PP-1039

Fusarium Dry Rot

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The Fusarium fungi cause disease in a number of crops, including potato. In potato it can cause seed decay, wilt and dry rot decay in storage. Most varieties do not have resistance to dry rot.

The most common Fusarium causing dry rot in storage is known as *Fusarium sambucinum* (synonym = *F. sulphureum*). Two Fusarium species can cause seed piece decay; *Fusarium sambucinum* and *F. coeruleum*. Fusarium is both seed-borne and soil-borne. The fungus gains entrance into the tuber only through wounds or injuries associated with cutting, harvesting and handling operations. If such infections are left unchecked, the tubers will slowly rot during storage. Temperatures below 40°F inhibit the growth of Fusarium, and temperatures greater than 50°F allow growth, with growth being more rapid at warmer temperatures.

Dry rot is easily identified by a dry, crumbly decay and the presence of the fungus growing in the rotting tuber (Figures 1 and 2). The fungus may be reddish, white, yellow or dirty tan in color. The rot may be wet if Erwinia (soft rot) bacterial infections occur with the dry rot, as often happens. It may cause a vascular discoloration of the tubers (Figure 3) and the stem (Figure 4) similar to Verticillium wilt and is difficult to distinguish without laboratory tests. It may also cause wilted plants in the field which resemble Verticillium wilt.

Dry rot can be reduced or even halted by the tuber if a proper storage environment is provided and reasonable care is exercised in the harvesting and handling operations. Proper wound healing (suberization) immediately after harvest may wall off early infection sites and prevent further development.

Because infections occur only through wounds, disease begins with cuts, bruises or through openings caused by other diseases. The primary sources of infection are tubers with internal decay, spores on seed tuber surfaces or infested soil clinging to tubers. The fungus is also soil-borne and persists in the soil for many years.

Fusarium produces three kinds of spores: microspores, macrospores and chlamydospores. Macro- and microspores spread rapidly as large numbers of airborne spores, which act as continual inoculum. Chlamydospores persist in the soil for many years and can be present in the soil clinging to tubers at harvest.

Susceptibility to dry rot increases in storage and is the greatest at planting time. Wounds to tubers during harvest act as entry sites for infection (Figure 5). The fresh cut surface of cut seed also acts as a site for dry rot decay (Figure 6).

Figure 1

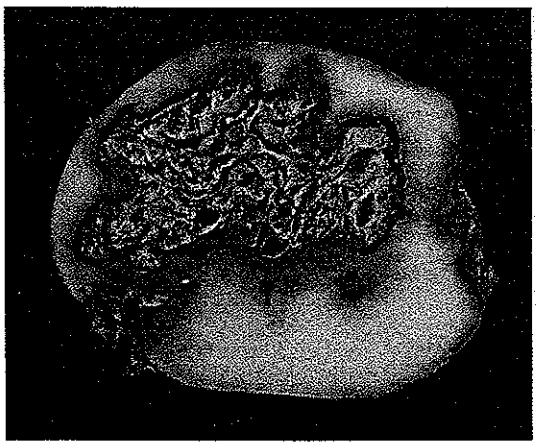

Figure 2

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Management and Control.

Dry rot in storage.

Harvest tubers after vines are dead to assure skin maturity. Avoid injuring or bruising tubers at harvest.

Table 1 lists ways to reduce damage at harvest. Maintain tubers after harvest at 55-65°F and 90-95 percent relative humidity in storage for one to two weeks to promote wound healing. Promote a general storage environment that will enhance suberization, which includes oxygen and humidity. Thiabendazole (TBZ) (Mertect) may be applied post-harvest as part of an overall management program for dry rot control. TBZ has specific activity against Fusarium. Application with a low volume of water is recommended. It is important to apply TBZ by a method which ensures coverage of the entire tuber surface. Tolerance of Fusarium to TBZ has recently been found throughout the United States. Because of this, it is important to not rely totally on post-harvest application of TBZ for dry rot control, but as a tool in an integrated approach to dry rot control. Indiscriminate use or over application of any chemical may increase the occurrence of tolerant strains. Table 2 lists a number of practices that should be considered in a management plan for dry rot reduction and control.

