

Grant Report, 2019

Maryland Soybean Board

Project title: Evaluation of Growth-Promoting Products for Soybean Production in Maryland

Principal investigator(s): Andrew Kness, Agriculture Extension Agent
University of Maryland Extension, Harford County

Project location(s): Wye Research & Education Center, Queenstown, MD (Wye)
Western Maryland Research & Education Center, Keedysville, MD (WMREC)

Experimental design: Spatially-balanced complete block design², 8 treatments x 5 replications

Plot size: 11'x30' (both sites)

Variety: Mid-Atlantic Seed 4077

Previous crop & tillage: Corn, no-till (both sites)

Planting: 150,000 seeds/A, 7.5" rows, seeded using a no-till drill (both sites)
6/10/19 at Wye
5/17/19 at WMREC

Treatments:

1. Untreated control
2. Take Off-treated seed (Take Off ST)
3. Take Off LS Foliar @ R1 (2 pints/A)
4. Take Off ST + Take Off LS Foliar @ R1 (2 pints/A)
5. Take Off ST + K28 (Monty's liquid potash) @ R1 (0.36 pints/A)
6. K28 @ R1 (0.36 pints/A)
7. Monty's Carbon @ pre-plant (1/2 gal/A in 15 gal water)
8. Monty's Carbon (1/2 gal/A in 15 gal water) @ pre-plant + AgriSweet @ R1 (24 fl oz/A in 15 gal water)

Treatment application:

- Take Off ST seed treatment applied by seed dealer.
- Take Off LS foliar, K28, and AgriSweet applied per label instructions using a tractor-mounted small plot sprayer to soybean foliage at R1.
 - R1 treatments applied 8/17/19 at Wye
 - R1 treatments applied 7/8/19 at WMREC
- Monty's Carbon applied per label instructions pre-plant using a tractor-mounted small plot sprayer.
 - Monty's Carbon applied 6/5/19 at Wye
 - Monty's Carbon applied 5/15/19 at WMREC

Harvest: 5'x30' from center of each plot using small plot combine.
11/5/19 at Wye

11/15/19 at WMREC.

Samples & other data collection:

- Emergence counts completed at V1 by counting the number of emerged plants per two 30' rows from each plot. The same rows were counted for each plot.
 - 7/10/19 at Wye
 - 6/4/19 at WMREC
- NDVI ratings recorded using a handheld Greenseeker by walking down the center row of each plot from front to back (length of the plot). Greenseeker held approximately 2' above plant canopy.
- Canopy height recorded at the Wye on 8/5/19 from 4 random locations per plot. Measurements taken from upper-most part of canopy and data reported are the average.

Data analysis: Mixed model ANOVA with blocks as random effects, Students t-test for mean separation.

Notes: Extensive early groundhog and deer damage at Wye. Planting delayed at the Wye due to equipment malfunction and weather/poor field conditions.

Background & justification: Soybean farmers have had many new products come on the market in recent years touted as growth-promoting products intended to help growers attain high-yielding soybeans. Many of these products contain plant growth regulators, hormones, humic acids, carbon, sugars, and/or fertilizer¹. Limited replicated research has been completed at the University level with these products to assess their application and utility in Maryland's unique climate and growing conditions.

Objectives:

1. Evaluate select growth-promoting products (treatments listed above) to assess their effect on soybean growth and yield, and to compare them to equivalent treatments of fertilizer and an untreated control.

Summary of methods: All plots were flagged prior to any work and blocked for soil type and soil moisture. Monty's Carbon treatments were applied pre-plant to the appropriate plots using a tractor-mounted small plot sprayer and following the label instructions.

Plots were seeded into no-till corn residue using a no-till drill set on 7.5" rows. Untreated soybean seed was seeded into all plots except for the Take Off ST treatment plots; in which Take Off treated soybean seed of the same variety was planted.

Emergence ratings were taken at approximately V1. Four NDVI ratings were recorded for Wye and three for WMREC using a handheld Greenseeker held two feet above the crop canopy.

All foliar treatments were applied in a single application at R1. The K28 treatment was applied at a rate of 0.36 pints/A, which supplies the equivalent amount of potassium as is found in the Take Off LS treatment.

