

MAJOR DISEASES AND THEIR MANAGEMENT IN VEGETABLE CROPS IN NEPAL : A REVIEW

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ABSTRACT

Area under vegetable cultivation is increasing in Nepal. However, the farmers are unable to meet the demand of vegetables particularly in the urban areas. Diseases are one of the main constraints for successful cultivation of vegetables in the country. Almost all kinds of vegetables suffer from one or more diseases caused by fungi, bacteria, virus and nematode. Some of them are reported to cause significant losses in production. Based on research results of different authors, integrated management approaches of major diseases of vegetables at farm level have been discussed.

Additional Key Words: Cole crops, crucifers, solanaceous crops, causal organisms

INTRODUCTION

Fresh vegetables being rich in protein, minerals and vitamins, are important constituents of Nepalese diet. Extreme variations in physiographic locations and agroclimatic conditions of Nepal are boon for growing various vegetables at different seasons of the year. Therefore, two hundreds or more species of indigenous and exotic types are used as vegetables in Nepal. However, about fifty species are commonly grown for home consumption and/or marketing (Pandey, 1995). Estimated areas under vegetable crops are 1,40,500 ha (3.5 % of total cultivated area). Production was estimated as 1,197,496 mt and productivity 8.5 t/ha in the year 1994/95 (Sapkota, 1995). His Majesty's Government of Nepal has envisaged to increase its productivity to 9.1 t/ha by the end of Eighth Five Year Plan. At present, vegetable production is in increasing due to rapid urbanization, population growth and people awareness towards its nutritional value. Thus, as a high value crop, vegetables are becoming a sustainable source of income for the small and large farmers. However, per capita consumption per day is 56.07 g in 1992/93 (Chitrakar, 1995) as against the recommended amount of 200 g (Chadha, 1994).

There are several constraints to increase production and productivity of vegetables in Nepal but pests are major ones for successful cultivation. On the other hand, growers use pesticides indiscriminately to control vegetable pests and they concern little about environmental pollution, development of resistance and health hazard.

This article primarily deals with problems of major diseases and their management through available technologies to minimize losses and consumption of pesticides in vegetable crops.

Brassicaceae

A number of vegetable crops such as cauliflower (*Brassica oleracea* var. *botrytis* L.), cabbage (*B. oleracea* var. *capitata* L.), radish (*Raphanus sativus* L.), turnip (*B. rapa* L.), broad leaf mustard (*B. juncea* var. *folicosa* Bailey) are included in this family.

Alternaria leaf spot (*A. brassicae* Berk. Sacc. and *A. brassicicola* Schw. Wiltshire)

Alternaria leaf spot disease attacks brassicaceous vegetable crops at all stages of plants. On leaves, small brownish-black to large concentric dark spots are formed. On the curd and siliqua the symptom appears as brownish-black spots. The infected seeds are small and shrivelled. Shrestha (1990) recorded seed infection ranging from 16 to 41% in cauliflower and cabbage. The disease has been recorded from both hills and terai but its severity is more in terai.

The disease can be managed by using disease free seeds, seed treatment with Thiride (2.5 g/kg), Rovral (Iprodione, 2 g/kg), field sanitation by removing stumps and volunteer plants, isolated cultivation of crops away from collateral crop hosts (rapeseed and mustard), application of recommended doses of fertilizers, providing timely irrigation and 2-3 foliar sprays with suspension of Dithane M-45 or Rovral.

Sclerotinia stalk Rot (*Sclerotinia sclerotiorum*(Lib.) de Bary)

A serious disease of cauliflower which was first recorded at Paripatle farm, Dhankuta in 1978. In subsequent years, the disease was reported from Musikot, Palpa, Pokhara and Lalitpur (Shrestha, 1985). The disease infects the stem near to soil showing a white fluffy mycelium of the fungus. It gradually spread towards upper part including the cauliflower head. Eventually, infected parts start to rot and the fungal mycelium turns into black sclerotia which survives more than a year in soil. Besides cauliflower, the disease is reported to attack rapeseed-mustard, eggplant tomato and beans. The disease reduced seed yield from 300 kg/ha to 50 kg/ha in Dhankuta Agriculture Station (Rekhi, 1983).

At present there is no cultivar resistant to the disease. However, seed-transmission can be checked either by sowing the seeds collected from healthy area or by proper cleaning to separate sclerotia before sowing. Crop rotation especially with rice will reduce the soil-borne inoculum. Seed treatment with Bavistin/ Vitavax in combination with foliar spray of Bavistin @ 0.1% for three times at 15 days interval was found effective to suppress the disease in rapeseed and mustard (Shrestha *et al.*, 1994).

