Management of Soil and Seed Sources of *Rhizoctonia* with Fungicides

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Rhizoctonia solani is endemic to most potato production regions and can affect potato development over the entire course of the growing season. Symptoms associated with *Rhizoctonia* stem canker include reddish brown to black, sunken lesions on underground plant tissues. These lesions can girdle, or pinch-off stems, stolons and roots. The fungus may also form black sclerotia on the surface of mature tubers and is often referred to as "black scurf". Black scurf can affect the marketability of fresh pack potatoes and the quality of seed tubers if severe. It has been suggested that the most economically damaging aspect of this disease is not due to yield loss. Rather, money is lost due to a shift in the size profile, to more small tubers and fewer larger tubers, and loss of quality.

Conditions that favor extensive disease development include cool, moist soils, short potato rotations and high inoculum. Any condition that delays emergence or slows plant development will increase the chance of a severe disease outbreak. In contrast, anything that speeds up emergence or plant development, such as warm soil temperatures and shallow planting depths, will decrease the impact of *R. solani.*

Infested soil and/or infected seed tubers provide inoculum for disease development. The length of rotation between potato crops is thought to primarily determine *Rhizoctonia* levels in soil, while the amount of scelerotia on seed determines the level of seed inoculum. There is a fair amount of debate over the relative importance of inoculum sources. Seed inoculum is thought to primarily determine early sprout and stem infection levels, while soil inoculum is thought to primarily impact stolon infection and development of black scurf. Inoculum source might also impact fungicide efficacy as seed treatments would be expected to target seed inoculum more effectively compared to in-furrow treatment. Conversely, in-furrow placement would provide a broader zone of treatment for soil inoculum compared to seed treatment. This article summarizes research from 2003-2005 in ID and OR that evaluated the relative importance of inoculum source and fungicide placement on incidence of Rhizoctonia stem canker and black scurf.

Role of Inoculum Source

Seed of several potato cultivars was evaluated at low (seed with no visible sclerotia), medium (<10% black scurf), and high (>10% black scurf) inoculum levels. Prior to planting, the plots were inoculated with *R. solani* cultures at low, medium and high rates. Each level of seed inoculum was planted in each level of soil inoculum.

Seed inoculum consistently impacted disease on both stems and stolons, while soil inoculum only increased disease on stems when present at the highest levels (Figure 1). Furthermore, soil inoculum increased stem disease severity only when very clean seed was planted, while seed inoculum was always important, regardless of soil inoculum (Figure 2). This suggests that seed inoculum is more important than soil inoculum in terms of stem and stolon canker development.

Figure 1. Impact of *Rhizoctonia* inoculum source of stem and stolon disease severity.

