Alternative Fungicides for Management of Sooty Blotch and Flyspeck

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Summer fungicide applications in New England largely target the blemish disease complex, sooty blotch and flyspeck (SBFS). A significant part of the fungicide applications made in apples in a growing season target SBFS. Over the 2000 to 2002 growing season, a set of Massachusetts growers averaged 9 fungicide applications per year, with an average of 3.5 (39%) of those made in summer (Figure 1). Most growers apply captan and/or thiophanate-methyl (Topsin-M and related products) to manage SBFS. Strobilurine fungicides, Flint and Sovran, are also very effective but are prone to resistance development.

Because these fungicides are applied relatively closer to harvest than other fungicides, they present the greatest risk in terms of residue retention. While applications made within label restrictions should present no risk to consumers, the market is such that minimizing the use of older fungicides may be useful to growers. At the least, if new fungicides can found that are less expensive than the strobilurines, it will both save money and delay the development of resistance to these fungicides.

The organic market is expanding, and some growers are looking for organic alternatives to standard fungicides. A number of new materials have come on the market recently, but generally they have not been subjected to rigorous testing by university programs. In order to determine efficacy of these materials, they need to be evaluated in standard tests.

A test at Belchertown in 1997 had shown that $CaNO_3$ and $CaCl_2$ applied six times at two-week intervals could reduce SBFS from levels in non-sprayed controls by 24% and 43%, respectively. However this compared with a 95% reduction obtained by Benlate plus captan applied four times at three-week intervals. More importantly, incidence of SBFS in the calcium treatments was 40% and 54%, while in the standard fungicide treatment it was 3.5%. So, the lesson from this trial was that calcium applications can reduce SBFS, but not to commercially acceptable levels.

In 2006, a block of mature Jonagold/M.7 trees,

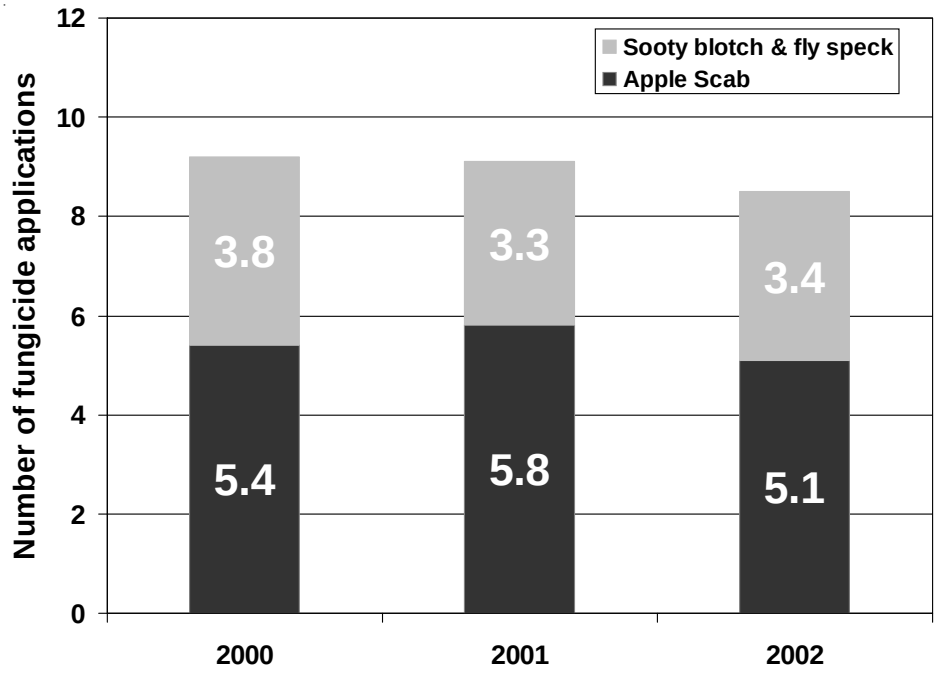

Figure 1. Fungicide applications (and their target organism) by a set of Massachusetts apple growers in 2000-02.

approximately 12 ft tall, were treated with different chemical treatments in order to manage SBFS. The experiment was replicated four times, using single trees with buffer trees between treatment trees. All treatments were applied with an airblast sprayer at 175 gallons/acre, on July 20, August 21, and September 22. A standard treatment of Topsin-M 70W plus Captan 50W (6 ounces plus 1 pound/100 gallons, respectively) was compared to treatments of a lower rate of Captan 50W (0.5 pound/100 gallons), either alone or in combination with calcium chloride (3.3 pounds/100 gallons) or calcium nitrate (5.3 pounds/100 gallons). Calcium treatments also contained Regulaid (1 pint/100 gallons). These were also compared to two relatively new products, Serenade MAX plus Biotune (l pound plus 24 ounces/100 gallons) and Armicarb 100 (5 pounds/100 gallons). Serenade has as an active ingredient a bacterium, *Bacillus subtilis*, that competes with other microbes directly by producing compounds that are toxic to them and indirectly by inducing resistance in the plant. Biotune is a spray adjuvant formulated for use with biocontrols. Armicarb 100 is a potassium carbonate compound that is registered for use on apples. All treatments were compared to trees that were not sprayed.