Plots were harvested using a small plot combine when they approached 13% moisture. Yield, test weight, and moisture data were collected at this time.

All data were analyzed using statistical methods in the statistical software, JMP (SAS, Inc.).

Results: Yields at both locations were decent, but higher at WMREC than at Wye. This is likely a function of planting date. All treatments were applied per the manufacturer’s approved label. Average treatment yields ranged from 52.8 bu/A to 57.7 bu/A at WMREC. Yields at Wye had greater variability about the average, ranging from 43.8 bu/A to 53.8 bu/A. The mixed model ANOVA shows no significant effect on yield, moisture, or test weight for any of the treatments at either location (Table and Figure 1).

Table 1. Treatment effect on yield, test weight, and moisture.

Treatment	Yield (bu/a)		Moisture (%)		Test Weight (lbs)	
	<i>WMREC</i>	<i>Wye</i>	<i>WMREC</i>	<i>Wye</i>	<i>WMREC</i>	<i>Wye</i>
Take Off ST	55.3	47.8	14.8	14.4	54.7	58.3
Take Off LS	54.2	48.1	15.0	14.4	54.4	58.0
Take Off ST + Take Off LS	57.7	47.8	15.0	14.4	55.0	58.3
Take Off ST + K28	57.1	47.5	15.3	14.4	54.9	57.6
K28	55.0	49.1	15.2	14.3	55.3	58.4
Monty’s Carbon	52.8	50.1	14.8	14.4	54.7	58.0
Monty’s Carbon + AgriSweet	55.0	53.8	15.1	14.3	54.1	58.0
Untreated	54.0	43.8	15.0	14.4	54.6	56.8
<i>*(P) > F</i>	<i>0.5354</i>	<i>0.5933</i>	<i>0.4904</i>	<i>0.9732</i>	<i>0.2253</i>	<i>0.4321</i>

*Mixed model ANOVA results and mean separation using Student’s t-test. No significant differences.