Dry growing conditions favor dry rot because of increased bruising due to higher specific gravity (solids), more clods at harvest, and a tendency for later harvests when the potatoes are colder and more susceptible to bruising.

Seed Decay.

Warm seed tubers for a week before planting or cutting into seed pieces. Treat seed pieces with a fungicidal dust; this will help control new dry rot and indirectly reduce blackleg. Topsin and TBZ have good activity against Fusarium and are recommended as seed piece treatments. Recommended seed treatments and comments can be seen in Table 3.

If cut seed pieces must be stored before planting, hold at 50-60°F with high humidity for the first 24 hours and provide adequate air movement and exchange with fresh air. Do not pile the cut seed more than 6 feet deep. The temperature can be lowered after the first five days or as soon as the cut surfaces have healed over. Prolonged holding of pre-cut seed under improper conditions is risky and can result in severe dry rot decay of the cut seed. Cover all loads of seed during transport to avoid freezing and dehydration.

Fusarium dry rot decay potential can be determined by a simple test. Collect 25-50 tubers, cut in half lengthwise, shake in a paper bag, and store paper bag inside a partly closed plastic bag (to maintain humidity) at room temperature. The amount of dry rot that develops in two weeks can be used to estimate potential for seed decay. Cut tubers can be treated with a seed treatment

Table 1. Checklist for Reduced Bruising

1. See that all unnecessary drops are eliminated and all drops are kept to less than 6 inches.
2. At harvest time, place primary emphasis on keeping bruising at a minimum.
3. Make no modifications on the harvester without first considering the effect on injury.
4. Use either a tractor with a hydrostatic transmission or a harvester that has a 3-speed transmission to provide the flexibility to adapt to varying soil conditions.
5. Minimize tangling and plugging problems caused by wet, tough vines by cutting the vines lying in the furrows with two disc blades or coulters mounted beside each other on a tool bar and angled to form a "V".
6. Adjust the digger blade or bridge the gap between the blade and the primary chain with metal plates so the potatoes do not bump into the front of the chain.
7. Replace the digger chain as often as the manufacturer recommends to minimize flexing of the links that may increase pinching.
8. Minimize link pinching by not using a one-up, one-down link pattern.
9. Use chain with a wider pitch to help minimize soil elimination problems.
10. Use rubber-covered chain throughout the harvester.
11. Keep the chains tight to minimize bouncing of tubers and rocks on the chain and to reduce whipping.
12. Run digger chain speed 1.2 to 1.5 times faster than forward speed.
13. Where hard clods are a problem, do not use severe shakers in a futile attempt to break up the clods.
14. Remember to lower or remove shakers when digging conditions are good.
15. Run the rear cross, elevator and boom chains at a speed which is 0.4 to 0.6 times ground speed in order to keep the chains full.
16. Install belting to divert potatoes away from link hooks and bare link ends.
17. Adjust tilt of the rear crossover and elevator to give a uniform distribution of potatoes over the width of the chains.
18. Carefully regulate boom height to minimize the drop onto the pile in the truck.
19. Stop or slow down the chains whenever you stop or slow down the tractor.
20. If the harvester is PTO driven, increase forward speed by shifting gears rather than by opening the throttle.
21. If windrowing, allow the potatoes to lie for at least 20 minutes before picking them up.
22. Harvest during the hours of the day when the soil temperature is above 45 degrees.
23. Use bruise detector kits, available from extension service staff, to determine actual damage levels at harvest.
24. Have the proper number of trucks to keep the harvester going without hurrying.
25. Tarp every load to avoid the sun and wind damage that can prevent suberization.

compound to determine susceptibility of the Fusarium fungus to the fungicide.

Seed should be planted in a well-aerated moist soil at 50°F, as this is optimum for wound healing and also for minimizing decay. Sanitize all equipment between seed lots.

Dry rot is often difficult to see, especially in seed lots, because decay is often internal. Seed lots are allowed 2 percent dry rot at shipping time and grading may be required to meet this tolerance.