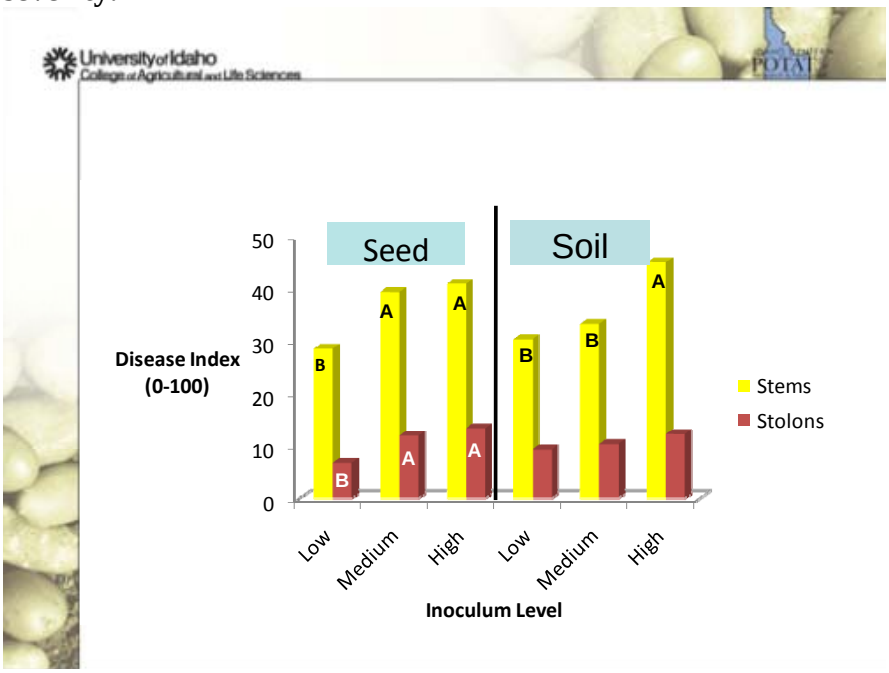
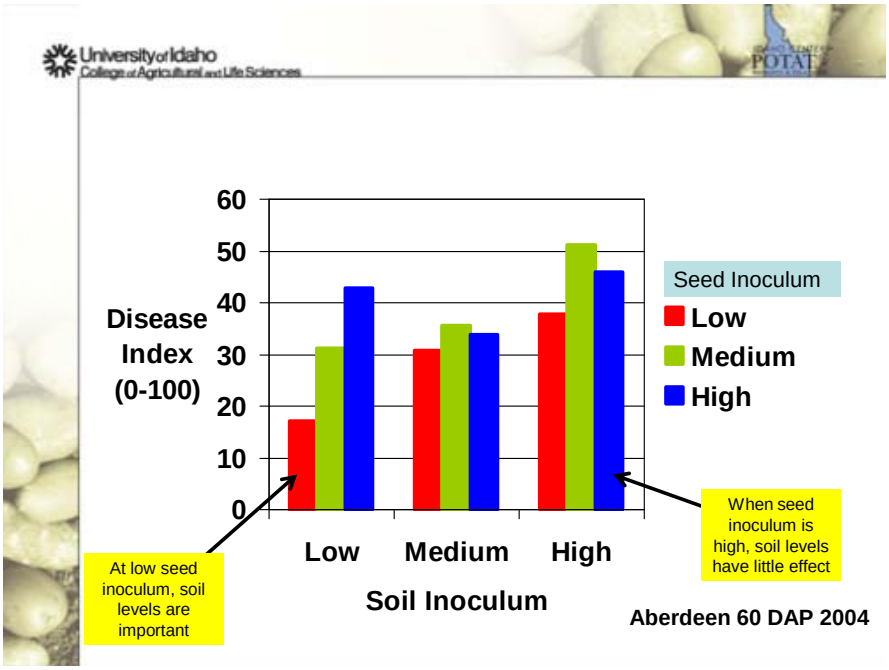
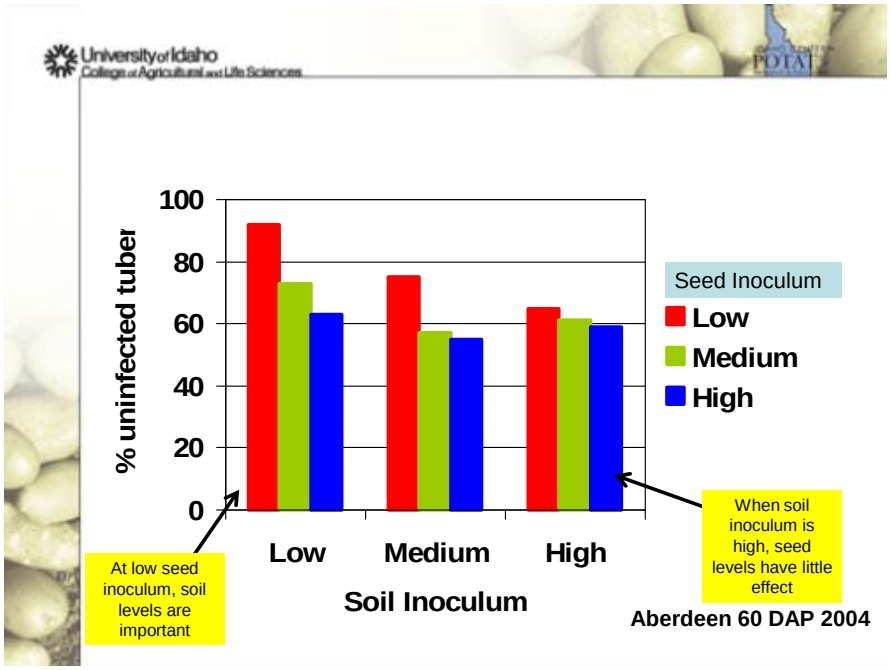


Figure 2. Relationship between seed and soil inoculum sources on development of *Rhizoctonia* stem canker.



