

Summary of a Preliminary Evaluation of Raw Milk as a Fungicide for Apple Scab Management in Vermont

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The fungicides containing sulfur and lime sulfur active ingredients are the most commonly used against apple scab, a major disease limitation in organic apple production systems. However, lime sulfur-based fungicides are highly caustic to the applicator. Sulfur is less caustic, but is not as effective against apple scab and has detrimental effects on beneficial mites. In addition, lime sulfur is injurious to the tree and can cause lower fruit yields. Because of these potential non-target impacts on the apple trees and surrounding ecosystem, it is important to evaluate alternative fungicides for apple disease management. With Vermont's large dairy industry, the antifungal properties of milk, and the readily available milk from the University of Vermont dairy farm, it made sense to try milk as an alternative fungicide in the orchard. In scientific literature, milk was found to have antifungal properties in a number of studies. The objective of this trial was to compare the efficacy of a 30% v/v raw milk dilution to

Figure 1. Example of unacceptable fruit at harvest.



a non-sprayed treatment for the control of apple scab and other fungal diseases and to evaluate the potential non-target effects of milk on beneficial and pest arthropod populations. The study was conducted at the University of Vermont Horticultural Research Center on 'McIntosh' trees in a completely randomized design with three single-tree replications. Milk applications were made on approximately a weekly schedule from 26 Apr 2007 to the end of June and every two weeks through 23 Jul 2007. Disease incidence and severity on terminal leaves were recorded in June and August 2007 and on the fruit in September 2007. The milk treatment resulted in no apple scab management, i.e., 96-97% of the fruit had apple scab at harvest (Figure 1; Table 1).

The trees in the research orchard were in poor condition during the growing season and were defoliating prematurely. Therefore, a timed count of the number of yellow leaves per tree was conducted and the milk treatment resulted in significantly more yellow leaves per tree than the non-sprayed treatment, 288.3 yellow leaves compared to 166.7 yellow leaves, respectively (Table 1).

Table 1. Apple scab and yellow leaves on 'McIntosh' trees, 2007

Treatment and rate/A (rate/ha)	Application timing ^z	Scab Incidence %			Average # of
		Terminal leaves ^y		Fruit ^x	yellow leaves ^w
		18-20 Jun	22-24 Aug	10 Sep	18-20 Jun
non-sprayed.....	1-12.....	28.7 ^y	76.0	97.3	166.7 b
raw milk 34 gal (0.32 kl)....	1-12.....	23.8	74.2	96.0	288.3 a

^zApplication timings: 1 = (Green-tip) 26 Apr; 2 = (TC) 7 May; 3 = (Pink) 11 May; 4 = (Pink) 17 May; 5 = (Pink-Bloom) 24 May; 6 = (Petal fall) 29 May; 7 = 7 Jun; 8 = 14 Jun; 9 = 22 Jun; 10 = 29 Jun; 11 = 12 Jul; 12 = 23 Jul.

^yAssessment of 10 terminals per tree on 3 single-tree replicates per treatment

^xAssessment of 50 fruit per tree on 3 single-tree replicates per treatment

^wEach tree was assessed for 5 minutes, counting the number of yellow leaves first in the lower 3m of the canopy, then the remaining upper canopy while circling the tree.

^vNumbers within columns followed by the same letter do not differ significantly, Fisher's Protected LSD, $P \leq 0.05$; columns with no letters following the numbers do not have a significant F-value, Analysis of Variance, $P \leq 0.05$.

This study did not indicate any non-target impacts on arthropod pests. However, the study does indicate a significant adverse effect of milk as shown in the extent of yellowing (dying) leaves (i.e., premature defoliation). In addition, a black growth was observed on the leaves in the milk treatment and may have contributed to the premature defoliation (Figure 2). Overall, milk did not provide management of disease and caused premature leaf yellowing and defoliation of the apple trees.



Figure 2. Black mold observed on milk treated trees.

*Research results are part of a study conducted by Morgan Cromwell for a Master of Science degree. Complete results can be found in: Cromwell, M.L. 2009. Evaluation of alternative fungicides for organic apple production in Vermont. M.S. Thesis, University of Vermont. 151 pp. June 2009