

Field-Scale Studies Evaluating Soybean Seed Treatments and Inoculants

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The New York soybean market price increased from an average of ~\$6.00/bushel from 2003-2005 to ~13.00/bushel from 2011-2013 so soybean is now a high-value crop. Growers now manage soybean more intensively, including using the myriad seed treatment options commercialized during the last 10 years. Many soybean growers in New York routinely order pre-treated seed with rhizobium inoculant, as well as fungicide, insecticide, and biological compounds. We evaluated the following five seed treatments at four sites (Livingston, Seneca, Tompkins, and Yates Co.) in 2012 and 2013 field-scale studies: **1) untreated seed, 2) untreated seed + Cell-Tech (a liquid rhizobium) applied at planting, 3) PPST 120 (pre-treated seed with rhizobium inoculum) +PPST 2030 (a biological seed treatment) +FST (fungicide seed treatment), 4) PPST 120 + PPST 2030 +IST/ FST (insecticide and fungicide seed treatments), and 5) PPST 2030 +IST/FST + Cell-Tech at planting.** The objective of the study was to determine if the use of seed treatment products increase yield and profit under New York grower conditions.

Growers at all sites planted (grain drills at Livingston and Seneca Co. and Kinze planters at Tompkins and Yates Co. sites; all sites in 15-inch row spacing) in May of 2012. Growers at Livingston and Tompkins Co. planted in May of 2013 but planting was delayed until early June at Seneca and Yates Co. because of the wet spring. Seeding rates, when averaged across the 2 years, were 200,000 seeds/acre at Livingston Co., 175,000 seeds/acre at Seneca Co.; 170,000 seeds/acre at Yates Co., and 155,000 seeds/acre at Tompkins Co. The growers harvested all studies with their respective combines in October (all sites in 2013) or November (Tompkins and Seneca Co. in 2012). We or the growers provided Weigh Wagons or grain carts with scales to determine yield. Two samples from each load were taken to a field lab to estimate moisture

and then grind the seed before sending the sample to Dairy One for protein analysis.

Partial budget analysis was used to determine partial costs and returns, based on 2 years of data, for all treatments. Soybean seed price, averaged across the 2012 and 2013 growing seasons, was estimated at \$54.50/bag for a 140,000 seed bag. Cell-Tech cost was estimated at \$3.75 to treat a bag of seed. When averaged across the 2 years, seed-applied rhizobium with the biological and fungicide seed treatment was estimated at \$11/bag and seed-applied rhizobium with the biological and fungicide/insecticide seed treatment was estimated at \$14.50/bag of seed. Hauling costs were estimated at \$0.21/bushel. The average soybean marketing price in New York was reported at \$13.60 in 2012, but we estimated it at \$13.00/bushel in 2013.

Table 1. Yield and plant populations (mid to late June) of P92Y12 soybean variety with different seed treatments in field-scale studies on farms in Livingston, Seneca, Yates, and Tompkins Counties averaged across the 2012 and 2013 growing seasons.

	LIVING	SENECA	TOMPKINS	YATES
SEED TREATMENT	Yield (bushels/acre)			
Untreated	68	64	63	54
Cell-Tech-planting	68	64	63	55
PPST 120 PPST 2030+FST	68	63	64	55
PPST 120 +PPST 2030+FST/IST	68	69	63	57
PPST 2030+FST/IST +Cell-Tech-planting	67	67	64	56
LSD 0.05	NS	3	NS	2
	Plant populations (plants/acre)			
Untreated	159,960	125,715	133,955	129,710
Cell-Tech-planting	152,260	124,730	131,480	130,090
PPST 120 PPST 2030+FST	194,562	135,490	142,220	130,822
PPST 120 +PPST 2030+FST/IST	185,665	151,360	145,000	143,510
PPST 2030+FST/IST +Cell-Tech-planting	161,790	155,155	130,734	141,510
LSD 0.05	9,918	4,899	8,649	6370

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Table 2. Partial costs and partial return of P92Y12 soybean variety with different seed treatments in field-scale studies on farms in Livingston, Seneca, Yates, and Tompkins Counties averaged across the 2012 and 2013 growing seasons.

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PPST 2030+FST/IST +Cell-Tech-planting	67	67	64	56
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When averaged across the 2012 and 2013 growing seasons, the biological and fungicide seed treatment compared to untreated seed increased early plant populations (~10,000 to 25,000 plants/acre) at the Livingston and Tompkins Co. sites with no further increase in plant populations when the insecticide seed treatment was added (Table 1). Nevertheless, yields were not significantly higher for the biological and fungicide seed treatment at these two sites (Table 1). In contrast, the biological and fungicide/insecticide seed treatment increased early plant populations (~25,000 plants/acre) as well as yield (2.6 to 4.8 bushels/acre) at the Yates and Seneca Co. sites, respectively (Table 1). Partial budget analyses indicated a significant partial return advantage for the biological and fungicide/insecticide seed treatment at the Seneca Co. site (~\$45/acre) but not at the Yates Co. site (Table 2). Evidently, the 2.6 bushel/acre increase at Yates Co. (at an average selling price of \$13.30 across the 2 years) did not generate adequate increased revenue to offset the increase in planting costs for the biological and fungicide/insecticide seed treatment. The grower at the Yates Co. site planted at about 170,000 seeds/acre so the increased partial seeding costs of ~\$18/acre offset the

increased revenue of~\$34.50/acre to render the increased partial return (\$17.20) insignificant in the statistical analysis (Table 2). The February USDA-NASS Crop Value Summary estimated that the soybean market price in New York will average \$12.50/bushel in 2013, which would reduce the difference in partial return between the biological fungicide/insecticide seed treatment and untreated seed at this site even further. If the grower at this site, however, sold the crop at \$13.50/bushel in 2013 (\$13.55/bushel, 2-year average), the biological fungicide/insecticide seed treatment would have had greater partial returns than untreated seed. The use of Cell-Tech rhizobium inoculant at planting never increased yield or partial return at any of the sites when compared to the untreated seed (Tables 1 and 2).

Conclusion

When averaged across both years, the biological and fungicide/insecticide seed treatment increased plant

populations and yield at two sites; whereas, the biological and fungicide seed treatment increased plant populations at two sites but not yield. Furthermore, the biological and fungicide/insecticide seed treatment increased partial return at one site. Given the uncertainty of the response of plant populations to soybean seed treatments (a fungicide response at some sites and an insecticide response at other sites), the "fully loaded" biological and fungicide/insecticide seed treatment would provide the greatest insurance of stand protection. Because of the ~15,000-25,000 plant/acre increase in early plant populations with the biological and fungicide/insecticide seed treatment at all sites, growers could consider a reduction in seeding rates by ~ 10,000-15,000 seeds/acre to increase partial returns. Soybean growers should also consider running test strips on their farms with or without rhizobium inoculum, be it planter box or seed-applied, to see if inoculation is still necessary on their fields. We are grateful for the partial support of the project by the New York Corn and Soybean Growers Association and Pioneer-Hi-Bred for donating the seed.