



# Potato Progress

Research & Extension for the Potato Industry of Idaho, Oregon, & Washington

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## Pre- and Early Season Control Measures for Late Blight

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### Volunteer potatoes

During recent epidemics of late blight late in the 2014 and 2015 growing seasons there was speculation as to the origin of these outbreaks and debate as to the relative importance of overwintering sources of inoculum. *Phytophthora infestans*, the causal agent of late blight, overwinters in potato tubers intended for planting as seed, but may also be harbored in waste or cull potatoes, or in late blight-infected volunteer potatoes left behind in the field during harvest the previous season.

Volunteer potatoes have become an important perennial weed in many potato growing regions. Researchers in Washington State have reported that up to 1.1 million tubers per acre are returned to the soil after harvest. Potato sprouts emerge from overwintered tubers and grow rapidly in the spring. This rapid growth, combined with the tuber's ability to re-sprout, makes them very difficult to control, even with multiple control measures. Studies with field corn showed that when volunteer potatoes were not controlled, corn yields were reduced up to 62%. Volunteer potatoes also act as hosts for a number of important pests and diseases, including late blight, Colorado potato beetle, *Potato leafroll virus*, *Potato virus Y*, and nematodes such as *Paratrichodorus allius* (the nematode that transmits *Tobacco rattle virus*, the causal agent of corky ringspot disease).

Potato tubers are susceptible to cold injury and in the past tubers left in the soil after harvest would likely be killed by freezing soil temperatures during winter. Tuber death resulting from cold injury is usually caused by freezing of intracellular water in the tuber tissue. Field trials conducted in Washington State showed that when soil temperatures at tuber depth reached 27°F or lower, extensive tuber death occurred.

Winters in the PNW are becoming warmer which may favor survival of volunteer potatoes and cull potatoes over winter. With the recent trend for warmer winters, more volunteers and cull pile potatoes are surviving the winter and acting as sources of disease inoculum in the spring. Recent studies have shown that mycelia of newer genotypes of *P. infestans* (e.g. US-8 and US-23) are becoming more tolerant to cold temperatures and are tolerant to 27°F for up to three days continuous exposure.

We have developed a model that predicts the likelihood of tuber survival over the winter based on soil temperatures at 2 and 4 inches between November 1st and March 31<sup>st</sup>. (see: <http://bit.ly/1eEGuF4>). During the 2014/2015 winter in Idaho, most areas in the Snake River Valley experienced conditions that placed them in the high-risk category for volunteer survival. Even with the severe sub-zero air temperatures in mid-November 2014, none of the locations where the model was run had average monthly soil temperatures below 30°F. This winter (2015/2016), the situation was essentially the same as in the winter of 2014/2015, with average monthly soil temperatures above 31°F in all locations except Parma, which had an average monthly temperature of 28°F in January 2016 (Table 1).

**Table 1.** Average monthly soil temperatures (°F) at 4 inches below the soil surface for winter 2015/2016.

Month	Agrimet Location								
	Ashton	Rexburg	Aberdeen	Malta	Rupert	Twin Falls	Picabo	Fairfield	Parma
November	37	35	43	40	40	42	37	37	37
December	32	31	36	34	32	36	33	34	31
January	33	32	33	33	31	32	34	33	28
February	34	33	34	35	34	35	34	33	33
March	36	38	43	42	43	45	38	34	40

This situation should alert growers to the high risk of potato volunteers surviving the winter and all growers should therefore be implementing their IPM scouting programs early in 2016 and considering volunteer elimination programs in adjacent non-potato crops if possible. Growers in southeast Idaho counties where the 2015 late blight outbreak was most severe should be especially vigilant, as similar conditions last spring lead to the earliest recorded outbreak of late blight in the state (July 10) for over a decade.

### Cull Potatoes

Late blight can also survive the winter in cull potatoes. Cull potatoes are those potatoes deemed unusable for the fresh market, processing, or dehydration because they don't meet minimum size, grade, or quality standards, or potatoes disposed of for some other reason such as overproduction or waste (slivers) from seed production.

