Influence of water pH and adjuvants on management of strawberry diseases and yield

Leandro G. Cordova and Natalia A. Peres

Summary

Influence of water pH and adjuvants on the management of strawberry diseases and yield was evaluated by conducting two distinct field trials during the 2016-17 season. High incidence of angular leaf spot (ALS) was observed on all the adjuvant treatments regardless of its chemical properties. Further investigation is needed to confirm if there is a pattern between adjuvant type and incidence of ALS. The water pH trial had very little disease incidence on all the treatments including the non-treated control, and no conclusions could be drawn.

Methods

Water pH experiment. Bare-root transplants from a Canadian nursery were planted into black plastic mulched raised beds on 12 Oct 2016. Plants were spaced 12 in. apart within and 15 in. between rows. After planting, overhead irrigation was used for 10 days to facilitate plant establishment. Further irrigation and fertilization were by drip tape until the end of the season. Nineteen treatments were tested, a non-treated control and combinations of the three following: two fungicides (Switch 62.5WG and Kenja 400 SC), three water pH values (6, 7, and 8), and three spray timings (1, 12, and 24 hours). Spray timing corresponds to hours between mixing and spraying the fungicide. The trial was set up in a randomized complete block design with four blocks in adjacent rows. Plots were 6 ft long containing 12 plants each and were separated by 2 ft without plants. Fungicides were applied only when plants were in bloom and if weather conditions favored disease development. Weather favorability for infection was assessed by following the Strawberry Advisory System (StAS) (http://agroclimate.org/tools/sas). Three applications were made (22 Dec 2016, 20 Jan 2017, and 16 Feb 2017). Treatments were sprayed using a CO_2 back-pack sprayer calibrated to deliver 100 gal/A at 60 psi through a boom mounted with two hollow-cone T-Jet 8002 nozzles. During mixing, water pH was adjusted with 1N KOH or 8.5% phosphoric acid to reach the desired values (6, 7, and 8). Fruit were harvested and graded twice a week from 6 Jan 2017 to 6 Mar 2017 (18 harvests). Number of marketable and diseased fruit were used to determine disease incidence.

Adjuvant experiment. Bare-root transplants of the cultivar Radiance obtained from a Canadian nursery were transplanted into black-plastic mulched raised beds on 11 Oct 2016. Plants were spaced 15 in. apart within and between rows. Overhead irrigation was used for 10 days after planting to facilitate plant establishment. Further irrigation and fertilization were made by drip irrigation for the remainder of the season. Eight treatments were tested, a non-treated control and seven different spray adjuvants at a standardized rate of 0.05% v/v, except for the anionic adjuvant. The trial was performed in a randomized complete block design with four blocks in neighboring rows. Plots were 7.5 ft long containing 12 plants each and were separated by 3 ft without plants. No fungicides were sprayed during the entire experimental period. Treatments were sprayed weekly from 23 Nov 2016 to 3 Mar 2017 (15 applications). Sprays were done using a CO_2 back-pack with a boom mounted with two hollow-cone T-

Jet 8002 nozzles. Flow rate and pressure were 100 gal/A and 60 psi, respectively. On 11 Jan 2016, plots were inoculated with a 10^8 cfu/ml suspension of *Xanthomonas fragariae*, the causal agent of ALS, and overhead irrigation was used to increase favorability for disease development. Fruit were harvested and graded twice a week from 5 Dec 2016 to 9 Mar 2017 (26 harvests). Number of marketable and 'brown cap' symptomatic fruit were used to determine disease incidence and yield. Evaluation of ALS was performed on 8 Mar 2017 by collecting 90 leaflets per plot and determining the percentage of ALS infected leaflets.

Results

Water pH experiment. Disease incidence was low on the non-treated control, reaching 7.2% of BFR and 9.2% of AFR, despite the use of overhead irrigation during strategic days to increase leaf wetness duration. None of the treatments tested differed from the non-treated control in managing either AFR or BFR. Moreover, water pH and timing did not interfere with fungicide effectiveness (Table 1). However, definite conclusions cannot be drawn due to the low disease incidence. Further investigations need to be performed under higher disease pressure.

Adjuvant experiment. Before inoculation, no symptoms of ALS and 'brown cap' were present. Fifty five days after inoculation, all of the treatments showed more than 85% incidence of ALS, but no differences were found among the treatments. Brown cap incidence was not significant either, even though it ranged from 0.1 to 8.0%. The lack of statistical significance was due to the high variability among the repetitions. None of the treatments differed in yield from the non-treated control, except for the treatment with Organosilicone 2 (Table 2). No pattern was observed between the type of adjuvant and the development of ALS or 'brown cap' symptoms. Even though organosilicone 2 was the only treatment that reduced yield, further investigation is needed to confirm these findings.

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Contact

Dr. Natalia A. Peres
UF/IFAS Gulf Coast Research and Education Center
P: 813. 419-6602
E: nperes@ufl.edu

Table 1. Disease incidence on nineteen different treatments intended to manage Botrytis and anthracnose fruit rot of strawberries at the UF/IFAS Gulf Coast Research and Education Center during the 2016-17 season.

Fungicide	Water pH	Timing[x]	Disease Incidence (%)[y]	
			BFR	AFR
Non-treated control	-	-	7.2	9.2
Switch 62.5WG	6	1	6.0	4.5
	6	12	4.1	6.0
	6	24	4.4	5.2
Switch 62.5WG	7	1	5.0	5.7
	7	12	4.8	4.9
	7	24	3.9	2.8
Switch 62.5WG	8	1	4.1	4.2
	8	12	5.4	6.8
	8	24	5.0	5.4
Kenja 400 SC	6	1	3.9	7.7
	6	12	4.3	6.9
	6	24	5.5	6.1
Kenja 400 SC	7	1	4.4	8.0
	7	12	3.7	7.9
	7	24	5.3	5.5
Kenja 400 SC	8	1	4.8	6.8
	8	12	4.3	6.5
	8	24	4.4	5.8

[x] Timing corresponds to the period between mixing and spraying (1, 12, and 24 hours).

[y] Average disease incidence Botrytis and anthracnose fruit rot, AFR and BFR respectively. Harvests were from 19 Jan 2017 to 6 Mar 2017.

Table 2. Yield, angular leaf spot and brown cap incidence on 8 different adjuvant treatments on strawberries at the UF/IFAS Gulf Coast Research and Education Center during the 2016-17 season.

Treatment (rate)	ALS (%)[x]	Brown cap (%)[y]	Yield (lb/A)
Non-treated control	87.6	0.3	26808 a[z]
Organosilicone 1 (0.05% v/v)	93.8	0.1	24751 ab
Organosilicone 2 (0.05% v/v)	89.1	0.6	23387 b
Non-ionic organosilicone based (0.05% v/v)	87.9	0.5	27042 a
Non-ionic 1 (0.05% v/v)	89.5	0.7	25265 ab
Non-ionic 2 (0.05% v/v)	86.2	0.8	26600 a
Non-ionic 3 (0.05% v/v)	85.3	0.9	26682 a
Anionic (24 floz/A)	95.8	8.0	24246 ab

[x] Incidence of ALS evaluated on 8 Mar 2017.

[y] Incidence of Brown cap during peak of incidence includes harvests on 16, 20, and 23 Feb, and 2 and 9 Mar 2017.

[z] Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD test (a = 0.05).