

APPLE (*Malus domestica* 'Ramey York')
Scab; *Venturia inaequalis*
Cedar-apple rust; *Gymnosporangium juniperi-virginianae*
Quince rust; *Gymnosporangium clavipes*
Sooty blotch; disease complex
Flyspeck; *Zygothiala jamaicensis*
Bitter rot; *Colletotrichum* spp.
White rot; *Botryosphaeria dothidea*
Fruit finish

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Evaluation of experimental and registered cover spray fungicide combinations for disease control on York apple, 2016.

Seventeen treatments, first applied at petal fall, were compared during the mid-season cover spray period on 16-yr-old trees. The test was conducted in a randomized block design with four single-tree replicates separated by in-row border trees. No fungicides were applied until the first treatment application date 2 May. Dilute treatments were applied to runoff with a single nozzle handgun at 250 psi as first- seventh cover sprays: 2 May (PF, petal fall); 1C-7C, (1st -7th covers): 19 May, 27 May, 10 Jun, 23 Jun, 11 Jul, 27Jul, 22 Aug. All diseases developed from inoculum naturally present in the test area. Foliar data are based on ten shoots per rep 29 Jun. Fruit ratings are based on 25-fruit samples per replication picked 6 Oct and incubated in ambient warm temperatures (64-82° F, mean 69.9° F), first rated 13 Oct and final rating for rots 24 Oct after 18 days' incubation. Maintenance materials applied to the entire test block included: Admire Pro, Altacor, Assail, Asana XL, BioCover, Beleaf, Belt, Danitol, Delegate, Imidan, and Lannate LV. Percentage data were converted by the square root arcsin transformation for statistical analysis.

The test was set up primarily to evaluate the treatments for summer disease control after petal fall, but scab lesions from pre-treatment scab infection periods 22-23 Apr, 28-29 Apr, and 30 Apr-1 May were incubating, and 17 more secondary scab infection periods occurred through May. Also, it is known that scab strains resistant to SI and QoI fungicides are present in the test area, so combinations of several fungicide classes were tested in an attempt to overcome this situation. Under these conditions, combinations involving Inspire Super gave good suppression of scab (Table 1). Aprovia and experimental materials AGR005 and F1757aa also gave significant scab suppression. It is possible that resistance somewhat impacted control by Luna Sensation and some experimental materials. Although scab test pressure was high during the period from petal fall to first cover, treatments involving Aprovia gave excellent fruit scab control as did treatment #17, a combination of Luna Sensation + Inspire Super + Manzate + oil. Cedar-apple rust infection occurred 22 Apr and 1 May and eight more cedar rust infection periods occurred 2 May-12 May. Combinations involving Inspire Super also gave excellent cedar-apple rust control. The protectant treatment, Manzate (#16) was weaker for scab and rust control on foliage, but gave good scab control on fruit. The unidentified "leaf spots" shown in Table 1 were likely partially inhibited rust lesions, but did not have any orange coloration to clearly identify them as such. Aprovia + Inspire Super + Manzate + Oil (#15) had the fewest leaf spots and also was among those with the fewest rust lesions. The 250-hr accumulated wetting hour threshold for sooty blotch/flyspeck (SBFS) activity, accumulating from 14 May, was reached as early as 21 Jun (before the 3rd cover application), and this resulted in good SBFS test conditions. Under these conditions, all treatment schedules ending with Captan + Ziram gave good SBFS control (Table 2). ARY-0438-005 (#2) and F1757aa (#5) were weak for SBFS and the combination of them at the same rates (#6) was less effective than either compound separately. Control of post-storage rots generally followed the pattern of SBFS control, however the early season schedule through 4th cover affected the post-storage control by treatment #13, Aprovia + Inspire Super, which had significantly more rots than #12 (Aprovia + Oil), #15 (Aprovia + Inspire Super + Manzate + Oil), or #16 (Manzate alone). Luna Sensation + Inspire Super + Manzate + Oil followed by Captan + Ziram (#17) also gave excellent rot control. Experimental treatments other than UBI-4319-01 + F1058ab (#9) did not give adequate control of bitter rot. F1757aa (#5) had significantly more bitter rot than the non-treated control. Several treatments were deleterious to fruit finish. Compared to non-treated fruit, Inspire Super + Manzate (#1) significantly increased russet and opalescence. Significant increases in opalescence also occurred with experimental treatments #2-6, and with combinations of Aprovia + Oil (#12), Aprovia + Inspire Super (#13), Aprovia + Inspire Super + Manzate (#14), and with Aprovia + Inspire Super + Manzate (#15), but not with Inspire Super (#10), Aprovia (#11) or Manzate alone (#16).