Downy mildew (*Peronospora parasitica* Pers.Fr.)Fr.

Most of the Brassica crops are infected by downy mildew disease in hills and terai of Nepal. Generally the disease appears in seedlings on cotyledonary leaves as irregular chlorotic yellow lesions on the upper side with dirty white downy growth on the under side of the spots. The infected seedlings become senescent and finally desiccated. The cauliflower

seedlings 50-100% in nursery beds in Kathmandu valley during 1987 (Shrestha, 1990) and 40% of seedlings in Dhunibesi (Shrestha *et al.*, 1989) were killed by this disease. The downy mildew may also appear in maturing stage of plants on leaves, stem and curd causing discoloration of curd which affects on seed production of cauliflower.

The disease can be managed by removing the crop debris to avoid perennation of oospore of the fungus in the field. Thin sowing with good drainage in the nursery beds followed by spraying with Dithane M-45 (2.5 g/l)/Blitox 50 (3-4 g/l)/Ridomil (matalaxyl 2 g/l) of water at an interval of two weeks for 2-3 times will result in the integrated management of downy mildew disease.

Black rot (*Xanthomonas campestris* pv. *campestris* Pammel) Dowson

Black rot is an important bacterial disease of cauliflower, cabbage and other brassicaceous crops. The infected stem, petiole and curd become black and leaves show V-shaped yellowing symptom. Ultimately infected parts rot and give foul smell. The pathogen survives in the infected crop debris and seeds for longer period but it survives in the soil at free state for short period only. Seed health test of cauliflower indicated black rot infection ranging from 1 to 6 percent (PPP, 1991). Incidence of disease has been recorded from both hills and terai in cauliflower growing areas. Shrestha *et al.* (1989) reported yield loss due to black rot up to 60% at Pokhara during 1989.

Sanitation of the field by removing crop debris and weed hosts, crop rotation with non host crops for 2-3 seasons and cultivation of Kathmandu local variety of cauliflower are recommended to manage this disease at farmer's field.

Turnip Mosaic Virus (TuMV)

Broad leaf mustard, a common leafy vegetable is often severely infected by Turnip Mosaic Virus (TuMV) in Kathmandu Valley, Kaski and other areas of the country. The disease was also reported on turnip, radish and nasturtium (*Tropaeolum majus*) (Shrestha, 1984; Shrestha and Albrechtsen, 1989). The infected leaves show mosaic, mottling, puckering and greenish island formation. Early infection causes stunting, reducing in leaf size.

Lumle Agriculture Research Center has reported a local cultivar, Mankamana as tolerant to the disease. Management of aphid-vector, rouging of infected plants at initial stage, isolated cultivation from collateral host crops and removal of weed hosts are common measures for management of TuMV.

Solanaceae

Tomato (*Lycopersicon esculentum* Mill.), eggplant (*Solanum melongena* L.), hot and sweet peppers (*Capsicum frutescens* L. and *C. annum* L.) are the common vegetables of the family, Solanaceae.

Late blight (*Phytophthora infestans* Mont.de Bary)

Late blight, a destructive disease of tomato causes economic loss in yield in the summer crop of hills and winter crop of terai. The disease appears as small brownish black water soaked lesions on the leaves and develops a downy growth of fungus sporulating on the lower surface of the leaves around the lesions. Under cool, humid and rainy weather conditions, the lesions increase rapidly coalescing each other and cover large areas of leaves. A single infected plant can lead for destruction of whole crop within a couple of days during epidemics. The foliage become blighted and brownish-black lesions are formed on stem which makes the stems brittle. The infected fruits show grayish to black lesions on the surface due to which they start rotting within a few days. During November, 1995 to January, 1996, the disease was spread in epidemic form in tomato and potato crops in Chitwan, Sarlahi, Mahottari and Danusha districts. All commercial varieties like CL 1131, Roma, Pusa Ruby were severely damaged by the disease causing >75% of losses of the fruits.

So far, none of tomato variety was found resistant to late blight. However, Shrestha (1989) reported that indigenous cultivars bearing small fruits were found resistant to some extent. Till now, tomato crop is protected from late blight by the application of fungicides like Dithane M-45 (0.2-0.5%) and Blitox 50 (copper oxychloride) (0.3-0.4%), Ridomil (0.1%) (Shrestha and Bhardwaj, 1982, Manandhar and Amatya, 1986; Shrestha, 1989; Shrestha, 1990). Based on experimental data, it was found that alternate sprays of Dithane M-45 and Blitox 50 at the interval of 7-10 days were effective to reduce the intensity of the disease at low level (unpublished). Besides, field sanitation, eradication of ground keepers of potato and tomato, isolation of tomato field from potato crop, monitoring of disease in the field and Aug. to Sept. planting have been recommended as integrated approach to minimize disease level below the economic loss.

