of storage. 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 center of the concentric 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 loose water and become dry, hard and shriveled.

Control: Use only clean and healthy seed tubers for planting and tuber washing followed by drying under shade substantially reduces the infection. Dipping the tubers in organomercurial compounds (0.2%) for 30 minutes is effective. Tuber damage and injury must be avoided during harvest and storage. Tubers should be stored in cold stores in plains. In country stores, tubers must be examined periodically and rotting tubers sorted out. If possible, splitting of seed during planting should be

avoided. Otherwise seed pieces may be treated with Mancozeb (1kg in 450 litres water) for 10 minutes and dried for 24-48 hrs before planting.

Late Blight (*Phytophthora infestans*):



The disease affects all plant parts, viz., leaves, stems and tubers. It appears on leaves as small pale green spots, which enlarge into large water soaked lesions. A white mildew (cottony growth) ring forms around the dead areas on the lower side of leaves. In dry weather, water soaked areas turn necrotic brown. On stems, light brown elongated lesions are formed which may encircle the stem. Tubers develop reddish brown, shallow to deep, dry rot lesions. The affected tuber flesh becomes 'caramalised' with a sugary texture. Frequently metallic tinge develops on the margins of the affected tissue.

Tubers carrying the pathogen are the real carriers and serve as the source of the disease in the subsequent season. Infected seed tubers grow into healthy plants but under favourable conditions for the disease (10-12°C and RH > 80%) development, the disease infects the stem and lower leaves.

Control: Seed potatoes should be checked thoroughly before storage. All blighted tubers must be removed and buried deep in the soil. Ridges should be made high enough to cover all daughter tubers and reduce chance of their infection upon exposure. If the weather conditions (temperature 10-20°C, RH > 80%) are favourable for the disease development irrigation should be stopped immediately. If essential only light irrigation is given. When the disease affects 75% crop foliage, the haulms should be cut, removed from the field, and buried deep.

Protective sprays with a contact fungicide, viz., Mancozeb (0.2%) before appearance of the disease is effective. Subsequent sprays if necessary should be repeated at 8 to 10 days interval. In case of severe blight attack, one or two sprays of Metalaxyl (0.25 %) are given to check the further spread of the disease. Mancozeb is applied at an interval of 15 days after the Metalaxyl application.

Early blight (*Alternaria solani*):

The disease mainly infects leaves and tubers. Initially the symptoms occur on the lower and older leaves in the form of small (1-2 mm) circular to oval brown spots. These lesions have the tendency to become large and angular at later stage. Mature lesions on foliage look dry and papery, and often have the concentric rings, looking like bulls eye. The symptoms on the tuber comprise of 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 shriveled.



Control: Use of disease free seed tubers for raising the crop. The crop must be given balanced doses of fertilizers, especially nitrogen. Spraying the crop with urea (1.0%) at 45 days after sowing and giving subsequent sprays 8-10 days after the first spray helps the crop to easily escape the severe onslaught of early blight disease.

In the hilly regions, spraying of Copper Oxchloride (0.30%) and Bordeaux mixture (1.0%), is

recommended for control of early blight disease. Solanaceous crops, which act as the collateral hosts for the disease organism, hence their cultivation nearby potato fields, must be avoided.

Potato Leafroll Virus (PLRV):

The PLRV invokes primary or secondary types of symptoms in plants depending upon the age of infection. The primary symptoms develop during the crop growth. These symptoms are confined to top young leaves, which usually stand upright, roll and turn slightly pale. The secondary symptoms of PLRV develop when plants are grown from infected seed tubers. Such symptoms are rather prominent in older leaves. Infected plants have characteristic pale, stunted and upright appearance with rolling of lower leaves that turn yellow, brittle and are leathery in texture.

Control: The disease is managed by using virus-free seed potatoes. Multiplying virus-free seed in aphid free areas. Population of aphid vectors is controlled by application of suitable contact/systemic insecticides.

Potato Mosaics

Potato mosaics mostly invoke inter-veinal and veinal chlorosis, mild mottling and slight crinkling of leaves. Top necrosis occurs in immune varieties while others express light yellowing of the leaf margins or shiny yellow mottle of the entire leaf lamina. The potato plant is also affected by a severe