

Potato Late blight Update 8/19/2013 and Late Season Recommendations

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Late blight was reported in potatoes on August 20, 2013 in central Bingham county in a field with solid set irrigation. This is the first report of late blight in Idaho for several years. This year there have been numerous outbreaks of late blight up the east coast of the US, with reports from New Jersey and other mid-Atlantic states. There have also been several outbreaks of late blight in Michigan and Wisconsin. To date, most of the late blight strains in the outbreaks have been identified as US23. It is not yet known what genotype is responsible for the current outbreak in Idaho, but studies are underway to determine this.

For further information see: <http://www.idahopotatodiseases.org>

Monitoring and control

Effective management of this disease requires implementation of an integrated disease management approach. Although the most important measures are cultural, resistant cultivars and chemical controls should also be utilized.

Late Season Disease Biology and Recommendations

Sporulation in this pathogen is favored by wet weather with moderate temperatures (60 – 80°F), high humidity and frequent rainfall. Under such conditions, the disease can spread extremely rapidly and has the potential to completely defoliate fields within three weeks of the first visible infections if no control measures are taken. In addition to attacking foliage, *P. infestans* can infect tubers at any stage of development before or after harvest and rot of tubers often occurs in storage following tuber infections. Considering the extremely hot and dry weather which has been prevalent in southern Idaho this summer it is surprising that an outbreak of late blight has occurred. However, it illustrates that in fields with solid set sprinkler or pivot irrigation can have microclimates with suitably wet conditions for disease development.

Symptoms

The first symptoms of late blight in the field are small, light to dark green, circular to irregularly shaped water soaked lesions (See the Late Blight Bulletin). These usually first appear on the lower leaves where the microclimate is more humid. However, they may occur on upper leaves if weather conditions are favorable and the pathogen has been carried into the field by air currents. Lesions often begin to develop on the compound leaf near the point of attachment to the petiole (which is often cupped) or edges, where dew is retained longest. During cool, moist weather, lesions expand rapidly into large, dark brown or black spots, often appearing greasy. Lesions are not limited by leaf veins, and if formed at leaf tips or edges, they can cause young expanding leaves to be misshapen. As new infections occur, and existing lesions coalesce, entire leaves may become blighted and killed within a few days. On stems, lesions are often initiated at the point of attachment to the stem and leaves become detached shortly after infection. The lesions continue to develop along the length of the stem and even in hot dry weather can remain active.

In the early morning or during cool damp weather, a white velvety growth may be seen on the underside of infected leaves. This white velvety growth distinguishes late blight from

several other foliar diseases of potato. A pale green to yellow border is also often present around lesions. Plants severely affected by late blight also have a distinctive odor resulting from the rapid breakdown of potato tissue. This odor is similar to that produced by chemical vine-kill or after severe frost.

Late blight infection of tubers is characterized by irregularly shaped, slightly depressed brown to purplish areas on the skin. These symptoms may be less obvious on russet and red-skinned cultivars. A tan to reddish-brown, dry, granular rot is found under the skin in the discolored area, extending into the tuber usually less than half an inch. The extent of rotting in a tuber depends on the susceptibility of the cultivar, temperature, and length of time after the initial infection. The margin of diseased tissue is not distinct and is marked by brown finger-like extensions into the healthy tissue of the tuber. In time, the entire tuber becomes blighted and discolored. Late blight rot of tubers is often accompanied by soft rot.

Positive identification of late blight can be made by microscopic examination of lesions from infected leaves or tubers collected when the fungus is producing spores. The water mold can be quickly identified by the distinctive size and shape of the spores and spore bearing stalks.

