

Powdery Mildew and Pumpkins

Pumpkins destined for use as Jack-o-Lanterns are one of the most popular and potentially profitable vegetable crops grown in Saskatchewan. With care and some luck growers can usually expect an abundant harvest of high quality fruit. While few insect pests are of concern in pumpkin production in Saskatchewan, there are a number of diseases that can cause problems – with Powdery Mildew at the top of the list. Many vegetable crops are affected by powdery mildew – but the frequency of occurrence and severity of crop damage experienced in Saskatchewan are highest in the cucurbits (melons, cucumbers, squash and pumpkins). Within the cucurbits, melons and cucumbers tend to be most resistant to powdery mildew, while the squash and pumpkins are more prone to damage.

Powdery mildew disease is caused by one or more closely related fungi – with the actual fungal species involved varying with the crop, the region and prevailing weather conditions. While the disease shows up across North America every year, there is still considerable debate as to the source of the initial inoculum that starts the mildew outbreak. The powdery mildew organism can produce a resting spore form capable of overwintering but there is limited evidence that the yearly outbreaks actually spring from this relatively rare inoculum source. Alternatively, the powdery mildew may carry over on plants which grow through the winter in more southerly areas – with spores produced by these host plants being spread large distances on the wind. The concept of wind spread from more southerly plantings may explain why the infection typically arrives in Saskatchewan relatively late in the growing season.

Powdery mildew is well adapted to the growing conditions typically encountered in mid-summer in Saskatchewan. It can infect plants over the range of temperatures experienced during a Saskatchewan summer – and most importantly, infection and development of the disease does not rely on high humidities or leaf wetness. While mildew typically attacks the older leaves first, it is capable of infecting even the most healthy, vigorously growing crops.

As powdery mildew is a fast moving disease, frequency scouting of the crop is an important step in mildew management. Symptoms of powdery mildew infection are easy to diagnose. The upper and lower surfaces of the leaves, as well as the stems, but rarely the fruit are covered by a fast-growing white fuzz. Much of this fuzz consists of spores ready to spread from the infected tissues onto adjacent plants and crops. Infected leaves and stems turn yellow, then brown within a week of infection. This loss of leaf tissues slows growth of the crop, leading to a loss of yield and fruit quality. In pumpkins, powdery mildew infections result in a reduction in the average size of the fruit and poor fruit colour. While powdery mildew damage to the pumpkin fruit is usually restricted to a few superficial spots, damage to the handles is a major concern as it causes them to shrink, wrinkle and occasionally rot.

In the past, growers relied on foliar-applied fungicides to protect their pumpkin crops against the yield and quality losses caused by powdery mildew. Two classes of fungicide are typically used in management of powdery mildew. Broad spectrum protectant products like chlorothalonil (Bravo) are applied in a preventative manner prior to arrival of the powdery mildew infection. As efficacy of these protectant products hinges on thorough coverage of both the upper and lower leaf surfaces they are best applied using drop nozzles and/or air assist sprayers. These relatively low cost protectant products are applied on a regular basis to maintain high levels of coverage and to insure all new leaves are protected. Once the first signs of mildew are seen growers switch to fungicides like the strobilins (Quadris, Headline, Quilt) and myclobutanil (Nova). These products have more specific activity against powdery mildew and also provide effective protection of both leaf surfaces without requiring as thorough coverage. While these products

can be highly effective, there is evidence that some strains of powdery mildew are at least partially resistant to this class of products.