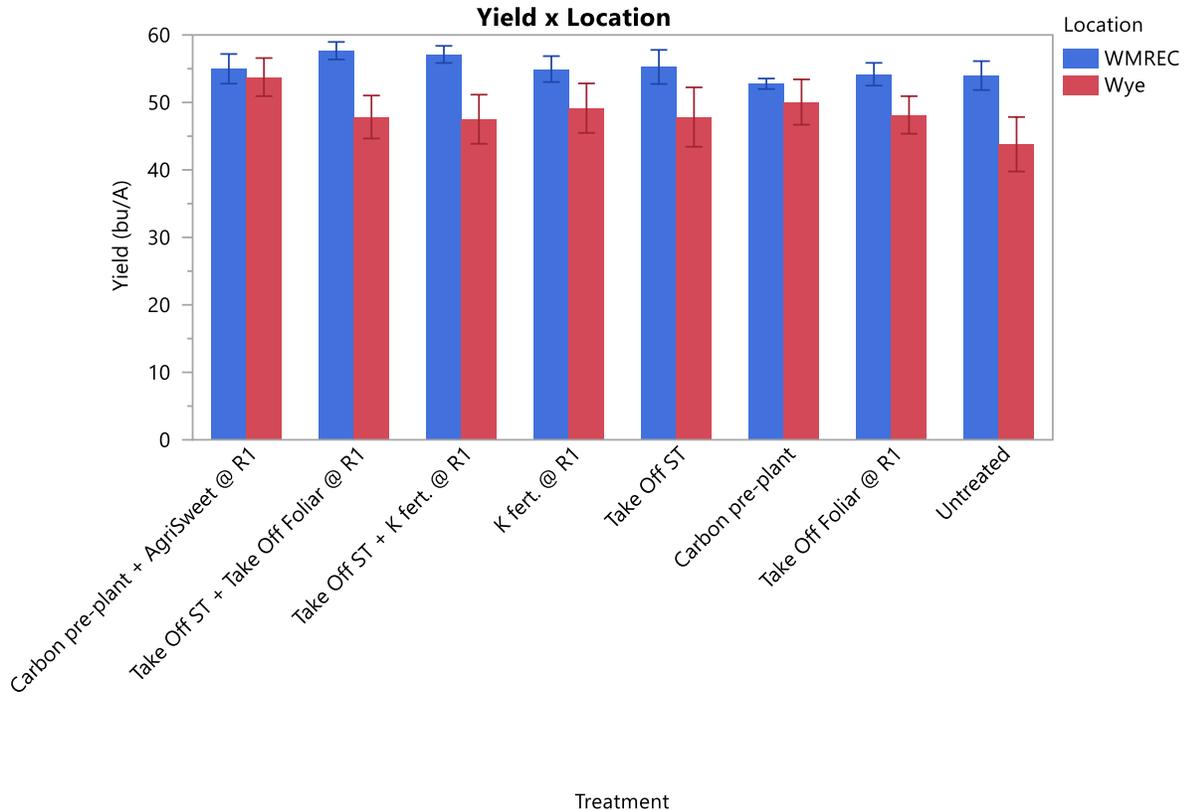


Figure 1. Treatment yield by location. Each error bar is constructed using 1 standard error from the mean. Treatments not significant at $\alpha=0.10$.

There was a significant treatment effect on emergence at the WMREC location (Table 2 and Figure 2). There was no significant treatment effect on emergence at Wye. Take Off ST, Take Off ST + Take Off LS, and Take Off ST + K28 treatments had significantly better emergence than the Take Off LS, K28, Monty's Carbon, Monty's Carbon + AgriSweet, and the untreated control treatments at WMREC. There was no difference in canopy height measurements that were recorded at Wye (Table 2).

In the mixed model analysis, we found a significant effect on emergence with Take Off treated seed vs. untreated seed at the WMREC location ($P=0.0006$, Figure 3). There was also a weak but significant correlation between emergence and yield ($R^2=0.2022$, $P<0.0001$).

Table 2. Treatment effect on emergence and canopy height.

<i>Treatment</i>	¹ <i>Emergence</i>		² <i>Canopy Height (in)</i>
	<i>WMREC</i>	<i>Wye</i>	<i>Wye</i>
Take Off ST	208.6 ab	186.4	18.1
Take Off LS	203.0 bcd	185.0	18.0
Take Off ST + Take Off LS	221.6 a	193.2	18.4
Take Off ST + K28	208.2 abc	178.2	18.0
K28	186.8 d	194.8	17.9
Monty's Carbon	197.2 bcd	184.0	17.5
Monty's Carbon + AgriSweet	191.2 cd	189.4	18.6
Untreated	190.0 d	190.2	18.1
<i>*(P) > F</i>	<i>0.0046</i>	<i>0.9704</i>	<i>0.9256</i>

*Mixed model ANOVA results and mean separation using Student's t-test. Highlighted cells indicate a significant difference at $\alpha=0.10$. Levels not connected by same letter are significantly different.

¹Emergence reported as number of emerged plants per 60' of plot row.

²Canopy height reported as average of four random canopy height measurements per plot.