Late Season Disease Cycle

Sporangia may germinate at temperatures between 44 to 55°F when free water is present on leaves and form 8 to 12 zoospores per sporangium. These swim freely in water films, attach to the leaf surface (encyst), and infect the plant. Encysted zoospores infect leaves by penetrating the leaf surface with a germ tube, either through stomata (breathing pores) or by means of direct penetration. At temperatures of 55 to 70°F, sporangia germinate by means of a single germ tube. Night temperatures of 50 to 60°F accompanied by light rain, fog, or heavy dew, followed by days of 60 to 75°F with high relative humidity, are ideal for late blight infection and development. Tubers may become infected if sporangia produced on the foliage are washed down into the soil by rain or irrigation water. Water-borne spores appear to follow stems and stolons in a water film into the soil, reach tubers, and cause infection. Tubers near the soil surface are thus more likely to be infected.

Phytophthora infestans can only survive in living potato tissue, and usually survives from year to year in infected tubers placed in storage, in piles of cull potatoes or infected tubers missed during harvest that remain unfrozen over the winter (volunteer potatoes). In the spring, the pathogen can be transmitted from infected tubers in cull piles or volunteers to potato foliage by airborne spores. Infected seed potatoes are also an important source of disease. Some infected tubers may rot in the soil before emergence, and not every potato that emerges from an infected tuber will contract late blight. Sporangia of *Phytophthora infestans* may be spread from infected plants in one field to healthy plants in surrounding fields by wind, splashed rain, mechanical transport and animals thereby continuing the disease cycle. Many reproductive cycles are possible within a season that accounts for the rapid increase in disease once it becomes established in a field.

Recommendations

Late in the season it is advisable to avoid excessive irrigation as tubers become infected with late blight when spores wash down through the soil from infected leaves. Late season fertilizer applications should also be limited as although they will maintain green vines and promote tuber bulking, green and vigorous vines can also be difficult to kill with desiccants and immature tubers are more prone to skinning and therefore infection at harvest. Green vines may

also harbor inoculum that can infect tubers during harvest. At the end of the season petiole nitrate levels should drop down to levels that encourage vine senescence. Vines should also be killed at least two weeks before harvest, especially in blight infected fields. This interval minimizes the chance of tubers getting contaminated with late blight inoculum during harvest, and allows previously infected tubers to decompose in the field. If blight is present in the field or in the vicinity of the field at harvest, it may also be beneficial to spray foliage after vine killing with labeled fungicides to kill living late blight spores on the foliage.

Finally, after harvest if tubers are stored, they should be dry when placed in storage, and the storage air temperature and humidity should be managed so that the tubers remain dry. Condensation of moisture on tubers, resulting from air circulating through the tubers that is warmer than the temperature of the tubers, will cause any late blight present to form spores, and late blight may spread in the pile. Potatoes should be held at the lowest temperature possible consistent with their ultimate use (table stock or chipping). Most fungi do not grow much at temperatures of 38°F or lower, but some development will occur at higher temperatures.

Chemical control

Under high disease pressure situations the programs incorporating Revus products, Forum, Curzate 60DF, Ranman, Tanos, Gavel or Previcur Flex should be used. Consult your local advisor for appropriate rates and additional combinations. These products must be used in combination with protectant materials such as EBDC or chlorothalonil-based products. Products of note for controlling late blight include Tanos [Group 11, DuPont, 25% cymoxanil (as in Curzate) + 25% famoxadone] which should be applied at 6.0 oz/A (no more than 6 applications per year and mixture with Manzate or chlorothalonil recommended. Do not mix or follow with a Group 11 fungicide e.g. Quadris, 14 day PHI). Other very effective products include Gavel (zoxamide + mancozeb, Gowan Company), Revus (Group 40, mandipropamid) and Ranman (Group 21, cyazofamid). Applied within a protectant program all of these products give excellent late blight control. Gavel is also best used as a protectant and has been reported to reduce tuber blight.

Destruction of areas within crops with late blight should follow the rules that 30 rows either side of the newest lesions at the border of the late blight locus and 100 feet along the row (either side) are killed with Reglone or with Gramoxone. Although harsh, research has shown that the latent period between infection and symptom development is about seven days and although not visible plants within this area are already infected.

