

Economic Risk and Profitability of Soybean Seed Treatments at Reduced Seeding Rates

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Introduction

Earlier soybean planting coupled with increasing seed costs and higher commodity prices have led to a surge in the number of acres planted with seed treatments (Esler and Conley, 2012). Furthermore, the components and relative cost of various soybean seed treatments has broadened greatly. Recent studies have suggested that growers should consider lowering seeding rates to increase their return on investment (De Bruin and Pedersen, 2008; Epler and Staggenborg, 2008). This recommendation is attributed to the soybean plant's potential compensatory ability at lower plant populations. Ultimately, growers would like to know the value proposition of combining seed treatments with lowered seeding rates. Therefore, the objectives of this study were to:

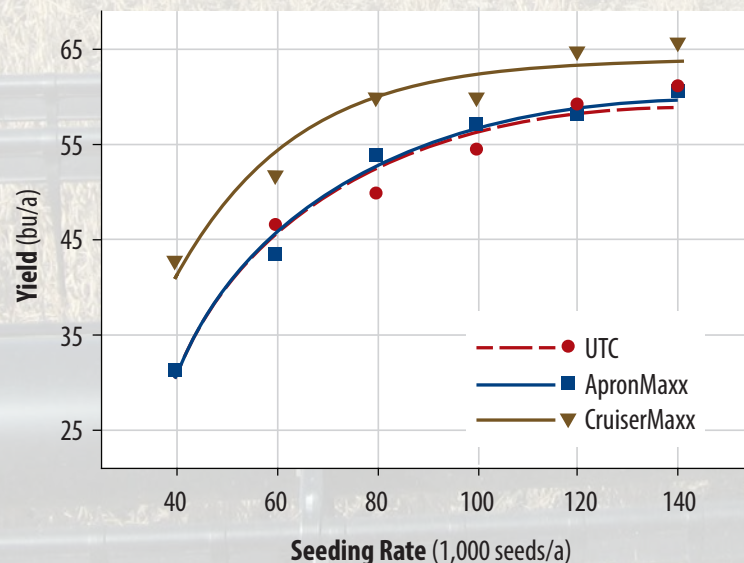
- Quantify the effects of seed treatments and seeding rates on soybean yield.
- Assess the economic risk and profitability of seed treatments and seeding rates, including calculating economically optimal seeding rate (EOSR) for each seed treatment.

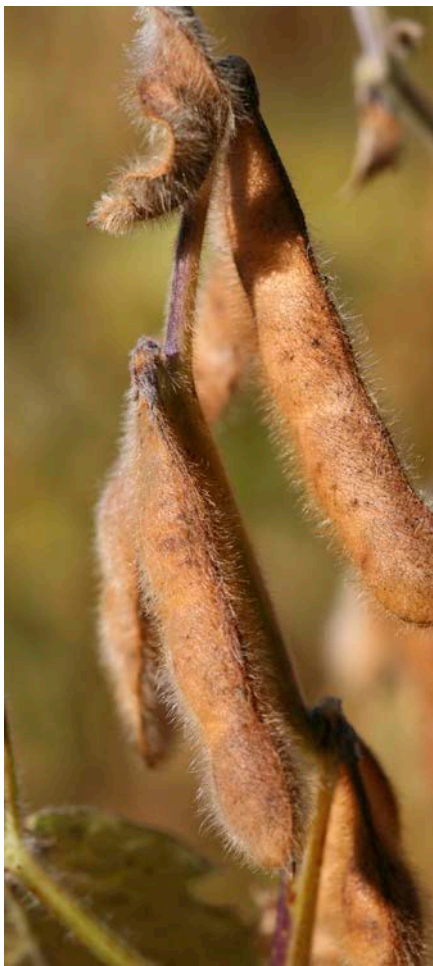
ApronMaxx RFC and CruiserMaxx (Syngenta Crop Protection) seed treatments were used to achieve these objectives because they differ in their components and relative cost per unit. This study was conducted in 2012 and 2013 at nine Wisconsin locations. All locations were planted in 15 inch rows within the first 3 weeks of May.

Effects on Soybean Yield

When pooled over all seed treatments, the highest seeding rate (140,000 seeds/a) yielded 64 bu/a, which was significantly higher than all other seeding rates, except 120,000 seeds/a. ApronMaxx showed no improvements in yield at any seeding rate compared to the untreated control (UTC), while CruiserMaxx provided increased yields at all seeding rates (Figure 1). CruiserMaxx showed a trend of larger yield increases as the seeding rate was lowered. We observed a 4% and 12% yield increase at 140,000 and 40,000 seeds/a, respectively, over ApronMaxx and the UTC (Figure 1).

Figure 1. Yield (bu/a) of the three seed treatments across all seeding rates.