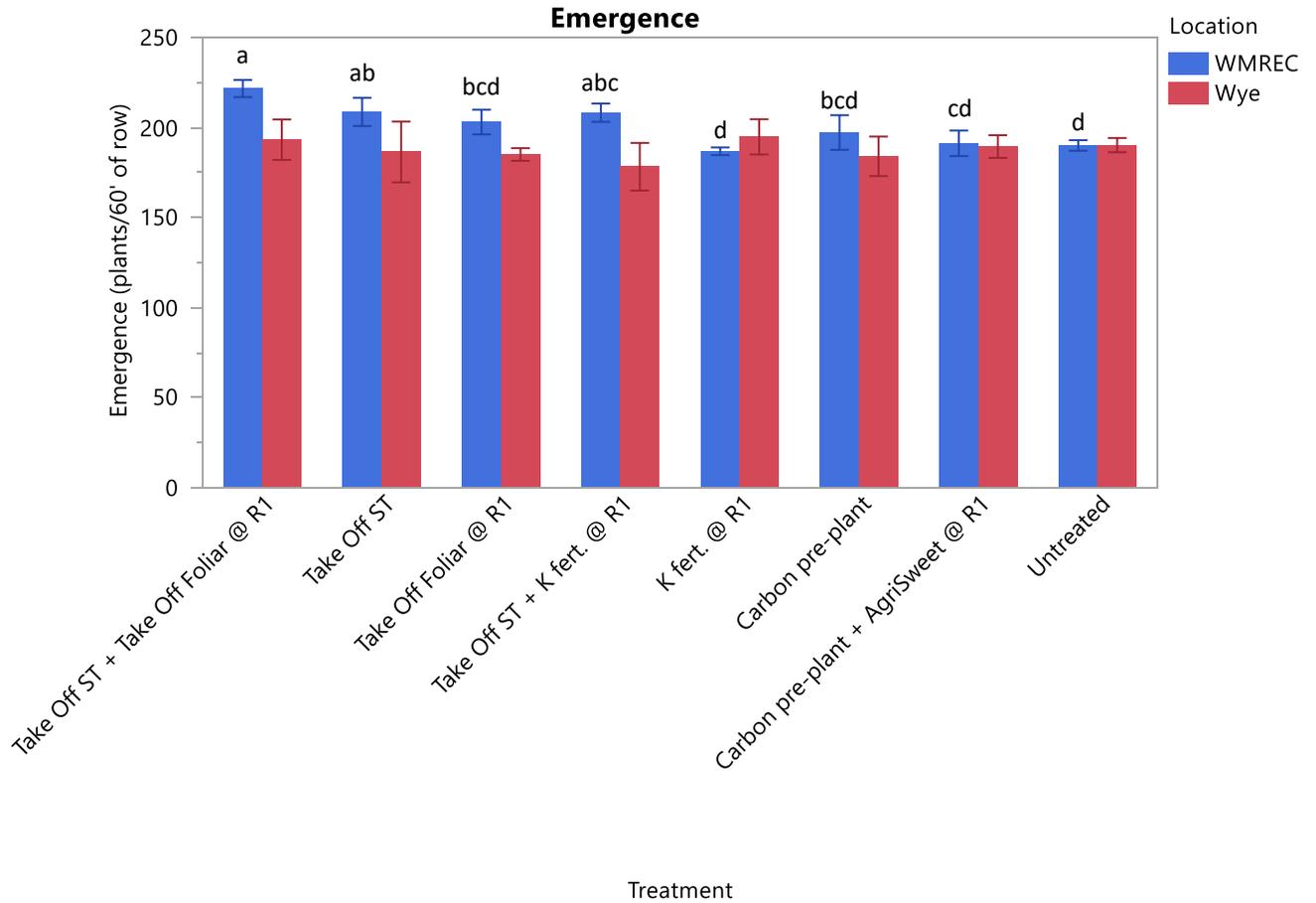


Figure 2. Plant emergence by treatment. Each error bar is constructed using 1 standard error from the mean. Levels not connected by same letter are significantly different. Treatment effect not significant at Wye (P=9704).