In seasons when the severity of weather conditions would not favor severe late blight development, programs based on chlorothalonil [e.g. Bravo WS 6SC, Echo 6SC, Equus 6SC or other formulations], EBDC (e.g. Manzate 75DF, Penncozeb 75DF, Polyram 80WP) will reduce the risk of the establishment of the disease. The addition of TPTH 80WP to any of the protectant programs would enhance disease control particularly towards the end of the growing season. (TPTH 80WP has a seven-day pre-harvest interval, also note maximum use rate since 2002 is 11.25 oz per season). For organic growers, fixed copper-based products (such as Champ and Kocide) can also be used in protectant programs. These products are best used early in programs or immediate post-harvest for killing spores perhaps from adjacent crops and should always be applied at the full recommended rate of application. The observations of individuals responsible for implementing programs should determine when best to change from one product to another.

The appropriate placement of translaminar and other systemic products within programs is determined by the mode of action of the product in relation to host and disease development but all products are best used within a preventative protectant program. For example, Previcur, Quadris, Headline, Gem, Gavel or Curzate may be applied to protect new growth early in development. Curzate and Previcur Flex may be applied while the canopy is expanding but before senescence, and Forum is most effective during canopy expansion and as a post-senescence product and can be applied up to late crop senescence.

Recommended programs for late blight control are not straightforward. The product of choice may well depend on how and from where the disease has developed. Some possible scenarios are shown in Table 1 where a range of containment procedures is described for susceptible varieties and different levels of disease in the field.

Table 1. Suggestions for appropriate fungicides for late blight control including semi-systemic fungicides under different late blight conditions in susceptible potato varieties.

Disease category	Late maturing especially storage varieties	
	No senescence - early senescence	Mid- late senescence
a) none	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil Quadris or Headline or Gem + EBDC or Gavel Omega Champ or Kocide can be added to enhance activity	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + Supatin/Agrin + EBDC or chlorothalonil Chlorothalonil or Gavel (various + ZN) Omega Champ or Kocide can be added to enhance activity
b) low random lesions even distribution throughout field (0 - 1% foliar infection)	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + TPTH or Chlorothalonil fb EBDC + TPTH or Chlorothalonil + TPTH 5 day fb Chlorothalonil (various + ZN) or Gavel	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + TPTH or Chlorothalonil fb EBDC + TPTH or Chlorothalonil + TPTH 5 day fb Chlorothalonil various + ZN) or Gavel
c) one or more (upto 5) loci spreading from the edge of the field or from several centers within the field (1% overall field infection but locally heavily infected plants 5 - 10%)	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + TPTH kill infected area with Reglone**** fb EBDC + TPTH or Chlorothalonil + TPTH every 5 days until vines dead	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + TPTH kill infected area with Reglone fb EBDC + TPTH or Chlorothalonil + TPTH every 5 days until vines dead
d) partial crop infection large areas infected with up to 20% loss of GLA evenly distributed throughout the field or large areas of the field	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + TPTH Chlorothalonil (various + ZN) + TPTH kill infected area with Reglone fb EBDC + TPTH or Chlorothalonil + TPTH every 5 days until vines dead	Curzate or Tanos or Forum or Previcur Flex or Revus or Ranman + EBDC or chlorothalonil + TPTH Chlorothalonil (various + ZN) + TPTH kill infected area with Reglone fb EBDC + TPTH or Chlorothalonil + TPTH every 5 days until vines dead
e) 20-100% crop infection with large loss of GLA***	kill infected area with Reglone fb EBDC + TPTH or Chlorothalonil + TPTH every 5 days until vines dead	kill infected area with Reglone fb EBDC + TPTH or Chlorothalonil + TPTH every 5 days until vines dead

fb followed by:

GLA Green Leaf Area

* TPTH has 7 day post harvest interval (max 11.25oz/Acro/season);

** Chlorothalonil has 7 day post harvest interval;

*** Protectant applications of an EBDC or chlorothalonil-based fungicide should be maintained on a 5 day schedule until the vines are completely dead;

**** Infected areas should be treated last and a fungicide should be applied during the exit from the field