

Diseases Affect Vegetables, Flowers, and Fruit Crops before Harvest in the Northern Region of Uttar Pradesh

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Abstract

The investigation involved the study of pre-harvest fungal diseases of vegetables, flowers and fruits. A pre-harvest disease survey of various vegetables, flowers and fruits was carried out at the study site of different farmers' fields in a village of Rampur, Uttar Pradesh. 08 fungal diseases were reported on various vegetables like chilli, tomato, pumpkin and bottle gourd. These vegetable diseases were found to be caused by fungal pathogens like *Leveillula Taurica*, *Phytophthora capsica*, *Alternaria solani*, *Fusarium oxysporum* f.sp. *lycopersici*, *Erysiphe* spp., *Sphaerotheca* spp., *Cercospora citrullina*, *Colletotrichum orbiculare*, *Pseudoperonospora cubensi* etc. The study also studied 06 fungal pre-harvest diseases of fruits like mango, guava and banana. The fruit diseases were found to be caused by fungal pathogens like *Colletotrichum gloeosporioides*, *Oidium mangiferae*, *Cephaleuros virescens* Kuntze, *Fusarium* spp., *Fusarium oxysporum* f. sp. *cubense*, *Pestalotiopsis leprogena* etc. The study also studied 04 fungal pre-harvest diseases of flower like rose and marigold. Diseases in flowers were found to be caused by fungal pathogens such as *Diplocarpon rosae*, *Sphaerotheca pannosa* var. *rosae*, *Alternaria*, *Cercospora* and *Septoria* sp., *Alternaria dianthi* etc. Symptoms of pre-harvest diseases were also observed and reported.

Keywords: Pre- harvest diseases, Fruits, Flower, vegetables crops, fungal pathogens, Symptoms, *Phytophthora* blight etc.

Introduction

India is the largest producer of vegetables, flower and fruit crops in the world. India is the second-largest producer of vegetables and fruit in the world after China, and shares about 16% of global vegetable production and 10% global fruit production [1]. In 2023, the global production of fresh fruit amounted to some 951.91 million metric tons, increasing from 576.65 million metric tons in 2000 [2]. Total horticulture production in the year 2022-23 is estimated to be 351.92 million tonnes, an increase of about 4.74 million tonnes (1.37%) as compared to the year 2021-22 (final). Production of fruits, vegetables, plantation crops, flowers and honey is expected to increase. Fruit production is estimated to be 108.34 million tonnes in the year 2022-23 as compared to 107.51 million tonnes in the year 2021-22. The production of vegetables is estimated to be 212.91 million tonnes in the year

2022-23 compared to 209.14 million tonnes in the year 2021-22 [3]. Insect infestation along with bacterial, fungal, and viral infections are other main contributors to diseases found in plants [4]. Changes in climate and temperature are also factors that may contribute to the increase in diseases found in plants. Once a plant has been infected, symptoms develop on various segments of the plant, ultimately degrading the growth of the subsequent fruit or vegetable [5].

Fungal diseases are among the most significant threats to the health and productivity of fruit, vegetable, and flower crops worldwide. These diseases can severely affect yield, quality, and marketability, often leading to substantial economic losses for farmers and the agricultural industry. Pre-harvest fungal infections, which occur before the crop is harvested, are particularly problematic as they can remain latent and later develop during storage, transportation, or even post-

harvest handling. Diseases and defects found in plants and crops have a great impact on production in the agriculture industry and can lead to significant economic losses^[6].

These infections have drastic impacts on countries that rely heavily on their agriculture sector as their main source of income. In order to overcome these losses and issues of plant diseases, farmers tend to use chemical pesticides as a remedy solution. This solution may be effective in eliminating plant diseases but has drastic drawbacks. As well as being costly, the increased use of pesticides creates dangerous toxic residue levels on agricultural produce^[7].

Fruits and vegetables are abundant in both water and nutrition. Any injuries or physical harm results in the leakage of nutrients from the surface, so inviting microorganisms. Fruits possess an acidic character, making them susceptible to fungal attacks, whereas vegetables, being non-acidic, are mostly affected by bacterial infections. The majority of fungus responsible for postharvest disease are classified within the phylum Ascomycota and the related fungus Anamorphic (Fungi Imperfecti) (Coates and Jhonson, 1997) [8].

Materials and Methods

Study Site

Sigankheda and Lalpur Kalan villages are located in Tanda tehsil of Rampur district of Uttar Pradesh state of India. The study site is located 11 km from Tanda and 12 km from Rampur. The total geographical area of the village is 969.68 hectares, while the total geographical area of Lalpur Kalan village is 132.032 hectares. The site is located at 79°05' E and 28°48' N latitude. Diseased samples of various vegetables, flowers and fruits were collected from the site. Various types of vegetables, flowers and fruit plants are grown in the study area.

