WHAT TO EXPECT FROM SEEDPIECE TREATMENT

by [1]
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Many potato diseases can be introduced with seed. Potato seed may provide a primary means for the spread of numerous pathogens that include viruses (e.g. leafroll, PVS, PVY and TRV), fungi (e.g. Verticillium dahliae, Rhizoctonia solani Ag-3, and Fusarium spp), and bacteria (e.g. Corynebacterium sepedonicum and Erwinia spp). In Idaho there occur two seedborne pathogens of frequent concern to many growers: Erwinia carotovora f. sp. atroseptica, and Fusarium sambucinum. These organisms are commonly associated with seedpiece decay, and these are the pathogens for which the preponderance of this presentation shall be directed.

The blackleg causing bacterium, Erwinia carotovora f. sp. atroseptica (Ea) is of particular concern for Idaho. In addition to the ability to rot potato seed, this bacterium may also produce blackleg symptoms on the potato plant, and these symptoms can occur at any stage of plant development. With this disease (blackleg), the stems exhibit a black decay with water-soaked margins. Generally, the appearance of blackleg begins at the decaying seedpiece and extends up the stem. The pith of the stem is often decayed, and infected plants are commonly stunted and have a stiff erect growth habit. Leaflets and, later, entire plants may wilt, slowly decline, and eventually die. Young shoots may be invaded and killed before emergence. Tubers can be affected with soft rot from Ea. Soft rotted tissues are wet, cream to tan, with a soft, slightly granular consistency. The rotting tissue of tubers infected with Ea are usually odorless in the early stages of decay but as secondary organisms invade the infected tissue, a foul odor may then develop.

The mere presence of Ea is generally not sufficient to produce a problem -- various predisposing factors are also important. These include wet conditions (excess moisture), poor aeration and interaction with other organisms.

There are many accounts in the literature relating fungi to the potato blackleg disease. In Idaho Fusarium sambucinum has been found to interact with Ea. Results have consistently demonstrated the increased potential for yield losses with the Russet Burbank potato when infected with both F. sambucinum and Ea. Yield reduction from these two pathogens has been found to be greater than from either pathogen alone. Since F. sambucinum is commonly associated with either seed or soil, the potential for reduced yield with Ea-infected potatoes appears to be high.

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For two consecutive years we have observed significant effects of F. sambucinum on potato production. These effects have been observed to occur even without reductions of either emergence or stand. Results consistently show that control of Fusarium spp. can be economically significant to the grower. Table 1 demonstrates this relationship. Variables of the study shown with this table include seed that had either not been inoculated or seed that had been inoculated with an isolate of F. sambucinum (Note: seed used with this investigation were naturally infected with Ea). Although emergence and stand were not reduced, the percentage of malformed tubers was significantly increased in the presence of F. sambucinum, and both total and U.S. #1 yields were reduced by 31 to 35 cwt/A.

Among seedpiece treatments with the ability to control this disease, Mertect (TBZ) is relatively inexpensive and it can do an excellent job. Field studies at Aberdeen have shown this product to both suppress the blackleg disease of potato (indirectly with Fusarium control) and to increase potato yield. Table 2 illustrates blackleg control with this product and Table 3 shows a consistency of yield benefits in the field.

Recent results suggest that a control of seedpiece decay may be even more important after a soil fumigation treatment. Table 4 shows this relationship. Among plots that had been treated with Vapam (metam sodium) at 50 gpa, the degree of seedpiece decay was found to be significantly more severe. With a suitable seedpiece treatment for Fusarium control (Tops), the problem was readily corrected.

How could treatment with a soil fumigant increase seedpiece decay caused by Fusarium spp? The removal of organisms in the soil that are suppressive to Fusarium might provide a plausible answer to this question. There are numerous naturally occurring organisms in the soil that possess the ability to inhibit and control Fusarium spp. One of these organisms is a commonly occurring soilborne fungus (Gliomastix). Under controlled conditions we have found this fungus to suppress seedpiece decay of potato. Many bacteria may also inhibit Fusarium spp. Among these bacteria the green fluorescent Pseudomonads have been commonly found to accomplish this.

