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This Year's Crop Can Become Next Year's Weed

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Several years ago I planted a container of mixed wild flower seeds. The mixture looked good for a long time, but then one of the species began dominating the area. That particular flower that had once been a desired plant in the garden had become a weed. The same can be said of any plant, even potatoes.

Research from Washington and the Netherlands has reported that there can be approximately 185,000 tubers left in each acre of a potato field after harvest. This is pretty amazing given that a perfectly planted potato crop in 36-inch rows with a seed piece spacing of 12 inches would have only 14,520 plants. As you can see, volunteer potatoes can become a problem if the tubers left in the field are not killed by winter freezing temperatures. But, how cold and for how long does the cold need to last to kill the tubers left in the field? That is precisely the question studied and reported by USDA-ARS researchers in Prosser, Washington.[1]

Before reporting their results, it may be helpful to understand the processes involved for freeze injury to occur. As you know, potato tubers contain about 80 percent water that is contained both within (intracellular) and between (intercellular) cells. A tuber is usually killed when the water within the cells freezes—intracellular freezing. As water freezes, it gives off heat, and it is at this point that a tuber will actually freeze. Prior to freezing, a tuber can be "supercooled," which means a tuber can survive temperatures slightly below freezing. The flesh of tubers that has been supercooled generally turns gray or reddish brown.[2] After a tuber is supercooled, it releases heat. This releasing of heat is termed exotherm, and the temperature at which exotherm occurs is called the nucleation temperature.

In their laboratory studies using tubers placed in columns of air-dried soil, the USDA-ARS researchers found that most tubers could be supercooled to 19 to 27°F (-3 to -7°C) before an exotherm (releasing of heat) occurred. After the exotherm, the tuber temperature increased and stabilized at about 29°F (-1.4 to -1.5°C). The researchers interpreted this 29°F temperature to be the actual freezing temperature of tubers. The time it took to freeze individual tubers varied by as much as 10 hours.

In the field studies, whole Russet Burbank tubers weighing about 5 to 7 ounces were buried in November in a silt loam or sand soil at depths ranging from 2 to 8 inches—the amount of soil that was above the tubers—in fields that remained fallow throughout the winter. There were one to three locations per year. Thermocouples were placed in each plot to record soil temperature at the center depth of the tuber. The study was repeated for six years. Viability was determined by digging up the tubers in four of the test years, and by counting emerging plants in the remaining two years. In two years, the researchers placed tubers weighing about 1.75 ounces 2, 4, or 8 inches beneath the soil surface and then either left the plots fallow or seeded them with winter wheat at a rate of 98 lbs per acre (110 kg per ha).

> *"Tubers need to be exposed to temperatures of 28°F or less for brief periods to be rendered non-viable."*

Results from the field trials indicated that in five of six winters, at five locations no tubers buried at the 2-inch depth survived the winter, and at one location only 4 percent of the tubers buried at 2 inches survived. In one of the six winters, the soil temperature never got below 28°F even at the 2-inch depth. Consequently, few tubers were killed. During that mild winter at two locations, 95 to 96 percent of the tubers produced a sprout the following spring when buried at 2 inches. They found that at all sites and depths in all years, whenever "minimum soil temperature reached 27°F (-2.8C°), significant tuber mortality occurred."

In plots planted with winter wheat, soil temperatures were no more than 1°F warmer than plots remaining fallow. In one year comparing fallow vs. winter wheat cover, all tubers failed to produce a plant the following spring from either the 2- or 4-inch depth in both the fallow and winter wheat plots where soil temperatures reached 20°F (-6.5°C) or colder. Also, fewer tubers produced a sprout the following spring from the 8-inch depth under the winter wheat crop compared with fallow. The researchers surmised this was due to slower warming of the soil in the spring or lower soil moisture. In the second year comparing fallow with winter wheat, the winter wheat cover crop did not affect total emergence of potato sprouts by early June. However, sprout emergence was delayed in May by the winter wheat cover.

Many different sizes of tubers can be left in the field following harvest. The researchers minimally evaluated the effect of tuber size on winter survival. They found that tuber size had little to no effect on survival. They concluded that "Tuber size likely influences shoot vigor, ability to emerge from deeper depths, and ability to recover from various control treatments more than winter survival."

Several points that can be surmised from this research.

- Tubers need to be exposed to temperatures of 28°F or less for brief periods to be rendered non-viable.
- Tubers covered with more than 4 inches of soil are more likely to survive winter freezing temperatures, but

this will be greatly influenced by location and winter temperatures.

- How cold soil becomes is modified by residue and snow cover and soil moisture content.
- There is less temperature fluctuation in moist soil compared with dry soil.
- Tubers in dry soil are more likely to be damaged by freezing temperatures than tubers in moist soil.
- Only a slight amount of supercooling of tubers will likely occur in moist soil.

There will always be a certain number of tubers that will remain in the field after harvest. From a practical standpoint, this research clearly shows that producers should do all they can to keep tubers near the soil surface. Leaving potato tubers near the soil surface and allowing them to freeze over winter is likely your best management option in combating a volunteer potato problem the following season. Controlling potato volunteers the following season will require multiple cultural and chemical practices to minimize potential problems caused by volunteer potatoes.

[1]Boydston, R.A., M.D. Seymour, C.R. Brown, and A.K. Alva. 2006. Freezing Behavior of Potato (*Solanum tuberosum*) Tubers in Soil. Amer. J. Potato Res. 83:305-315.

[2]Thornton, R.E. Low-Temperature Injury to Tubers. *In* Compendium of Potato Diseases. 2001. W.R. Stevenson, R. Loria, G.D. Franc, and K.P. Weingartner (eds.). pgs. 90-91.

About the Author: See pub box.

Did You Know?

The first time the average yield in Idaho reached the 100 cwt per acre mark was in 1909 when producers harvested an average of exactly 100 cwt per acre from 28,000 acres.

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