Table 1: Pre-harvest Diseases of Vegetables

S No.	Name of the Plant	Scientific Name	Name of the Disease	Causal Organism
1.	Chilli	<i>Capsicum annuum</i> L.	powdery mildew	<i>Leveillula Taurica</i>
2.	Chilli	<i>Capsicum annuum</i> L.	<i>Phytophthora blight</i>	<i>Phytophthora capsica</i>
3.	Tomato	<i>Solanum Lycopersicon</i>	early blight	<i>Alternaria solani</i>
4.	Tomato	<i>Solanum Lycopersicon</i>	Fusarium wilt	<i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i>
5.	Pumpkin	<i>Cucurbita pepo</i>	powdery mildew	<i>Erysiphe</i> spp. <i>Sphaerotheca</i> spp.
6.	Pumpkin	<i>Cucurbita pepo</i>	<i>Cercospora</i> leaf spot	<i>Cercospora citrullina</i>
7.	bottle gourd	<i>Lagenaria siceraria</i>	anthracnose	<i>Colletotrichum orbiculare</i>
8.	bottle gourd	<i>Lagenaria siceraria</i>	downy mildew	<i>Pseudoperonospora cubensi</i>

1. Powdery Mildew

This is the major disease of chilli crops. This disease caused by the fungus *Leveillula Taurica* (Table no. 01). During the initial stage, white powdery coating starts to develop on the lower surface of the leaves and yellow patches appear on the upper side correspondingly. After some time, the affected area turns brown and converts the entire surface into yellowish colour. In most severe cases, infected leaves become dry and shed from the plant. Powdery mildew also affects branches and fruits, consequently, the growth of young fruits stops and they fall from the plant prematurely. According to Dhanuka Agitech Limited^[9].

2. Early Blight of Tomato

This is the major disease of chilli crops. This disease caused by the fungus *Alternaria solani* (Table no. 01). Symptoms of early blight can occur on the foliage, fruit, and stem at any

Sample Collection

The plant parts of vegetables, flowers and fruits infected with the disease were collected in polythene bags. The samples were brought to the laboratory. The symptoms of the disease were carefully observed and noted.

Isolation of Fungal Pathogens

Fungal pathogens were isolated from the diseased parts of vegetables, flowers and fruits. The infected tissues were allowed to grow on PDA culture media in Petridis. After full growth of mycelium and reproductive bodies they were stained in cotton blue and mounted in lacto phenol on clean glass microscopic slides.

Identification Fungal Pathogens

The temporary preparation of slide was observed under compound microscope the identification of fungal pathogens were made on the basis of somatic structure fruiting bodies, asexual and sexual reproductive structures. The keys was used for identification of fungal pathogens^[5].

Result and Discussion

1. Vegetables Disease

In the present research, a survey of pre-harvest disease flowers, fruits, and vegetables was carried out. Chilli, tomato, pumpkins, and bottle gourd were among the vegetables that were examined for fungal infections and the symptoms that resulted from them (Table 1). These are the symptoms of several diseases and the organism responsible for them.

stage of development. The disease is more commonly observed in the field, however, seedlings in the greenhouse can be affected by collar rot (also caused by species of *Alternaria*).

Lesions first develop on lower leaves as small, brownish-black spots which can expand to about $\frac{1}{4}$ - $\frac{1}{2}$ -inch in diameter with characteristic concentric rings in the darkened area. The area surrounding the lesions may become yellow and, as disease progresses, the entire leaf may turn yellow. In later stages, lesions may appear in the upper leaves and defoliation may occur in the lower part of the plant leaving the fruit susceptible to sunscald. Fruit may become infected through the calyx around the stem attachment and are susceptible in the green or red stage. Lesions can expand to cover the entire fruit and are typically sunken, leathery, and dark brown to black with concentric rings. According to NC State Extension Publications.

3. Powdery Mildew

This disease is caused by a fungus *Erysiphe* spp., *Sphaerotheca* spp. The fungal pathogen produces a white powdery coating on the leaves and stem of the plant. A white powdery mass of spores forms on the leaves, stem and fruits of the pumpkin. The infection affects plant parts and fruits. The fungus causes the fruits to rot and get spoiled.

2. Flower Disease

In the present research, a survey of pre-harvest disease flowers, fruits, and vegetables was carried out. Rose and Marigold were among the Flower that were examined for fungal infections and the symptoms that resulted from them (Table 2). These are the symptoms of several diseases and the organism responsible for them.

Table 2: Pre-harvest diseases of Flower

S No.	Name of the Plant	Scientific Name	Name of the Disease	Causal Organism
1.	Rose	<i>Rosa</i> spp.	Black Spot	<i>Diplocarpon rosae</i>
2.	Rose	<i>Rosa</i> spp.	Powdery Mildew	<i>Sphaerotheca pannosa</i> var. <i>rosae</i>
3.	Marigold	<i>Tagetes erecta</i>	Leaf Spot and Blight	<i>Alternaria</i> , <i>Cercospora</i> and <i>Septoria</i> sp.
4.	Marigold	<i>Tagetes erecta</i>	Flower Bud Rot	<i>Alternaria dianthi</i>

1. Black Spot of Rose

This disease is caused by the fungus **Diplocarpon rosae**. These spots appear as dark, often black, circular or irregular patches on the leaves, which can yellow and fall off. Leaves near the spots may turn yellow and finally drop off. Repeated black spot infections can weaken the plant, leaving it vulnerable to various diseases and winter damage.