In addition to relationships of Erwinia and Fusarium spp, Rhizoctonia solani (the causal organism of the rhizoctonia disease) may also be associated with seed. The effects of the rhizoctonia disease of potato are most severe prior to emergence.

At this time the growing tips of sprouts are particularly susceptible to R. solani infection and may be killed before emergence from the soil. In severe cases, a potato stand can be reduced. Lesions that are reddish-brown in appearance occur on underground stems and stolons. Symptom severity may vary from superficial lesion development to a complete cut-off of stems and stolons.

After emergence, the plant becomes more resistant to the disease. For this reason cultural practices that will accelerate plant emergence (e.g. use of a press wheel) may reduce disease severity.

In contrast, factors that will delay emergence (e.g. seedpiece decay) may accelerate the problem. For this reason, the control of seedpiece decay is also recommended with treatments that are directed towards controlling the rhizoctonia disease of potato.

The fungus that causes the rhizoctonia disease (R. solani) may occur either in the soil or be introduced with seed. Our preliminary investigations suggest that in about half of our Idaho fields, some degree of control might be anticipated when the inoculum on the seed is controlled. A seedpiece treatment called Tops (thiophanate) is a material that can accomplish this. In addition to suppressing the seedborne inoculum of R. solani, Tops also provides very good control against Fusarium spp and seedpiece decay (Table 4). Table 5 provides a sample of data comparing several seedpiece treatments for the suppression of rhizoctonia. From these results, Tops was the best of the cleared products to suppress seedborne rhizoctonia. It should be noted that this treatment is only effective against seedborne inoculum. If soilborne inoculum levels of the pathogen (R. solani) Ag-3) are high, Tops will not be effective.

Table 1. Reduction of yield and grade with Fusarium sambucinum on seed.

	Inoculation Treatments	
	Fusarium	Uninoculated
cwt/A Total	355 A	391 B[1/]
cwt/A U.S. No. 1	175 A	207 B
% Malformed Tubers	13 A	8 B

[1/] Comparisons between treatments horizontal. Different letters between treatments denote significant differences to 0.05 P level.

Table 2. Blackleg suppression with seedpiece treatment of mertect (TBZ).

Treatment	% stems with Blackleg 27 July	Log_{10} cfu of Erwinia/g stem tissue 27 July
Untreated	7.6 A[1/]	5.52 A
Mertect (TBZ 0.5% a.i. dust)	0.0 B	4.06 A

[1/] Different letters indicate significant differences to 0.05 P level.

Table 3. Influence of Mertect on total yield.

Treatment	Total cwt/A by location Field No. 1	Field No. 2
Untreated	352 A[1/]	242 X[2/]
Mertect (TBZ 0.5% a.i. dust)	371 B	266 Y

[1/] Different letters denote significant differences to 0.05 P level.

[2/] Different letters denote significant differences to 0.01 P level.

Table 4. Increased seedpiece decay after soil fumigation treatment.

Treatment	% Firm seedpieces 26 July
Not fumigated	68 B[1/]
Fumigated (Vapam 50 gpa)	32 A
Not fumigated - Tops 2.5% dust	78 BC
Fumigated (Vapam 50 gpa) - Tops 2.5 % dust	98 C

[1/] Different letters denote significant differences to 0.05 P level.

Table 5. A comparison of potato seedpiece treatments for the suppression of the Rhizoctonia disease on cv "Russet Burbank"

Treatments	Index of Rhizoctonia stem symptoms	% Rhizoctonia-free stems	% Tubers with >1% scurf	Total cwt/A	% Yield by grade Mal	<4 oz
Control + dust carrier (DC)	17.6 A[1/]	22 A[1/]	73 A[1/]	309[2/]	13 A[1/]	38 A[1/]
Uncleared material #1 + DC	9.8 BC	54 AB	58 A	329	13 A	40 A
PCNB (0.9% a.i. dip) + DC	9.0 BC	55 AB	60 A	309	11 AB	49 AB
Tops (2.5% a.i.) + DC	8.3 BC	60 B	30 B	324	7 C	55 B
Uncleared material #2 + DC	4.8 C	79 B	28 B	351	9 BC	46 AB

[1/] Different letters denote significant differences to 0.05 P level.

[2/] Differences not significant.