Table 2. Checklist for Dry Rot Reduction in Storage

1. See that bin filling equipment has adequate capacity to allow removal of dirt, debris, and undergrade product and to handle the crop without excessive speeds.
2. See that storage filling personnel are well trained in proper procedures to reduce tuber damage.
3. See that all potato handling surfaces are rubberized or padded on every piece of equipment used for handling potatoes into storage.
4. Insist on step-piling when placing the crop in the bins.
5. Good skin maturation (set) helps prevent injuries at harvest time that could act as Fusarium entry sites.
6. Avoid cold harvest; cold tubers are more susceptible to bruise and injury.
7. Fusarium can only enter through a wound. By preventing injury, Fusarium infection is prevented.
8. Mertect (TBZ) is the only post harvest chemical treatment registered on potatoes for dry rot control. Application rate is 0.42 fl. oz./ton.
9. It is important to use a TBZ application method that gives maximum coverage of the tubers. Best coverage occurs if applied while the tubers are tumbling and the application area is covered and under pressure to cause swirling of the TBZ.
10. After tubers are harvested and in storage, provide conditions favorable for rapid wound healing; plenty of air, humidity and warm temperatures (55-65 degrees F) for 10-14 days, then lower temperature about 0.5 degrees per day until desired temperature for long term storage.
11. Prevent any conditions, such as accumulation of soil or debris that would block air circulation around tubers. Rot can develop in areas of poor circulation.
12. Avoid free moisture on surface of tubers.

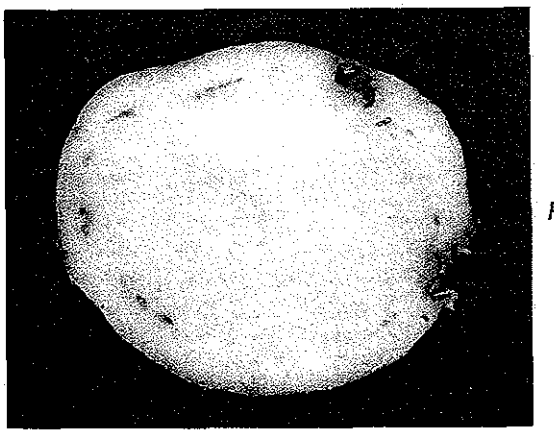

Figure 3

Figure 4

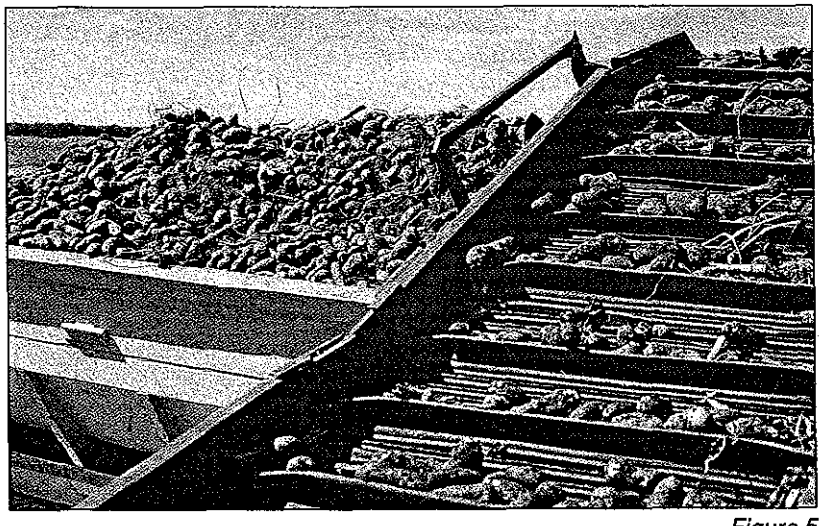

Figure 5

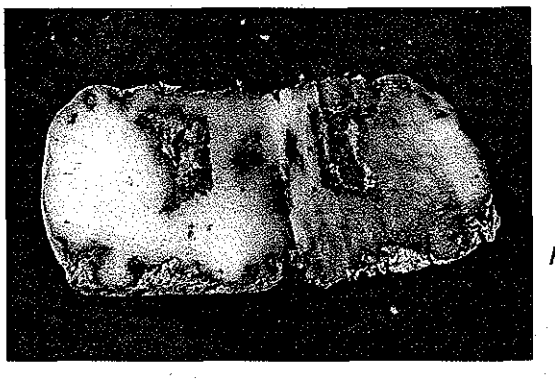

Figure 6