

Effects of Surfactant Combinations with Captan for Control of Apple Fruit Rots and Russeting

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Introduction

Surfactants are adjuvants that lower the surface tension between two liquids or between a liquid and a solid. Surfactants can improve efficacy of fungicides on crops and could reduce the rate and number of fungicide applications. Combining fungicides and surfactants may increase the efficacy of existing control options. However, since some fungicide-surfactant combinations have been reported to cause phytotoxicity, these compounds should be screened. This is the first year of a two-year study to evaluate commercial surfactants+captan for control of apple fruit rot and phytotoxicity.

Materials and Methods

The trial plot consisted of 9-year-old Redfree, Liberty, and Gold Rush trees on M9 rootstock at the ISU Horticulture Research Station, Ames, Iowa. Six non-ionic surfactants were compared, each with differing active ingredients (Table 1). Each surfactant was applied alone or with captan (2.5 lb/acre). Controls were as follows:

1) unsprayed, 2) high rate of captan (5 lb/acre) with no surfactant, and 3) low rate of captan (2.5 lb/acre) with no surfactant, for a total of 15 treatments

(Table 2). Treatments were replicated four times in a completely randomized experimental design. Subplots consisted of

five trees of a single cultivar, with the end trees in each subplot acting as guard trees.

Captan (4 lb/acre) plus vinegar was used as the first-cover spray for all treatments. Treatments were applied with a 25 gallon carboy and battery-operated pump every 14 days after the first-cover spray until harvest.

At harvest, three arbitrarily chosen branches/tree from three center trees were assessed for number of fruit with russeting. Significance of differences in the incidence of fruit russeting among treatments were determined using the PROC GLM statement in SAS program followed by a protected least significant difference test ($P < 0.05$).

Results and Discussion

Fruit rot symptoms were not observed in the test plot. Apple russeting observed from surfactant+captan treatments did not differ from russeting in the high-captan-rate control ($P > 0.05$). Only Bond+captan differed from the low-rate captan control and showed the highest percentage of russeting (Table 2). The surfactants Widespread Max, Regulaid, Attach, and Bond differed significantly from the non-spray control treatment. In conclusion, combinations of surfactants and captan may have potential for further studies aimed at increasing the efficacy of fungicides to control summer apple diseases.

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Table 1. Surfactants used in combination with captan to determine possible phytotoxic responses on apple.

Surfactant	Surfactant active ingredient	Surfactant properties
Bond	Alcohol ethoxylate, 1,2-propanediol and synthetic latex	Spreader sticker with superior adherence
Attach	Pinene (terpene) polymers, petro-latum, a-(p-Dodecylphenyl)—Omega-hydroxypoly (oxyethylene)	Spreader sticker, reduces photodegradation—filming agent
Widespread Max	Polyalkyleneoxide modified heptamethyltrisiloxane	Lowers surface tension, improves wetting
Regulaid	2-butoxyethanol, poloxalene, monopropylene glycol.	Spreader-activator adjuvant that slows drying time
Latron B 1956	Modified phthalic glycerol alkyd resin	Water-dispersible, resin-based nonionic surfactant spreader-sticker (not a detergent-type wetting agent) that resists rewetting and removal by rain
LI700	Phosphatidylcholine, methylaceticacid and alkylphenoethoxylate	Penetrant, acidifier, prevents alkaline hydrolysis of pesticides

Table 2. Surfactant treatments and incidence (%) of apples with russetting in 2013.

Treatments*	Fungicide used	Rate/acre	% apple with russetting**
Bond+captan	Captan 80WDG + Bond Max	2.5 lb + 20 oz.	2.77 a
WidespreadMax	WidespreadMax	8 oz	2.57 ab
Regulaid	Regulaid	32 oz	2.51 ab
Attach	Attach	16 oz	2.48 ab
Bond	Bond Max	20 oz	2.35 a-c
Regulaid+captan	Captan 80WDG + Regulaid	2.5 lb + 32 oz	2.28 a-d
Latron B-1956+captan	Captan 80WDG + Bond Max	2.5 lb + 20 oz	2.07 a-e
LI700	LI700	32 oz	2.04 a-e
Latron B 1956	Latron B-1956	20 oz	1.63 a-e
LI700+captan	Captan 80WDG + Bond Max	2.5 lb + 32 oz	1.45 a-e
WidespreadMax+captan	Captan 80WDG + WidespreadMax	2.5 lb + 8 oz	0.70 c-e
Attach+captan	Captan 80WDG + Attach	2.5 lb + 16 oz	0.59 de
No spray	None	2.5 lb + 1 gal	0.42 e
Captan low	Captan 80WDG + Topsin M 4.5 FL	2.5 lb	0.97 b-e
Captan high	Captan 80WDG + Topsin M 4.5 FL	5 lb	2.10 a-e

*After the first-cover spray, all treatments except the no-spray control were applied at intervals of 14 days.

**Means followed by the same letter are not significantly different ($P < 0.05$).