Seed and soil inoculum were important in determining the extent of development of black scurf on daughter tubers (Figure 3). This indicates that both rotation length and seed quality impact black scurf incidence.

Figure 3. Relationship between seed and soil inoculum sources on incidence of black scurf on tubers.



Importance of Fungicide Placement

Field studies were conducted to compare the effectiveness of in-furrow fungicide treatment against seed piece treatment for the control of *Rhizoctonia* stem canker and black scurf. The effectiveness of each fungicide placement was evaluated for control of both seed-borne and soil-borne *R. solani* inoculum. Quadris was used as the in-furrow fungicide treatment and Maxim MZ was used as the seed piece treatment. A combination of seed piece treatment with an in-furrow treatment was also evaluated.

All fungicide treatments had significantly lower stem and stolon disease ratings than did the untreated control (Figure 4). Seed treatment with Maxim, and the combination of seed treatment with in-furrow treatment tended to reduce stem and stolon disease ratings more than in-furrow treatment alone. Black scurf ratings on daughter tubers were also significantly reduced by fungicide applications compared to the untreated control (Figure 5). Seed treatment and the combination treatment had lower black scurf ratings than in-furrow treatment alone. While the combination of seed treatment with in-furrow fungicide always has the lowest disease ratings, it was not significantly lower than seed treatment alone.

Figure 4. Impact of fungicide placement on *Rhizoctonia* stem and stolon disease severity.

