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Vegetable Program
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Organic Management of Alternaria Leaf Spot and Crown Rot in Broccoli, 2021

The experiment was conducted at the University of Massachusetts Research and Education Farm in Deerfield, MA in a field with soil classified as a Hadley silt loam. 'Imperial' broccoli seeds were sown July 6 in the greenhouse in 72-cell flats and moved outside to harden off on July 28. Soil was amended with 10, 8, and 16 lbs/A of N, P, and K, respectively, in the form of 5-4-8. Seedlings were planted with a water wheel transplanter on July 30 at 12" in-row spacing and 2 rows per bed 10-12" apart. Plots were 10 bed feet and separated by 5 feet of planted bed. Plots were arranged in a randomized complete block design. There was enough natural rainfall during the growing season that irrigation was not required. Weeds were controlled by hand within and between beds. Exirel was applied at a rate of 20.5 oz/A on August 13 to control flea beetles and caterpillars.

Alternaria leaf spot on broccoli

Treatments were applied weekly, on August 24 and 31, and September 7, 14, and 21, using a CO_2 pressurized backpack sprayer delivering 30 psi with two TXA8004VK hollow cone nozzles, 20" apart, to achieve adequate leaf coverage.

Alternaria leaf spot (ALS) was assessed by estimating the percentage of symptomatic leaf, petiole, and stem area on ten individual plants per plot, as well as in each plot as a whole. Ratings were made weekly on August 24 and 31 and September 10, 17, and 28. Disease severity data were used to calculate area under the disease progress curve (AUDPC). ALS severity on broccoli heads and harvest weights were measured on September 28. 10 heads per plot were harvested and weighed and the percentage of florets with head rot symptoms was assessed via visual estimation.

Average monthly air temperatures (°F) were 73.1 in August, and 64.7 in September. Rainfall (in.) was 10.81 in July, 4.06 in August, and 4.16 in September.

All data were analyzed using a general linear model and means were compared using Tukey's honestly significant difference test ($P = 0.05$) in SAS (SAS v.9.4, SAS Institute, Cary, NC).

Natural inoculum of ALS was the only source of inoculum for this trial. The positive control, Luna Experience applied at 8.6 fl oz/A, significantly reduced both ALS severity as represented by AUDPC and head rot compared to the untreated control and all four experimental treatments. The Luna Experience treatment resulted in an average ALS severity on the broccoli heads of 5.75%, compared to 43.13% severity achieved by the untreated control. None of the four experimental treatments (Badge X2 1.8 lb/A, Stargus 2 qt/A + Badge X2 1.8 lb/A,

Unmarketable (top) vs. marketable (bottom) broccoli heads

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Regalia 1 qt/A + Badge X2 1.8 lb/A, and Stargus 2 qt/A + Badge X2 1.8 lb/A ALT Regalia 1 qt/A) significantly reduced ALS AUDPC compared to the untreated control. Badge X2 alone, Stargus + Badge X2, and Regalia + Badge X2 reduced ALS severity on the broccoli heads significantly compared to the untreated control, lowering the ALS severity from 43.13% with the untreated control to 21.82%, 26.29%, and 27.47%, respectively. This level of head rot (30%) is probably unmarketable, and heads with that much disease would not store long.

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	Whole Plot Severity (%)						Harvest	Head Disease
	24-Aug	31-Aug	10-Sep	17-Sep	28-Sep	AUDPC[x]	Weight (lbs)[y]	Severity (%)[z]
UTC	5	6.25 a	21.25 b	22.5 b	26.25 c	598.13 b	3.05	43.13 d
Luna Experience	6.25	4.375 a	6.25 a	6.25 a	8.75 a	216.56 a	4.06	5.75 a
Badge X2	5	6.875 ab	15 ab	20 b	16.25 ab	472.81 b	3.19	21.82 b
Stargus + Badge X2	5	6.25 a	15 ab	23.75 b	22.5 bc	535.63 b	3.17	26.29 bc
Regalia + Badge X2	6.25	11.25 b	16.25 ab	20 b	21.25 bc	552.50 b	3.11	27.47 bc
Stargus + Badge X2 ALT Regalia	6.25	8.125 ab	22.5 b	27.5 b	26.25 c	674.06 b	2.48	35.07 cd
p-value	ns	0.0079	0.0017	0.0030	<0.0001	<0.0001	ns	<0.0001