Fruit were harvested on October 2, and placed in cold storage. On October 19, they were evaluated for incidence and severity of SBFS. Fifty fruit from each tree were rated according to USDA grading standards for sooty blotch and flyspeck. We combined Cull and Utility in a single class.

Extra Fancy Sooty blotch or fly speck which is thinly scattered over less than 5 percent of the surface, or dark, heavily concentrated spots which affect an area of more than one-fourth inch in diameter.

Fancy Sooty blotch or fly speck which is thinly scattered over less than one-tenth of the surface, or dark, heavily concentrated spots which affect an area of more than one-half inch in diameter.

Utility Sooty blotch or fly speck which affects less than one-third of the surface.

Cull Sooty blotch or fly speck which affects more than one-third of the surface.

In terms of incidence alone, that is, whether or not there was any sooty blotch or flyspeck on fruit, only three treatments had a significant effect, Captan/ Topsin-M, Serenade/Biotune, and CaCl /Captan low rate/Regulaid/Vinegar. Similarly, the same treatments had the highest percentages of Extra Fancy fruit, and

Table 1. Incidence of sooty blotch and fly speck in 2006 on Jonagold apples with various treatments.

Treatment	Rate per 100 gallons	Fly speck (%)	Sooty blotch (%)	Total of fly speck and sooty blotch (%)
Captan 50W + Topsin M 70W	1 lb. + 6 oz.	6 a	7 a	12 a
Captan 50W	1 lb.	12 ab	26 ab	33 abc
Captan 50W	8 oz.	20 abcd	23 ab	35 abc
$CaCl_2$ + Regulaid + vinegar	3.3 lb + 1 pt. + 2.2 fl.oz	36 cd	28 ab	47 bc
$CaCl_2$ + Regulaid + vinegar + Captan 50W	3.3 lb + 1 pt. + 2.2 fl.oz + 8 oz.	10 a	17 ab	24 ab
$Ca(NO_3)_2$ + Regulaid	5.3 lb + 1 pt.	35 bcd	24 ab	50 bc
$Ca(NO_3)_2$ + Regulaid + Captan 50W	5.3 lb + 1 pt. + 8 oz.	19 abcd	23 ab	34 abc
Serenade MAX + Biotune	1 lb. + 24 oz.	15 abc	15 ab	23 ab
Armicarb 100	5 lb.	22 abcd	27 ab	40 abc
Control (no spray)	None	40 d	41 b	59 c

Table 2. USDA grade of Jonagold apples with various treatments affecting sooty blotch and flyspeck.

Treatment	Rate per 100 gallons	Extra Fancy (%)	Fancy (%)	Utility/Cull (%)
Captan 50W + Topsin M 70W	1 lb. + 6 oz.	99.5	0.5	0.0
Captan 50W	1 lb.	89.2	9.3	1.6
Captan 50W	8 oz.	90.3	8.2	1.5
$CaCl_2$ + Regulaid + vinegar	3.3 lb + 1 pt. + 2.2 fl.oz	80.2	15.2	4.6
$CaCl_2$ + Regulaid + vinegar + Captan 50W	3.3 lb + 1 pt. + 2.2 fl.oz + 8 oz.	94.5	4.5	1.0
$Ca(NO_3)_2$ + Regulaid	5.3 lb + 1 pt.	83.8	12.6	3.7
$Ca(NO_3)_2$ + Regulaid + Captan 50W	5.3 lb + 1 pt. + 8 oz.	92.0	7.5	0.5
Serenade MAX + Biotune	1 lb. + 24 oz.	91.4	8.6	0.0
Armicarb 100	5 lb.	84.0	14.0	2.0
Control (no spray)	None	71.5	19.7	8.8

the lowest percentages of utility/culls.

Captan/Topsin-M was clearly the best treatment. Removing Topsin-M allowed incidence of SBFS to nearly triple. Calcium treatments alone allowed even higher incidence of SBFS. However, combining calcium chloride with a low rate of captan led to SBFS incidence that, while higher than Captan/Topsin-M, was less than almost all other treatments, including captan alone.

The only treatment to perform as well as calcium chloride/captan was Serenade/Biotune. The other alternative chemical, Armicarb, performed just slightly better than the calcium treatments.

Two issues made it difficult to fully analyze the results. The variability in SBFS from tree to tree with a given treatment was high, and so the normal level for accepting significance of differences, a 95% chance of being correct, was not met when comparing differences between grades. Similarly, in the disease incidence data, large differences in percent were still not significantly different at the 95% level. In addition, the interval between treatment applications was deliberately lengthened to approximately 4 weeks to insure some SBFS. In commercial settings, applications made at 2 to 3 weeks would be more normal, and might lead to more commercially acceptable levels of SBFS in the most promising alternatives, calcium chloride and Serenade treatments.

We plan to repeat this experiment next year using the more promising treatments and shorter application intervals.

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