Table 1. Scab and other early season diseases.

Treatment and rate/100 gal dilute	Timing ^y	Scab			Cedar-apple rust			Quince	“Leaf spots”
		% lvs inf.	lesions/ leaf	% fruit inf.	% lvs inf.	lesions/ leaf	% fruit inf.	rust, % fruit inf.	% leaves infected
0 No fungicide	---	52 fg ^z	5.0c	70g	62h	12.5f	6d	6d	17a-e
1 Inspire Super 2.82EW 3 fl oz + Manzate Pro-Stick 75DF 12 oz Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	13a	0.5ab	0a	1a	<0.1a	0a	0a	13ab
2 ARY-0438-005 11.3WDG 1.55 oz	PF-7C	55g	4.8c	24ef	19b-d	0.8a-c	0a	0a	23b-f
3 AGR005 65WDG 8 oz	PF-7C	26b-d	0.9ab	4bc	24b-d	1.1a-c	0a	0a	27d-f
4 ARY-0438-005 11.3WDG 1.55 oz + AGR005 65WDG 8 oz	PF-7C	30c-e	1.0ab	2ab	42fg	4.5de	0a	0a	26d-f
5 F1757aa 5SC 1.75 fl oz	PF-7C	27cd	0.9ab	18de	47gh	2.7a-d	2c	0a	25b-f
6 ARY-0438-005 11.3WDG 1.55 oz + F1757aa 5SC 1.75 fl oz	PF-7C	20a-c	0.8ab	15de	45g	3.1b-d	0a	2c	25b-f
7 UBI-4319-01 4SC 2 fl oz	PF-7C	51fg	4.4c	30f	14b	0.4ab	0a	0a	24c-f
8 F1058ab 80WDG 12 oz	PF-7C	42e-g	1.3ab	16de	46g	6.6e	0a	1b	31f
9 UBI-4319-01 4SC 2 fl oz + F1058ab 80WDG 12 oz	PF-7C	43e-g	2.0b	8cd	29d-f	2.0a-d	1b	0a	29ef
10 Inspire Super 2.82EW 3 fl oz Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	18a-c	0.6ab	8cd	3a	0.1a	0a	0a	28ef
11 Aprovia 0.83EC 1.4 fl oz Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	23a-c	0.5ab	0a	17ab	0.7a-c	0a	0a	16a-d
12 Aprovia 0.83EC 1.4 fl oz + Oil 1qt Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	21a-c	0.4ab	0a	27c-e	2.3a-d	0a	0a	18a-e
13 Aprovia 0.83EC 1.4 fl oz + Inspire Super 2.82EW 3 fl oz Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	14ab	0.3a	0a	2a	0.1a	0a	0a	14a-c
14 Aprovia 0.83EC 1.4 fl oz + Inspire Super 2.82EW 3 fl oz + Manzate Pro-Stick 75DF 12 oz Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	13a	0.2a	0a	3a	0.1a	0a	0a	17a-e
15 Aprovia 0.83EC 1.4 fl oz + Inspire Super 2.82EW 3 fl oz + Manzate Pro-Stick 75DF 12 oz + Oil 1 qt Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	13a	0.2a	0a	1a	<0.1a	0a	0a	9a
16 Manzate Pro-Stick 75DF 12 oz Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	39d-f	1.3ab	3bc	39e-g	3.5cd	0a	0a	18a-f
17 Luna Sensation 500SC 1.4 fl oz + Inspire Super 3 fl oz + Manzate Pro-Stick 75DF 12 oz + Oil 1 qt Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	PF-4C 5C-7C	15ab	0.3a	0a	3a	<0.1a	0a	0a	20b-f

^z Mean separation by Waller-Duncan K-ratio t-test (p=0.05). Four single-tree replications, ratings of all leaves on each of 10 shoots/tree, 29 Jun. Fruit ratings were of 25-fruit samples per replication, taken 6 Oct, put in warm storage then evaluated 13 Oct.

^y Dilute rates based on 400 gal/A equivalent. Applied dilute to runoff at 250 psi on the following dates: 2 May (PF, petal fall); 1C-7C, (1st - 7th covers): 19 May, 27 May, 10 Jun, 23 Jun, 11 Jul, 27 Jul, 22 Aug. Pre-treatment scab infection periods: 22-23 Apr, 28-29 Apr, 30 Apr-1 May.

Table 2. Summer diseases and fruit finish.

