Reducing Tuber Moth Damage with Proper Cultural Management Practices

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INTRODUCTION

Processors have put the squeeze on tuber moth-infested potatoes. The latest word is zero tolerance in tubers headed to the processor. Let's face it, consumers would make noise if they found worms in their fries. How can growers reduce tuber moth infestation? That question has researchers scrambling to find solutions for growers.

What we know:
1) Tuber infestation is typically end of season when vines senesce and tubers have expanded
2) Infested tubers are those that are typically within 2 inches of the soil surface and are often protruding through the soil surface
3) Green, surface-exposed tubers are more likely to be infested with tuber moth larvae than those that are not green or exposed.

Research conducted in the Columbia Basin during 2000-02 demonstrated how proper planting depth and hill drag-off can be effective tools in reducing tuber greening and surface-exposed tubers. Because of what we know about the tuber moth, reducing the amount of tubers near the top and side surfaces of the hill will likely reduce the ability tuber moths and tuber moth larvae have to invade tubers.

MATERIALS AND METHODS

Ten field experiments investigated the effects of planting depth on three different potato cultivars in Washington State during 2000, 2001, and 2002. Cultivars 'Umatilla Russet' (Umatilla R.) and 'Russet Burbank' (R. Burbank) were each planted in separate trials at 4 and 8 inch depths, measured from the top of the seed piece to the top of the hill, during 2000 and 2001. In 2002, both cultivars, along with 'Ranger Russet' (Ranger R.), were planted together in the same trial at 4, 6, 8, and 10 inch depths. During 2001-02, a small neighboring study was used to investigate the effects of hill drag-off; the initial planting depth was 10 inches and final depth was 6 inches.

Each study was arranged in a randomized complete block design with four replications. Certified seed tubers were hand-cut into pieces between 2 and 3 oz and planted into plots 3 rows by 25 ft long using a custom-built assist feed planter with hydraulic depth adjustment. Depth was checked often during planting and final measurements for each plot were recorded immediately after planting. Except for the drag-off study, hill shape, height, and width of each row were kept similar among treatments at planting. In-row seed piece spacing was 10 inches. Furrows were ripped 16 inches deep using a dammer-diker implement with no change to final seed-piece depth. Plots were harvested between 151 and 165 days after planting (DAP) and vines were removed with a flail 5 to7 days prior to harvest.

Plant emergence counts started at 30 DAP and continued until full emergence. To assess in-season plant development, growth and development data were collected at 70 and 130 DAP from two hand harvests. After vines were removed with a flail, tubers protruding through the soil surface (surface exposed tubers)

within each plot were recorded and the number per acre was calculated.

Plots were harvested with a 1-row mechanical digger. Total tuber yield was partitioned into U.S. No. 1, U.S. No. 2, malformed, and green categories. All data were analyzed using analysis of variance and the means statistically separated using Fisher's Protected Least Significant Difference Test at the 0.05 level of probability. In 2002, data were subjected to regression analysis to determine the effects of 10, 15, 20, and 25 cm planting depths on plant growth and development of R. Burbank, Umatilla R., and Ranger R.

RESULTS

In the 3-year study, tuber greening and surface-exposed tubers were effectively reduced as seed pieces were planted deeper (Figures 1 and 2). Planting depth was determined by measuring from the top of the planted seed piece to the top of the final hill. Planting too shallow (< 6 inches) increased tuber greening and surface exposed tubers and reduced yields. Additionally, plant emergence was occasionally delayed by planting into dry, shallow ground (< 6 inches) versus planting into deeper moist ground (6 to 10 inches). Planting too deep (> 8 inches), however, also reduced emergence. Umatilla Russet and Gem Russet were especially sensitive to soil temperatures and generally slower to emerge from deeper planting depths than the other cultivars.