It is difficult to estimate the probability that late blight infected potato stems or foliage will emerge from culled potato tubers. Several factors can influence the fate of the infected tuber. If the infection is severe, then the tuber may rot and prevent sprout development. Tuber infection, however, may be localized and optimal in terms of inoculum load and therefore it is possible that a developing sprout or the tuber itself could become infected and initiate an epidemic. Under optimal environmental conditions (cool, wet weather) the disease can then spread within individual plants, between plants, and to neighboring crops. Research has shown that the temperature within discarded cull piles may influence core tuber tissue temperatures affecting the survival of tuber tissue and thus *P. infestans* mycelia in infected tubers. Consequently, the risk of initiation of an epidemic of late blight from cull piles is closely related to the temperature experience of overwintered potato culls. Although the potatoes at the top and bottom of a cull pile may freeze over the winter when ambient air temperatures fall below freezing, research has shown that the temperature in the middle of the pile remained stable regardless of cull pile size (1-15 ton). Since cull piles in excess of 1 ton may enhance the survival of tubers and thus the *P. infestans* mycelia even in the coldest winters it is important to follow cull and waste potato management guidelines.

### Seed Treatments

Infected seed is thought to be the most important source of primary inoculum of *Phytophthora infestans* the cause of potato late blight. In the past, some specialists used to believe it was best to let late blight destroy already infected seed tubers and therefore prevent them from initiating epidemics. This may have been a practical solution with certain genotypes of the pathogen, such as US8, that were so aggressive they would totally rot infected tubers and kill sprouts before any had time to emerge. However, recent studies indicate that the newer genotypes of *P. infestans*, including US22, US23 and US24, are less aggressive on tubers than older genotypes, which may mean that more infected seed pieces could survive infection and initiate late blight epidemics. In 2015, US23 was the predominant and only genotype isolated from infected plants in the widespread late blight outbreak in southeast Idaho. As such, the use of an effective seed treatment is highly recommended for the control of late blight.

Seed treatments are easily applied and the treatments are generally inexpensive compared to foliar sprays. In addition, research has shown that plant growth will be more vigorous and the crop will produce greater yields if seed pieces are free of pathogens. When using a seed treatment to control late blight it is

essential to ensure that one or more of the components of the fungicide being used has efficacy against *P. infestans*, since there are numerous seed treatments available on the market which do not protect against late blight but are very effective against other seed-borne diseases such as Fusarium dry rot and Rhizoctonia. Some effective seed treatments that are NOT effective against *P. infestans* include fludioxonil (Maxim 4FS), penflufen (Emesto Silver), and flutolanil (Moncoat). In general, any seed treatment product containing mancozeb will provide effective control against seed-borne late blight. Seed treatment fungicides currently registered for use on potato in Idaho which contain mancozeb include Maxim MZ, Moncoat MZ and Nubark Mancozeb. Although Emesto Silver doesn't contain mancozeb the label does recommend "a Mancozeb containing product specifically designed for application to potatoes in place of the inert absorbent." Using a dust product containing mancozeb would thus provide protection against late blight. Cymoxanil (Curzate) is a systemic fungicide which is very effective against *P. infestans* and registered as a seed treatment. Fenamidone (Reason 500SC) is an effective foliar fungicide which has recently had its label updated and is now registered for use as a seed treatment for control of late blight. Mandipropamid (Revus) is another effective systemic foliar fungicide which is in the process of having its label updated so that it can be used as a seed treatment. However, it is not yet labeled for use as a seed treatment in Idaho so should not be used as a seed treatment at this time.

Seed treatments provide a chemical barrier around healthy seed pieces and also reduce the number of spores produced on the cut seed surface of infected seed pieces, thereby reducing the number of spores that can be spread during the seed cutting and handling operation. In addition to maintaining seed health after cutting and re-storage before planting, these products will also improve emergence and reduce incidence of bacterial soft rot and blackleg as they also reduce secondary infection by bacterial pathogens.