Treatment and rate/100 gal dilute	Timing ^w	Harvest, % fruit or fruit area inf.				% post-storage rots ^y			Fruit finish rating (0-5) ^x	
		Sooty blotch		Flayscale		Any rot	Bitter rot	White rot	Russet	Opalescence
		fruit	area	fruit	area	rot	rot	rot		
0 No fungicide	---	100f ^z	18f	100e	10e	17c-g	13b-g	6a-e	1.5a-c	1.0a
1 Inspire Super 3 fl oz+ Manzate 75DF 12 oz	PF-4C								2.1d	2.0d-f
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	0a	0a	8b-e	6a-e	2a-c		
2 ARY-0438-005 11.3WDG 1.55 oz	PF-7C	20d	1d	38c	2c	29gh	21d-h	9de	1.9cd	2.3f
3 AGR005 65WDG 8 oz	PF-7C	13d	<1d	32c	2c	27f-h	21f-h	6b-e	1.9cd	2.0d-f
4 ARY-0438-005 1.55 oz + AGR005 65WDG 8 oz	PF-7C	2ab	<1ab	18bc	1bc	28gh	23gh	6c-e	1.6a-d	1.8c-f
5 F1757aa 5SC 1.75 fl oz	PF-7C	11cd	<1cd	18bc	1bc	40h	31h	12e	1.6a-c	1.7c-e
6 ARY-0438-005 1.55 oz + F1757aa 5SC 1.75 fl oz	PF-7C	31e	2e	55d	4d	23e-h	20e-h	5b-e	1.5a-c	1.6b-d
7 UBI-4319-01 4SC 2 fl oz	PF-7C	4ab	<1ab	19bc	1bc	22e-h	15c-h	7b-e	1.6a-c	1.4a-c
8 F1058ab 80WDG 12 oz	PF-7C	9cd	<1cd	15b	<1b	12c-f	9a-g	3a-d	1.2a	1.2ab
9 UBI-4319-01 4SC 2 fl oz + F1058ab 80WDG 12 oz	PF-7C	5bc	<1bc	4a	<1a	6a-d	5a-e	1ab	1.3ab	1.4a-c
10 Inspire Super 2.82EW 3 fl oz	PF-4C								1.3ab	1.2ab
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	2a	<1a	11b-e	8a-f	3a-d		
11 Aprovia 0.83EC 1.4 fl oz	PF-4C								1.2a	1.4a-c
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	1ab	<1ab	2a	<1a	10b-e	6a-d	4b-e		
12 Aprovia 0.83EC 1.4 fl oz + Oil 1qt	PF-4C								1.9cd	2.2ef
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	1a	<1a	5a-c	3ab	2a-c		
13 Aprovia 0.83EC 1.4 fl oz + Inspire Super 3 fl oz	PF-4C								1.4ab	1.6b-d
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	0a	0a	19d-g	17c-h	2a-c		
14 Aprovia 0.83EC 1.4 fl oz + Inspire Super 3 fl oz + Manzate Pro-Stick 75DF 12 oz	PF-4C								1.6a-c	1.9c-f
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	0a	0a	9b-e	9a-g	0a		
15 Aprovia 0.83EC 1.4 fl oz + Inspire Super 3 fl oz + Manzate Pro-Stick 75DF 12 oz + Oil 1 qt	PF-4C								1.7b-d	2.2ef
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	1a	<1a	3ab	2ab	1ab		
16 Manzate Pro-Stick 75DF 12 oz	PF-4C								1.5a-c	1.4a-c
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	3ab	<1ab	4a	<1a	4a-c	3a-c	1ab		
17 Luna Sensation 1.4 fl oz + Inspire Super 3 fl oz + Manzate Pro-Stick 75DF 12 oz + Oil 1 qt	PF-4C								1.4a-c	1.5a-d
Captan 80WDG 7.5 oz + Ziram 76DF 12 oz	5C-7C	0a	0a	0a	0a	1a	1a	0a		

^z Mean separation by Waller-Duncan K-ratio t-test (p=0.05). Four single-tree replications, Fruit ratings were of 25-fruit samples per replication, taken 6 Oct, put in warm storage then evaluated 13 Oct.

^y Final rating for rots after 18 days' incubation at ambient temperatures 64-82° F (mean 69.9° F).

^x Fruit finish rated on a scale of 0-5 (0 = perfect finish, 5 = severe russet or opalescence).

^w No fungicides were applied until the first treatment application date. Applied dilute to runoff at 250 psi on the following dates: 2 May (PF, petal fall); 1C-7C, (1st-7th covers): 19 May, 27 May, 10 Jun, 23 Jun, 11 Jul, 27 Jul, 22 Aug.