In 1998 Cornell University produced the first pumpkin lines specifically bred to be resistant to powdery mildew. They achieved this breakthrough by crossing high quality but powdery mildew sensitive pumpkin lines with highly disease resistant wild cucumbers. The first commercially released pumpkin lines with genetic resistance to powdery mildew were Magic Lantern and Merlin. Since then a couple of new powdery mildew resistant cultivars have been added each year – and today most of the most widely sold lines have at least some degree of disease resistance. The degree of resistance expressed by a cultivar is a function of the number of resistance genes it has inherited. If only one of its parents had the resistance genes the new line will only have one copy of the resistance genes – and therefore it will not have a high level of disease resistance - these lines are therefore called “Powdery Mildew Tolerant (PMT). If however both parents used to create a new cultivar have the resistance genes the new cultivar will have two copies of the resistance genes and will therefore be expected to be better able to fight off the disease. These lines are called ‘Powdery Mildew Resistant’ (PMR). While the development of genetic resistance to powdery mildew represents a major step toward affordable, ecologically sound and sustainable disease management, problems with powdery mildew still exist. When conditions are consistently favourable for disease development – such as during the extended period of warm dry weather encountered in Saskatchewan through August and September of 2011 - the disease can overwhelm even the most highly disease resistant cultivars. It is therefore important to evaluate the actual disease resistance expressed under real world conditions. Links to the results from field tests of the relative powdery mildew resistance of a range of commercially popular pumpkin cultivars are available at end of this article.

There is increasing concern that widespread planting of powdery mildew resistant pumpkin cultivars featuring a limited number of resistance genes will exert heavy selection pressure on the fungus – eventually leading to development of powdery mildew populations capable of overcoming even the best genetic resistance. To help slow development of resistance to both the fungicides available to control powdery mildew as well as the genes capable of protecting the crop from this disease growers are being urged to adopt an integrated disease management approach to dealing with powdery mildew. Instead of simply planting a PMT or PMR line and relying on genetics to protect the crop, growers should still monitor the crop looking for signs of breakdown of the genetic protection. Where potential problems are observed – or ideally before they are observed - growers should employ a fungicide to eliminate any mildew fungi that might actually be capable of overcoming the resistance genes protecting the crop. Similarly growers should always rotate between types of fungicide applied in order to slow the development of resistance to these products. In a recent study, Coolong and Seeboth (2011) showed that regular applications of low cost protectant fungicides still enhanced crop health and yields in ‘Camaro’ pumpkin even though this cultivar is considered “powdery mildew resistant”. A more aggressive and costly fungicide program involving both protective and powdery mildew selective fungicides was required to protect the cultivar ‘Aladdin’ which is only considered to be “powdery mildew tolerant”, while even the best fungicide program could not fully protect the cultivar ‘Howden’ as it is genetically susceptible to the disease.

The last time the Vegetable Crops Program at the University of Saskatchewan conducted variety evaluation trials on pumpkins was in 2004 – at which time only a few powdery mildew tolerant lines were available and powdery mildew resistant lines had not yet been developed. The pumpkin cultivars recommend consistently produced high fruit yields even though they were not protected from powdery mildew by either genetic resistance or application of fungicides. Since then many new powdery mildew tolerant and powdery mildew resistant cultivars have been

released but these cultivars have not yet been tested for yields and fruit quality under Saskatchewan growing conditions. Growers should consider this information when selecting pumpkin cultivars and designing their integrated disease management program for powdery mildew.

Powdery mildew reaction of pumpkin cultivars recommended for production in Saskatchewan – based on trials conducted prior to 2005.

Susceptible	Tolerant	Resistant
Appalachian	Gold Dust	
Autumn King	Magic Lantern	
Cotton Candy	Mystic Plus	
Gold Gem	Touch of Autumn	
Gold Standard		
Howdy Doody		
King Midas		
Jack O'Lantern		
Jack Of All Trades		
Lumina		
Racer		
Sorcerer		

Sources : Coolong and Seeboth (2011). HortTechnology 21: p. 533-538.

Links to tests of Powdery Mildew Resistance of Pumpkin Cultivars

- http://vegetablemdonline.ppath.cornell.edu/NewsArticles/Pump_PM_Resistant.html
- <http://www.longislandhort.cornell.edu/vegpath/2005/PMRPkin.pdf>
- <http://vegnet.osu.edu/library/res05/pumpk05.pdf>
- <http://vegnet.osu.edu/library/libr.htm#rr>
- <http://capitalhort.cas.psu.edu/Research.html>