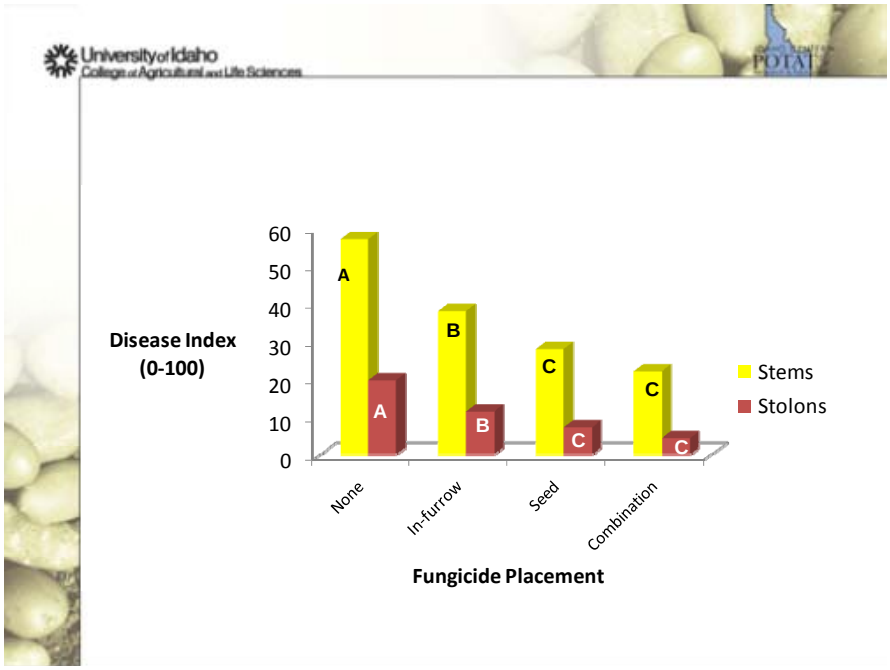
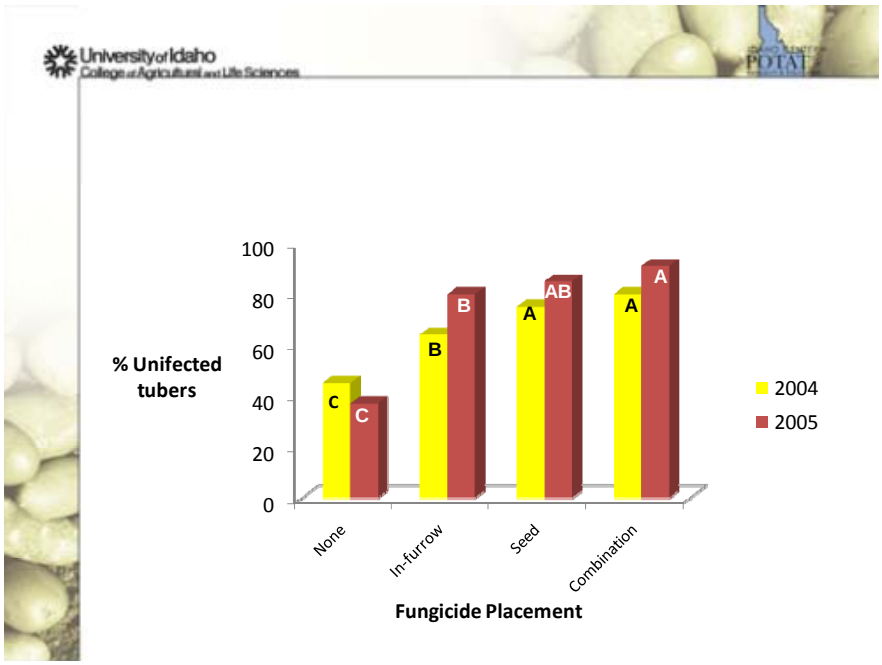
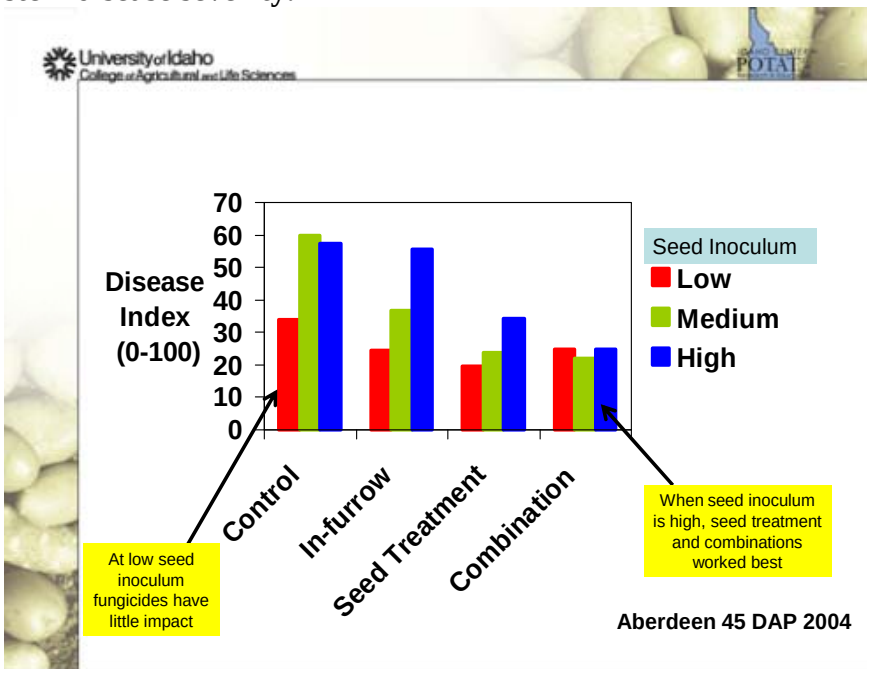


Figure 5. Impact of fungicide placement of black scurf severity.



In general, fungicide treatments caused the greatest reduction in disease levels on stems and stolons when seed inoculum was moderate to high (Figure 6). In furrow treatment was relatively more effective when inoculum was primarily from the soil (Figure 7) compared to when seed was the primary inoculum. In contrast, seed treatment and the combination tended to be effective regardless of inoculum source.

Figure 6. Impact of fungicide placement and seed inoculum level of Rhizoctonia stem disease severity.



Summary

Seed inoculum was always important in determining disease severity of stems, stolons and tubers. Therefore, planting high quality seed with little or no visible black scurf is one of the best ways to reduce damage due to *Rhizoctonia*. Only the high level of soil inoculum consistently increased disease compared to fumigated soil, indicating that in areas with shorter rotations, soil inoculum may influence disease incidence. Both seed treatment and in-furrow fungicides provided disease control, regardless of inoculum source. However, seed treatment and a combination of seed treatment with in-furrow treatment provided more consistent disease control than in-furrow fungicide alone. In-furrow fungicides provided the best control of black scurf when soil inoculum was high while seed treatments provided the best control when seed inoculum was high.

ACKNOWLEDGEMENTS

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Figure 7. Impact of fungicide placement and soil inoculum level of Rhizoctonia stem disease severity.