### **Cull and Waste Potato Management Options**

Potato production and processing operations may accumulate cull piles at any time during the year, but several periods are especially critical. In the spring during cutting and planting, potato waste material may accumulate as seed pieces or tubers are discarded due to size or disease problems. At harvest, potatoes that do not make the grade due to size, disease, or defects are sorted out and discarded prior to placement of the crop in storage. Disposal of cull potatoes discarded from storage or from in-coming seed lots during the spring pose a challenge for the industry. Depending on the timing of disposal, there is a real chance that these culls will not be thoroughly frozen to prevent new growth. Therefore, potatoes which are discarded during the winter and spring as culls should be disposed of in a way that will ensure they do not sprout and grow to provide unprotected foliage which could be a source of late blight to threaten the new season's crop. The method of disposal will generally depend on the individual situation (location, amount of potatoes, etc.) as well as the time of year. Disposal of potatoes in the winter months when waste potatoes can be reliably expected to freeze can greatly simplify the process, while disposal in the warmer months can greatly add to the challenge of proper disposal.

Disposal of cull potatoes during the winter by spreading them on fields that will not be used for potato production is a very good option for cull potato management. However, it is important to avoid fields that will be planted with potatoes in the following season as cull potatoes can introduce nematodes, weed seeds and other soilborne diseases to the field. Once applied to the field every effort to crush, cut and destroy the tubers should be attempted. These methods include running heavy machinery over the tubers or a cutting tool that does not bury the tubers. Crushing and chopping cull potatoes into smaller pieces makes the tuber tissue more susceptible to rot and desiccation, which is desirable. Weather conditions during the winter will also lead to desiccation of tubers, which will make spring field tillage easier. Avoid tilling until cull potatoes have had substantial time to freeze and desiccate. Premature tilling could bury live tubers deep enough in the soil to insulate them from further exposure to killing temperatures allowing them to survive the winter as volunteer potatoes.

It is extremely important not to pile waste potatoes too high during field disposal. As described above, this practice will often serve merely to insulate the potatoes underneath from freezing. Spread cull potatoes on top of the soil surface no more than two potato layers deep (approximately 6 inches). If spreading tubers is not an option and the amount is small e.g. up to 1000 cwt, growers may opt to dispose of tubers by piling

them into **temporary** cull piles. Culls should be piled close to areas where they can be closely monitored to insure that there will be no unprotected sprouting and foliar growth. These culls should be covered with black plastic sheets to increase the temperature of the respiring tubers and accelerate the rate of breakdown.

Whenever cull potatoes are discarded the area should be periodically monitored to assure that any unprotected foliage does not occur. The pile should also not be near residential areas, surface waters or wetlands due to potential for odor and leaching problems.

Cull potatoes are a significant fertilizer source that needs to be accounted for when calculating the fertility requirements of the crop following cull potato application. Fields that will be planted with grain or forage are particularly good candidates for using cull potatoes as a partial fertilizer source.

Other options for cull potato management in the warmer months of the year include burial, composting, and livestock feed. For further information refer to the University of Idaho bulletin CIS 814, *Cull and Waste Potato Management*.

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## Upcoming Field Days and Other Events

### **Parma/Malheur Cropping Systems Agronomy Field Day** - June 20, 8:30 am

- Location: University of Idaho, Parma R&E Center, 29603 U of I Lane, Parma, ID, 83660.
- Agenda
  - 8:30 am – 9:00 am Registration
  - 9:00 am – 12 noon Touring the experimental plots/demos
  - 12:00 noon – 1 pm Lunch/indoor presentations
- Crops/topics covered: winter & spring wheat, beans, corn, fresh peas/mustard/wheat rotations, nutrient management, water management, weed management, unmanned aerial vehicles, crop sensors. Detailed information will follow shortly.

### **Potato Virus Detection Training** – June 20, 9:00 am

- Location: Washington State University, Othello.
- For details, see attached flyer.

### **Oregon State University Hermiston Potato Field Day** – June 22, 8:00 am

- Location: Oregon State University, Hermiston Agricultural Research and Extension Center.
- Details to follow.

### **Washington State University Potato Field Day** – June 23, 8:00 am

- Location: Washington State University, Othello.
- Details to follow.