2. Leaf Spot and Blight

The disease is caused by fungi such as *Alternaria*, *Cercospora* and *Septoria* species. Leaf spot and blight are prevalent fungal diseases that affect marigolds, resulting in brown spots on

leaves, stems and flowers, which can grow large enough to cause severe damage. Such diseases can result in significant yield losses, with flower production potentially decreasing by 50-60%.

3. Fruit Disease

In the present research, a survey of pre-harvest disease flowers, fruits, and vegetables was carried out. Mango, Guava and Banana were among the Fruit that were examined for fungal infections and the symptoms that resulted from them (Table 3). These are the symptoms of several diseases and the organism responsible for them.

Table 3: Pre-harvest diseases of Fruits

S No.	Name of the Plant	Scientific Name	Name of the Disease	Causal Organism
1.	Mango	<i>Mangifera indica</i>	anthracnose	<i>Colletotrichum gloeosporioides</i>
2.	Mango	<i>Mangifera indica</i>	powdery mildew	<i>Oidium mangiferae</i>
3.	Guava	<i>Psidium guajava</i>	Algal leaf and fruit spot	<i>Cephaleuros virescens</i> Kuntze
4.	Guava	<i>Psidium guajava</i>	Guava Wilt	<i>Fusarium</i> spp.
5.	Banana	<i>Musa</i> spp.	Panama disease (or <i>Fusarium</i> wilt)	<i>Fusarium oxysporum</i> f. sp. <i>cubense</i>
6.	Banana	<i>Musa</i> spp.	Brown blotch	<i>Pestalotiopsis leprogena</i>

1. Anthracnose of Mango

The disease is caused by fungi such as *Colletotrichum gloeosporioides*. This disease that affects mangoes worldwide. It leads to considerable yield and quality losses. The disease manifests as dark spots on leaves, twigs, flowers, and fruits, causing premature fruit drop and rotting.

2. Guava Wilt

The disease is caused by fungi such as *Fusarium* spp. the symptom of the disease is the appearance of yellow coloration with slight curling of the leaves of the terminal branches. Plants, at a later stage, show unthrifty-ness with yellow to reddish discoloration of leaves. The roots also show rotting at the basal region and the bark is easily detachable from the cortex. Light brown discoloration is also noticed in vascular tissues. The pathogen attacks young as well as old fruit bearing trees but older trees are more prone to the disease.

A favourable environment has an impact on the onset and progression of fungal diseases. Humidity and temperature have an impact on the onset of disease. Fruits, vegetables, and flowers are more susceptible to illness when temperatures and humidity are high. In environments with elevated temperatures and humidity, bacteria become active and infect the host plant. Additionally, in favourable circumstances,

relative humidity is significant. Diseases are encouraged to develop by high humidity. Fruits, flowers, and vegetables all deteriorate due to spore spreaders that are left on the surface. During cultivation, fungal spores enter through wounds, cuts, holes, and abrasions to infect fruits, vegetables, and flowers. Agricultural tools, rodents, human handling, bird damage, bug attacks, and bad weather can all result in yield losses.

Conclusion

Fruit, flower and vegetable pre-harvest diseases are mostly brought on by fungus-related infections. Physiological malfunctions in the plant body are caused by disease infection and development. Insect invasion, mechanical damage, and the pathogen's environment all improve fungal infection. Fungal diseases have an impact on the quantity and quality of fruits, flowers, and vegetables. Either prior to or following harvest, the fungal infection may occur. Environmental elements that encourage the development and infection of disease include temperature, humidity, and pollution. In addition to destroying living tissues, the fungal pathogen encourages deterioration. Plant growth and flowering are the times when the infection of fruits, vegetables, and flowers can be identified.

Future Perspective

The Fruits, flower and vegetables are lost because people don't know enough about how to grow, harvest, handle, package, transport, and store them. A major factor in yield loss is the exposure of plant product to direct sunshine, high temperatures, a lack of low temperatures, humidity, and unfavourable cultivation conditions. The quantity and quality of fruits, flowers, and vegetables are impacted by the haphazard and careless handling of produce during marketing. The disease's infection, appearance, identification, and management must be understood by the plant farmers. To control pre-harvest illnesses, pathogen management is necessary. To reduce the loss of produce, disease control techniques such as physical, chemical, and biological methods may be helpful. Disease prevention and eradication would benefit from the management techniques. Utilizing disease-resistant cultivars could assist prevent produce loss. Pre-harvest technologies would assist meet the demand for fruits, flowers, and vegetables worldwide.

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