Hill drag-off followed by moderate post-planting hilling with a dammer-diker also effectively reduced green and surface-exposed tuber production by widening the hill. After both operations, final seed piece depth was between 6 and 8 inches. Widening the hill provided tubers additional room to bulk without being pushed out the side of the hill by other tubers. Post-planting hilling and drag-off also delayed weed growth.

DISCUSSION

The ideal planting depth is the one that will optimize grower revenue. However, no single planting depth will optimize grower revenue across all situations. Because dry soils can reduce emergence prior to irrigation, growers should plant into the deeper, moist soil and take steps to conserve soil moisture prior to plant emergence. Additionally, varieties with large tubers and yield require more soil coverage than those with smaller yields. Growers in the Columbia Basin should combine the proper planting depth with a wide final hill in an effort to reduce the number of tubers near the soil surface, reduce green tuber yield, and reduce the number of tuber moth-infested tubers. This is best done by planting between 6 and 10 inches below the surface of the hill and using hilling disks or post-planting tillage operations to widen the hill. Targeting a final planting depth of 8 inches in the Columbia Basin should provide rapid plant emergence, adequate room for tuber bulking and high yields while minimizing green and surface-exposed tubers.

Despite possible benefits from hill drag-off, growers should consider operating costs for each additional trip through the field and possible reductions in soil moisture from soil disruption. Growers should not use drag-off if their only intent is to "warm seed", rather, they should plant into moist soil between 6 and 8 inches deep and leave the surface soil undisturbed. Drag-off for weed control should be timed late enough to allow a maximum flush of weeds, yet early enough to prevent sprout damage. Without drag-off, an adequate reduction in green and surface-exposed tubers can be achieved by simply selecting the proper planting depth.

Given healthy seed of an adequate and similar size, the interval between planting and emergence for a given cultivar, regardless of planting depth, is largely dependent on soil temperature and moisture. Growers should use planting depth as a production tool to position seed pieces in what will hopefully be the most favorable growth environment throughout the season.

LITERATURE UTILIZED

Schreiber A., A. Jensen, G. Reed, and K. Pike. 2005. Integrated Pest Management Program for Insects and Mites in Oregon and Washington Potatoes. Washington State Potato Commission Website: www.potatoes.com.

Stalham, M.A., J.H. Fowler, and M.J. Pavek. 2001. Effect of planting depth and re-ridging on crop growth and tuber greening in FL 1953. *In*: Cambridge Univ. Potato Growers Res. Assoc. Annual Rep. 2001. Cambridge: CUPGRA, pp. 16-21.

Figure 1. Green Tuber Weight At Harvest
Averaged Across RB, Ranger, Umatilla

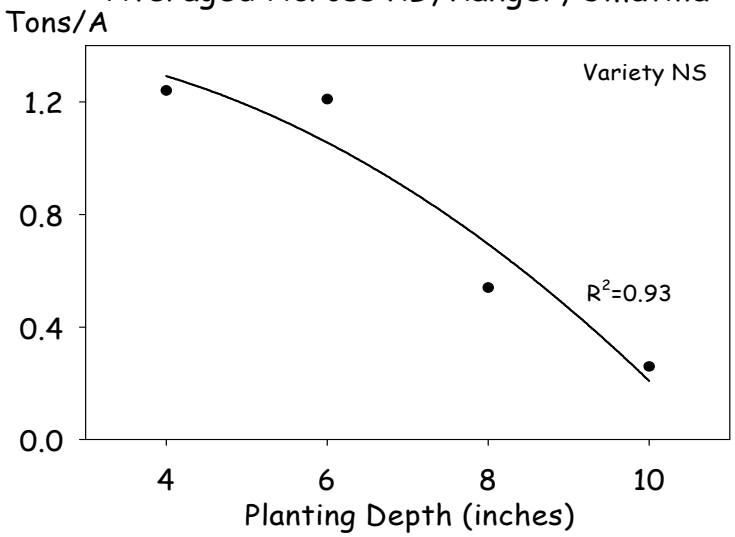

Figure 2. Tubers Per Acre Exposed on Soil Surface Prior to Harvest