



Black Mould Rot: An Important Post Harvest Disease of Onion and Its Management

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Black mould rot of onion (*Allium cepa* L.) incited by *Aspergillus niger* Van Tieghem, is a fungal pathogen causing several important post-harvest rot diseases incurring economic losses in 37 genera of fruits and vegetables such as tomatoes, grapes, onions and mangoes. Having broad host range and worldwide distribution of these fungi, single management strategy is not effective. This article will be helpful for providing knowledge about integrated disease management of black mould rot disease of onion under field condition as well as in storage.

Introduction

Onion (*Allium cepa* L.) bulb of family Amaryllidaceae is an important vegetable crop widely cultivated and used throughout the world. Among the vegetables it enriches health of the people. As a foodstuff they are usually cooked or used as a vegetable, but can also be eaten raw or used to make pickles or chutneys (Anonymous, 2013a). India produced around 18.78 million metric tons of onion from 11.73 lakh ha in 2013 and is the second largest onion producer in the world after China. In India, Maharashtra is first in onion production (5867 MT) followed by Madhya Pradesh (2826 MT), Karnataka (2466 MT), Gujarat (1858 MT), Andhra Pradesh (1525 MT), and Bihar (1304 MT) (Anonymous, 2013b). Onions contain phenolics and flavonoides that have potential anti-inflammatory, anti-cholesterol, anticancer and antioxidant properties. Dropsy, kidney, heart, liver, diabetes, bulbulosis are some of the major diseases which are cured by regular consumption of onion. Most onion cultivars contains about 89% water, 4% sugar, 1% protein, 2% fiber and 0.1% fat, vitamin C, vitamin B₆, folic acid and numerous other nutrients in small amounts (Anonymous, 2013a). This shows the importance of onion for human use and thus encourages for increasing its production and productivity. Several field and storage diseases affecting productivity of onion have been reported, among which black mould rot of onion is an important post harvest disease.

Distribution and Economic Importance

The fungus, *Aspergillus niger* is wide spread in distribution and is found in almost all kind of soils (Domich *et al.*, 1980). The fungus also possesses capability to tolerate a wide range of pH, salinity, alkalinity (Kis-Papo *et al.*, 2003), and even soil pollutants including heavy metals

(Baytak *et al.*, 2005; Ahmad *et al.*, 2006). Onion black mould rot disease is the most destructive disease of storages and in the field (Wani *et al.* 2011). Rajam (1992) reported that among the post-harvest diseases of onion, black mould rot caused by *Aspergillus niger* was the predominant one. Qadri *et al.* (1982) revealed that the spoilage caused by *A. niger* was as high as 80 per cent. *Aspergillus niger*, a soil saprophyte being ubiquitous in occurrence attacks onion by producing various enzymes and toxins and establishes itself in bulb and other tissues.

Disease Symptoms

Black mould rot develops at the neck of the bulbs on injured or necrotic leaf tissues. However, it can develop on injured or diseased roots or on bruised or split outer scales along the side of bulbs. Infected bulbs may develop a black discoloration at the neck. Clusters of black spores generally form along veins and on or between the outer papery scales of bulbs. Infected tissue first has a water-soaked appearance and over time will dry and shrivel. No external symptoms may be visible on some infected bulbs. Soft rot bacteria can follow infection through the avenues made by this fungus (Anonymous, 2012).

Disease Cycle and Dissemination

Aspergillus niger is a soil borne fungus that can survive on plant debris in the soil. Infections spread from bulb to bulb by direct contact, through bruises or wounds, by mechanical means or by air-borne spores. Spores can germinate within three to six hours under high relative humidity, but germination is inhibited below 75 per cent relative humidity. The optimum temperature for growth of *A. niger* ranges from 28 to 34 °C, and it is inhibited below 17 and above 47 °C (Sumner, 1995). Sporulation can take place in 24 h after infection (Salvestrin and Letham, 1994).

Integrated Disease Management

For integrated management of black mould rot of onion incited by *Aspergillus niger*, following methods may be followed:

Selection of healthy planting material: Selection of healthy bulbs for planting is best remedy to minimize the occurrence of the black mould rot disease.

Crop rotation: Crop rotation should be followed for 3 to 4 years with other than garlic and leek crops.

Soil solarization: Covering of soil surface with 100 gauge LLDPE transparent plastic film for 15 days in the hot summer season after giving light irrigation in the soil is effective in killing of soil borne fungi, bacteria, nematodes and weeds by increasing temperature inside the plastic up to 10°C.

Deep ploughing: Deep ploughing of soil in hot summer season helps to kill the pathogens present in the soil with direct exposure to high temperature, thus infection of bulbs can be minimized.

Water management: Stop irrigations 10–14 days before harvest. Wet soils at harvest time promote bulb infections. Withholding water before harvest encourages necks to dry and collapse (Anonymous, 2009).

Fertilizer application: Do not apply nitrogen 4–5 weeks before harvest. Nitrogen stimulates growth of soil fungi and makes the onion tissues susceptible to infections (Anonymous, 2009).

Chemical control: Application of carbendazim @ 0.1% concentration found most effective against black mould rot when applied either as foliar spray in standing crop of onion or as a post-harvest dip, followed by mancozeb (0.25%) (Srivinasan *et al.* 2006). Pre-harvest spray of carbendazim 0.1% (Bavistin) before 20 days of harvesting recorded maximum reduction (93.20%) in disease 15 days after storage (DAS) and 56.91 percent at 90 DAS. (Raju and Naik, 2006). Pre-harvest application of carbendazim + mancozeb at 0.2 per cent found most effective against black mould rot incidence in onion caused by *A. niger* followed by iprodione 50WP at 0.2 per cent (Ahir and Maharshi, 2008).

Field cares: Wash and sanitize all equipment and tillage implements regularly. Pathogen inoculum can be easily transferred from a diseased field to another location with tractors and farm implements. Clippers and other tools can also transmit disease organisms from bulb to bulb. Clippers should be frequently disinfected during harvest by dipping them into buckets of chlorinated water (Anonymous, 2009).

Cares at harvesting: Do not clip tops too close to the bulb. Tops should be cut 1/2 to 3/4 inch from the bulb to allow proper drying and sealing of the neck. Follow good sanitation in the field and packing shed. Remove diseased, bruised or sunburned bulbs during harvest, grading and packing to avoid contamination of entire lots. Minimize mechanical damage. Most injuries occur during harvest, grading, packing and shipment, but the injuries can take several days or weeks to become noticeable. Replace any old padding on grading and packing equipment with thick foam around all sharp corners, edges and drop points (Anonymous, 2009).

Storage cares: Keep bulbs dry and practice through curing. This is essential after harvest; wet or improperly cured onions are highly susceptible to fungal rots. Onions are considered cured when the neck is tight and dry. Keep storage and transit temperatures cool. The best storage temperature is 0–2°C (32–35°F); the best relative humidity is 65–70 per cent. When onions are removed from cold storage during warm weather, moisture can condense on the surface and favor decay. In this case, onions should be warmed slowly over a 2 to 3 days period. If cold storage is not available, keep onion storage sheds well ventilated (Anonymous, 2009).

Conclusion

Black mould rot is a major field and storage disease of onion causing serious storage losses at harvest resulting great economic losses in onion growing countries including India. The emphasis should be given on an integrated management approach including selection of healthy planting material, crop rotation, soil solarization, deep ploughing, water and fertilizer management, chemical control, field cares, harvest cares and storage cares for effective management of black mould rot of onion.

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