Bacterial wilt (*Pseudomonas solanacearum* Smith) Smith.

Bacterial wilt of tomato is an important disease of solanaceous crops like tomato, peppers, eggplant, chilli and potato. This disease has been observed in mid and foot hills and terai. It was first recorded in tomato crop in 1979 and the crop loss was estimated upto 60% in Jhapa district during 1989 (Shrestha, 1990). Prevalence of different races or biovars of this pathogen in Nepal have been reported (Shrestha, 1977; Adhikari, 1993; Timila *et al.*, 1996). The disease affects tomato plants at any stage of plant growth but the young and succulent plants are more susceptible. The diagnostic symptom is rapid wilting of plants which shows oozing of bacterial slime from the cut piece if hanged into a glass of water.

None of the cultivars are found resistant to bacterial wilt. However, CL 1131 and Rampur Small were found tolerant to the disease (Upreti and Adhikari, 1986; Adhikari, 1993). Tomato line, BL 333, was found field resistant to the disease at Panchkhal (Timila *et al.*, 1996).

The disease having wide host range, soil-borne nature, prevalence of different races, dependence on environmental factors for its infectivity, non availability of resistant cultivar and bactericide, it is very difficult for the management of this disease. However, disease management is possible through preventive measures such as maintaining soil, free from the pathogen and crop rotation with non-host crops like cereals. Hogger and Shrestha (1982) found that bacterial wilt of potato was effectively managed by crop rotation with rice followed by planting with disease free seed potato.

Leaf spot (*Septoria lycopersici* Speg.)

Septoria leaf spot is considered as a minor disease but occasionally the summer tomato crop of midhills was observed severely infected causing early defoliation. The disease is recognized with small circular grayish white spot in the center with brownish margin on the leaves. In severe condition, the spots are coalescing each other and causing blighted.

The disease is managed by spraying with Dithane M-45 or Blitox 50 when it appears in the field.

Virus diseases

Tomato crop suffers from a number of virus diseases but in Nepal two diseases such as Tomato Mosaic (TMV) and Tomato Leaf Curl (TLCV) viruses are economically important.

Tomato Mosaic Virus (TMV)

Tomato mosaic disease has been observed both in hills and terai. Mosaic with raised dark green tissues on leaves, distortion of young foliage, sometimes severe mottling and stunting of plants are typical symptoms of TMV. The virus is most contagious and transmitted through sap and seeds.

The disease can be managed by using seeds of disease free plants, treating seeds and seedling with trisodium phosphate/milk, sanitation of fields by removing of crop debris, maintenance of plant distance and less/no injury during cultural practices.

Tomato leaf Curl Virus (TLCV)

Since last few years, tomato leaf curl virus has become a serious problem in tomato growing areas of foot hills and terai. This disease is equally important to chilli crops as well.

TLCV is a gemini virus, the symptoms of which vary greatly. The typical symptoms are interveinal chlorosis, mottling, curling inwards, puckering, stunting, less flowering and reduced in leaf and fruit size. Timila *et al.* (1994 and 1996) reported the incidence of disease in tomato ranging from 5-35% and in chilli from 5-85%. Losses in yield of tomato were estimated up to 50% and in chilli 30-50% at farmers' field (Joshi *et al.*, 1996). All the exotic high yielding varieties are susceptible to TLCV. Roma, an improved variety was found

severely infected at Sarlahi Horticulture Farm in 1996. However, the local indeterminate varieties were observed tolerant to TLCV.

An integrated approaches are controlling of vector, white fly (*Bemisia tabaci*) by chemical or botanical pesticides, planting of tolerant variety, shifting of planting period from Aug./Sept. to Oct./Nov., removal of weed hosts like *Ageratum sp.*, *Sida sp.* and *Croton* from the field.

Phomopsis blight (*Phomopsis vexans* sacc.& Syd.)

Phomopsis blight is an important disease of eggplant in terai which attacks the stem, leaves and fruits at all stages of plants. It is observed as brownish black lesions on stem, round to oval brownish large spots with numerous black pycnidia on leaves and fruits. Eventually infected fruits get rotten encountering direct economic loss. Shrestha *et al.* (1989) reported that the disease caused 10-20% of fruit rotting in Sarlahi during 1983.

