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Effectiveness of Low-Risk Pesticides on Powdery Mildew and Leaf Spot Disease and Cranberry Leaf Mulch for Weed Suppression

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Trials were conducted during the summer of 2011-2013 at the University of Wisconsin West Madison Agricultural Research Station in Verona, Wisconsin. This multi-year trial on cut flowers included two cultivars of purple coneflower: *Echinacea purpurea* and *E. purpurea* 'Rubinstern'; two cultivars of black-eyed susan: *Rudbeckia fulgida* 'Goldstrum' and *R. fulgida* 'Summer Blaze'; and three cultivars of sunflower: *Helianthus annuus* 'Valentine', *H. annuus* 'Ikarus' and *H. annuus* 'Sonja'. Two aspects of research were addressed: One trial evaluated the potential control of powdery mildew and leaf spot diseases using low-risk bio-fungicides on high value cut-flower crops; the second trial examined the effectiveness of a novel mulch type, composted cranberry leaves, for weed suppression in cut flower beds.

Fungicide Trial

Three fungicides as well as an untreated control plot were compared over three years. 'Cease' and 'Regalia' were two certified organic bio-fungicides chosen, and 'Heritage' was a synthetic, conventional fungicide used. Cease' contains a group of natural antifungal and antibacterial compounds with multiple modes of action. It is a preventative bio-fungicide that produces active compounds that disrupt cell membranes, thus inhibiting the germination and growth of plant pathogens on a leaf surface. 'Regalia' induces a response in the plant's defense systems by producing cell strengtheners, antioxidants, phenolics, and pathogenesis-related proteins which inhibit plant pathogens (both fungal and bacterial) internally. 'Heritage' contains is a broad spectrum, preventive fungicide with systemic and curative properties, and is known to have a high risk of pathogen resistance.

Table 1. Characteristics of fungicides used in the trials.

Common name	Active ingredient	FRAC Code or Mode of Action*	Rank of effectiveness on Powdery mildew and Septoria leaf spot in our trials
Heritage	Azoxystrobin	Quinine outside inhibitor (11)	1
Regalia	Extract of giant knotweed (*Reynoutria sachalinensis)*	Induces Systemic Resistance (P5)	2
Cease	*Bacillus subtilis* QST 713	Disrupts cell membranes (44)	3

***** FRAC=Fungicide Resistance Action Committee, FRAC Code list 2013

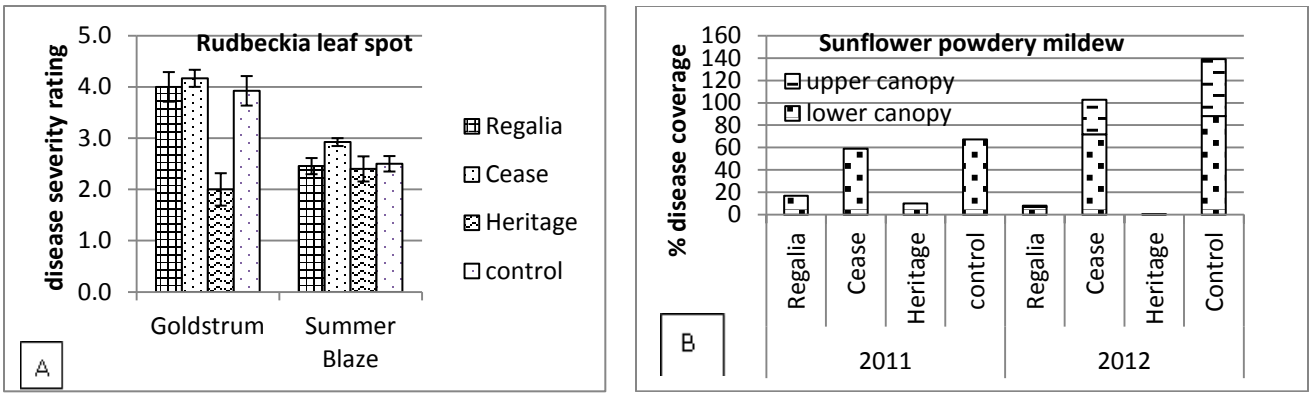

Figure 1. Effect of fungicide treatments on Septoria leaf spot on Rudbeckia in 2013 (A) and powdery mildew on sunflowers in 2011 and 2012 (B). A: Score 1 to 5 with 1=no disease; 2=trace; 3=minor; 4=moderate; 5=severe. Vertical bars on each column in Fig A is the standard error of the mean.

The conventional fungicide 'Heritage' provided the most control; 'Regalia' ranked second. 'Cease' was not effective and comparable to the untreated control. Septoria leaf spot, found only in 2013 on Rudbeckia showed clear cultivar differences (Fig. 1A). No obvious pattern emerged among sunflower cultivars having resistance to powdery mildew. In years with high powdery mildew disease present, 'Regalia' was comparable to 'Hertitage' (Fig. 1B). It was encouraging to find a low risk bio-fungicide, 'Regalia', that is effective and can be added as another mode of action to delay fungicide resistance.

Weed Suppression Trial

Cranberry leaf mulch was applied to 2/3 of all plots at depths of 2" and 4" inches while 1/3 of the plots were left un-mulched, as a control. Weed counts were taken over the summer of 2012 and 2013. Compared to no leaf mulch, the 2" suppressed many weeds after the first round of weeds were counted and removed. However, the grassy weeds started breaking through the 2" depth after about a month's time. Cranberry leaf mulch at 4" depth was an effective barrier against weeds for most of the season, particularly against broadleaf weeds.

Table 2. Summary of weed counts in cranberry leaf mulch trial, 2-yr avg.

	Average # monocots	Average # dicots	% reduction in weed counts over control	
No mulch	197 a	168a	Monocots	dicots
2"	158a	58b	20	65
4"	81b	17c	59	90
p-value	0.0021	0.0001		

Means with different letters within a column are statistically different

The data shows the effectiveness of cranberry leaves as a weed suppression mulch. It can be seen that there is a significant reduction in the number of weeds that grew in areas with cranberry leaves as compared to the areas with no cranberry leaves. The amount of weed suppression in the two-year study shows the impact this product could have for both cranberry growers and consumers as an alternative form of locally sourced mulch. There are very clear differences in the number of weeds that grew in different mulch depths across 2 years. The major conclusion is that 4" depth does an excellent job of suppressing weeds, especially for broadleaf type weeds and has a longer seasonal effect than the 2" depth.

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