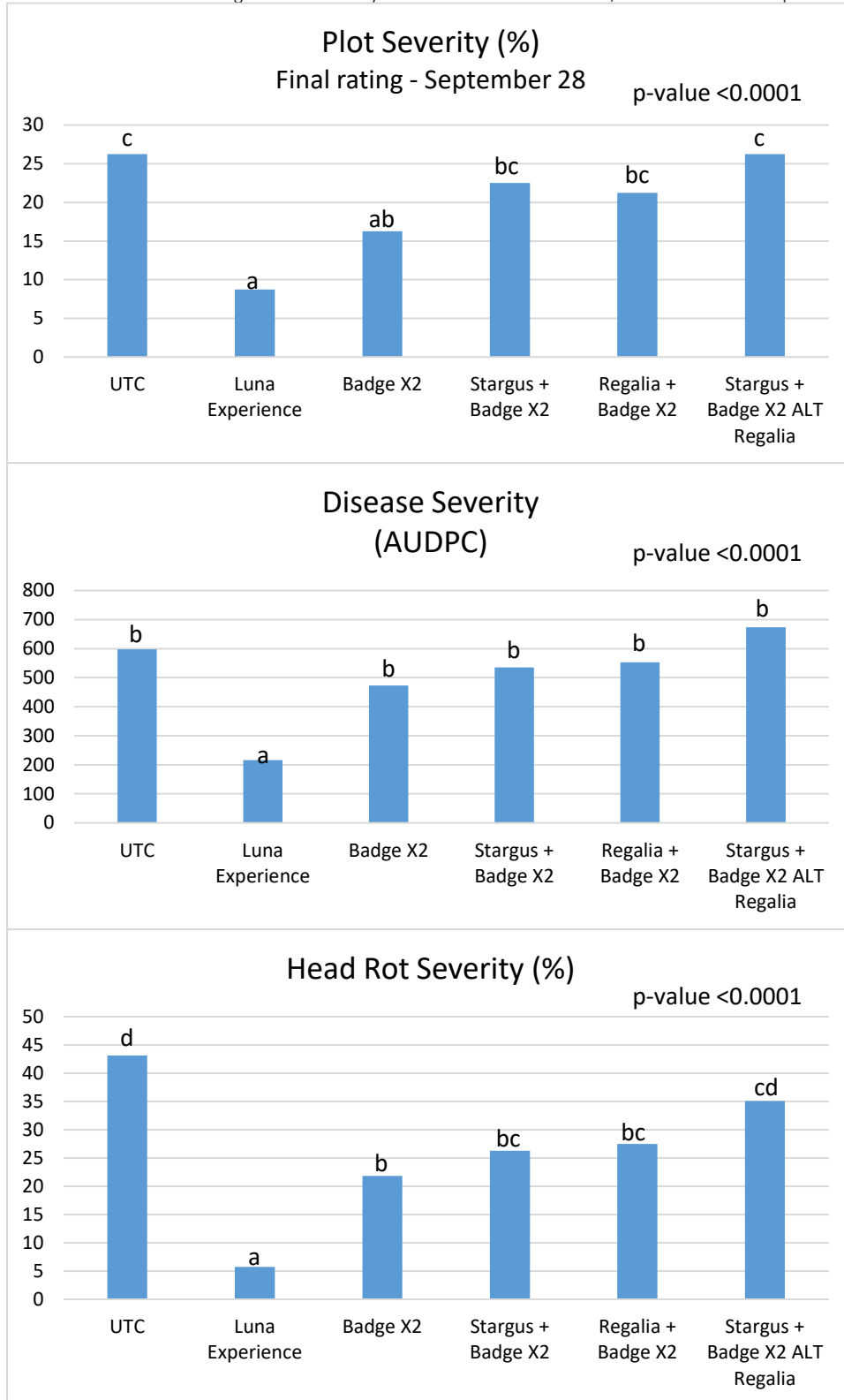[v]Treatment rates were: Luna Experience 8.6 fl oz/A, Badge X2 1.8 lb/A, Stargus 2 qt/A, Regalia 1 qt/A.

[w]Data were analyzed using PROC GLM and means were separated using Tukey's HSD. Numbers within each column followed by the same letter are not significantly different from each other.

[x]Area under the disease progress curve was calculated from August 24 to September 28 according to the formula : $\sum$n i=1[(Ri+1 + Ri)/2] [ti+1 – ti], where R = disease severity rating (% of leaf surface affected) at the ith observation, ti = time (days) since the previous rating at the ith observation, and n = total number of observations. Values were calculated based on the average percent disease severity across the plot.

[y]Harvest weight was recorded on September 28 and represents the total weight of 10 heads from the center of each plot.

[z]Head disease severity was assessed on September 28

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Plot Severity (%)
Final rating - September 28
p-value <0.0001

Disease Severity (AUDPC)
p-value <0.0001

Head Rot Severity (%)
p-value <0.0001