Use of disease free seeds along with sanitation in nursery beds and fields, treatment of seeds with Thiram/ Captan (2.5 g/kg) and 2-3 sprays with Dithane M-45/Blitox-50/Bavistin at the interval of 15 days just after disease appearance have been recommended for disease management.

Cucurbitaceae

Vegetables belonging to this family are generally grown in summer. cucumber (*Cucumis sativus* L.), luffa (*Luffa aegyptica* Mill.), bitter guard (*Momordica charantia* L.), pumpkin (*Cucurbita muschata* L.), squash (*Cucurbita pepo* L.) and bottle guard (*Lagenaria siceraria* L.) are main cucurbitaceous vegetables.

Downy mildew (*Pseudoperonospora cubensis* Berk & Curt) Rostow

Downy mildew appears both in hills and terai and occasionally causes damage to cucurbitaceous vegetables at economic level. The disease appears as small yellowish spots on leaves and in severe conditions, leaves become chlorotic to brown and shrivel. Fruits are ripening prematurely and become tasteless. In March 1996, cucumber crop was observed severely infected with downy mildew in the farmers' fields at Bara district.

Avoiding of close planting, sanitation of field, seed treatment with Thiram (0.2%)/Captan (0.2%), spraying with Dithane M-45 or Ridomil (0.2%) at 10-15 days interval depending of environmental conditions have been recommended for the management of disease at farm level.

Powdery mildew (*Erysiphae chichoracearum* DC.)

Powdery mildew is one of the important diseases of cucurbits. The disease forms a white powdery mass coating on both sides of leaves and stem. In severe cases, the leaves become yellowing and start desiccation. It affects on fruit causing small in size and

occasionally malformation. The disease occurs both in hills and terai and sometimes causes significant losses in yield.

Removal of crop debris from the field, use of early maturing varieties, spray with Karathane (Dinocap) 1 ml/litre of water or dusting with a mixture of sulphur and lime(1:3) for 2-3 times are integrated measures for powdery mildew management.

Leguminosae

Pea (*Pisum sativum* L.), cowpea (*Vigna sp.*) and beans (*Phaseolus sp.*) are main legumes used as green vegetables.

Rust (*Uromyces phaseoli* var. *typica* Arth.)

Most of the beans (*Phaseolus sp.*) are susceptible to rust and is a serious problem in some seasons when relative humidity reaches above 90% for prolonged period.

Generally the disease appears in the form of small whitish raised spots (pustules) on the leaves particularly on the lower surface and pods. After one week the pustules are observed as distinct reddish-brown with full of spores. Gradually, infected leaves become yellow and dry up. The disease was reported to be as a severe problem in mid hills and caused 10-45% reduction in yield (Shrestha, 1990).

Crop rotation with non-host crops, removal of crop debris from the field, maintenance of distance between the plants to decrease humidity and dusting of sulphur and lime (1:2), 2-3 times or application of Kavach (chlorothalonil) have been recommended to follow simultaneously to manage the disease in the fields.

Anthracoise (*Colletotrichum lindemuthianum* Sacc.& Magn.)Brios & Cav.

Anthracoise is a common disease of beans. The disease appears on cotyledonary leaves as brownish-pink spots and dark-brown lesions often girdling on the stems. Similarly, on leaves, the disease shows the symptoms of reddish-brown angular to elongated spots and on the pods dark red sunken lesions. The center of the lesions are sometimes covered with brown to black fruiting bodies of the fungus showing the sign of the disease. The infected seeds show brownish-black spots with whitish center on the seed coat.

The disease has been observed both in hills and terai. In severe conditions, the disease causes early defoliation and the infected pods either may fail to develop or get low market price.

The disease can be managed in the field through integration of planting disease free seeds, treatment of seeds with thiram (2.5 g/kg), removing of crop debris, avoiding of close planting and spraying with Bavistin (0.1%) 2-3 times.

Powdery mildew (*Erysiphae polygoni* DC).

Powdery mildew of pea is a severe problem both in hills and terai. The disease

attacks the crop with whitish powdery mass covering on leaves, stems and pods. Under severe conditions, significant reduction in yield is encountered due to less number of pods and seeds formation. The market value of infected pods is greatly reduced.

Removal and burning of crop debris in the field reduces the source of inoculum. Use of balanced fertilizers is reported to decrease intensity of the disease. Application of chemicals like Bavistin (0.1%), Calaxin (0.1%), Karathane (0.2%) and lime plus sulphur (1:1) reduce the disease effectively in the field (Bhardwaj *et al.*, 1982; Shrestha, 1985).

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