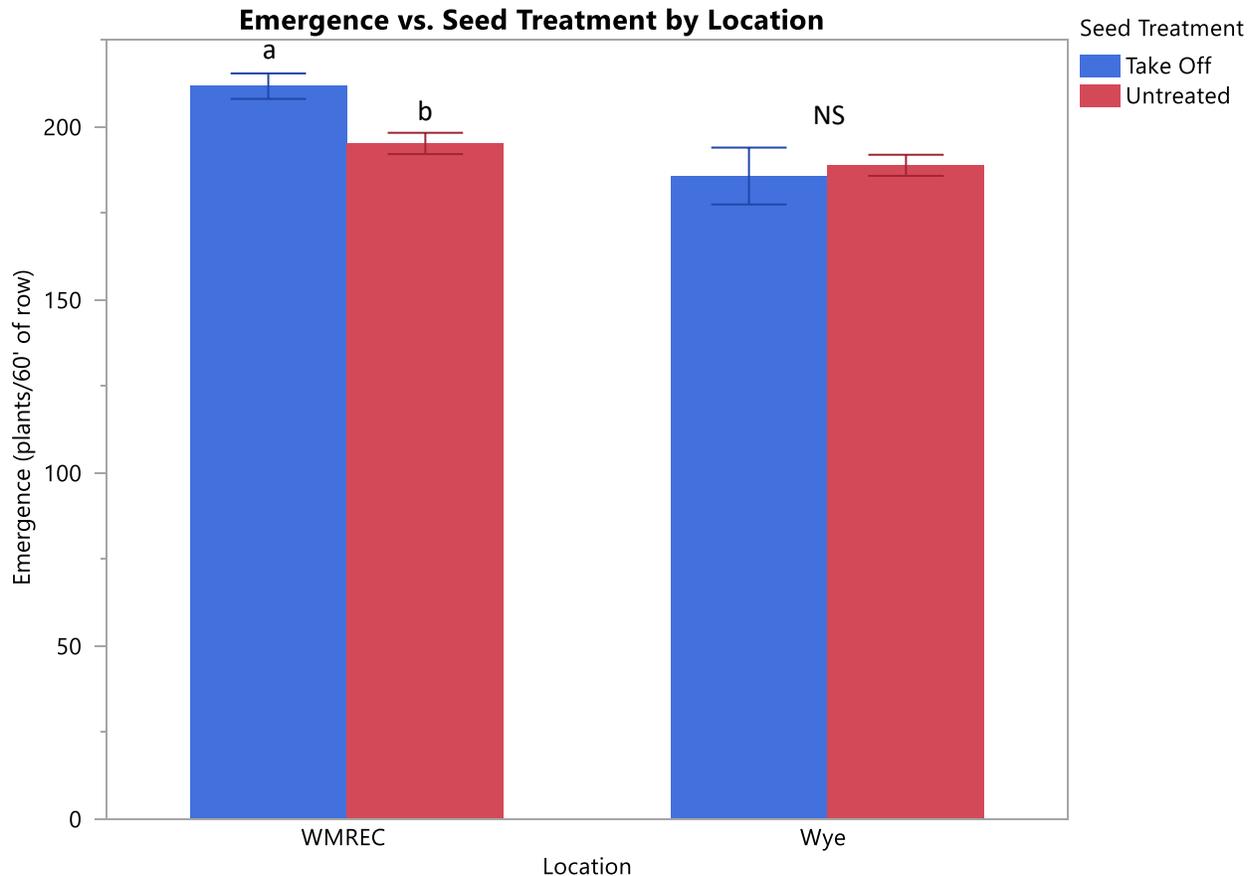


Figure 3. Plant emergence broken out by Take Off treated seed vs untreated seed by location. Each error bar is constructed using 1 standard error from the mean. Levels not connected by same letter are significantly different ($\alpha=0.05$).

Normalized difference vegetative index (NDVI) was recorded at several times throughout the growing season. There were no significant differences between treatments in NDVI ratings at any location at any of the rating events (data not shown).

Conclusions and discussion: All treatments with Take Off treated seed significantly improved soybean emergence over untreated seed at the WMREC trial location, but not the Wye. This is likely a function of the earlier planting date at WMREC. Cooler, wetter soils can inhibit germination; this data suggest that Take Off seed treatment may help soybeans germinate and emerge better in these conditions vs. warmer, drier soils at the Wye. More research is needed under these early field season conditions to confirm or refute this hypothesis. A bivariate fit of yield by emergence did reveal a weak but significant positive correlation between emergence and yield, meaning higher yields were influenced by greater emergence. However, these differences in emergence were not significant enough to cause a significant difference in yield between any of the treatments at either location.

NDVI and canopy height were used as indicators to estimate “plant health”; in which none of the treatments affected either metric.

This research should be conducted at least multiple years before drawing any conclusions. For next year we would like to focus this research on planting as early as possible to see if we get a treatment effect on emergence as we observed this year. In addition to the field trials, we also propose to conduct a more controlled germination/emergence trial using Take Off treated seed and untreated seed in a small greenhouse experiment.

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References:

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