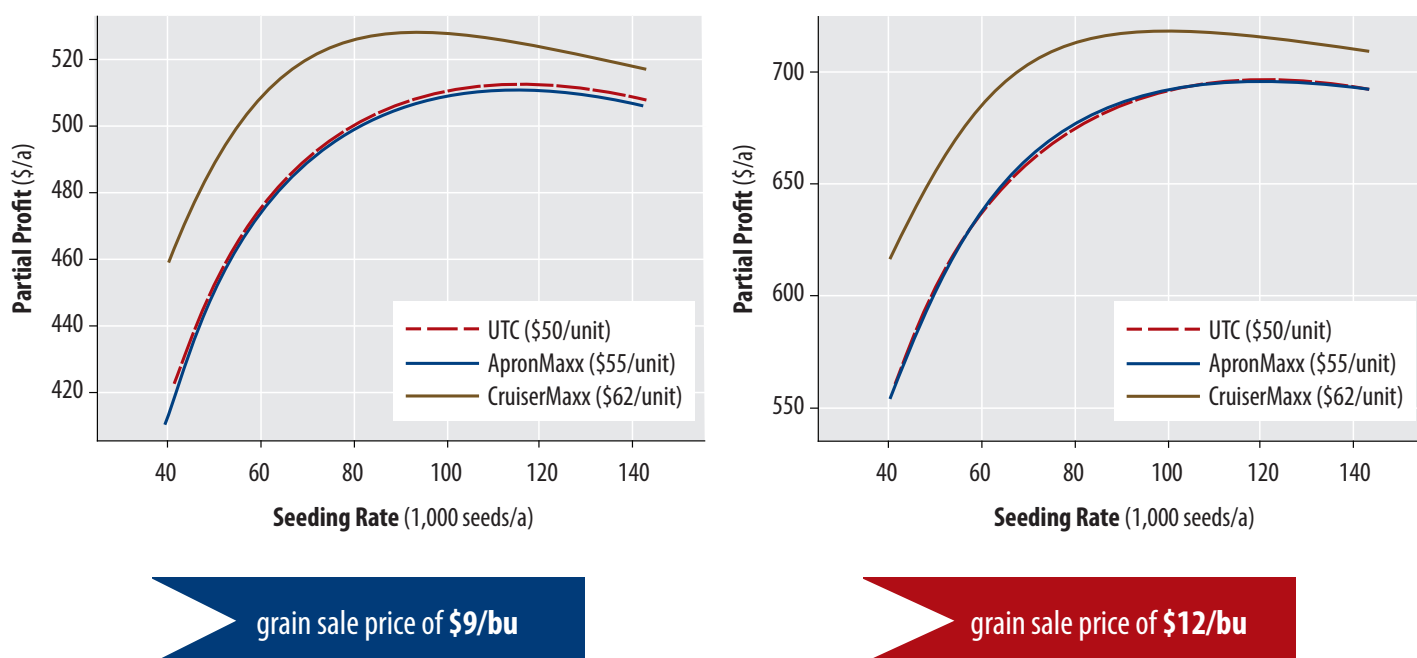
Profitability and Economic Risk

Partial profit was calculated as follows: (Yield x Grain Sale Price) – (Seed + Seed treatment cost). CruiserMaxx increased profit at each grain sale price and across all seeding rates compared to ApronMaxx and the UTC (Figure 2). Again, no differences were observed between ApronMaxx and the UTC (Figure 2). The economically optimal seeding rates (EOSR), or the high point on the profit curves, for the three seed treatments and two grain sale prices are displayed at the bottom of Tables 1 and 2.

Economic risk was applied to the profit curves (Figure 2), where risk is measured as the break even probability (the probability of breaking even relative to the base case of UTC at 140,000 seeds/a), and displayed in Tables 1 and 2 for soybean grain sale prices of \$9 and \$12/bu, respectively. For example, in Table 1, CruiserMaxx at 140,000 seeds/a had a 0.71 (71% chance) probability of increasing profit over the base case and on average for all outcomes (all environments), increased profit by \$10/a. In addition, an average \$18/a increase was observed for the positive outcomes and an average \$11/a decrease for negative outcomes. The positive outcomes column represents responsive environments while the negative outcomes column represents non-responsive environments.

At a grain sale price of \$9/bu (Table 1), ApronMaxx and the UTC obtained break-even probabilities >0.50 at seeding rates of 100,000 and 120,000 seeds/a. However, the average profit increases for all outcomes was minimal (<\$3/a). At this grain sale price, UTC at 120,000 seeds/a had the lowest risk (0.91) of any treatment combination in Table 1, but again provided a relatively low average profit increase for all outcomes (\$3/a). Using seeding rates below 100,000 seeds/a was very risky for ApronMaxx and the UTC; showing break-even probabilities <0.50 and negative average profit increase for all outcomes. CruiserMaxx produced break-even probabilities >0.50 for all seeding rates except at 40,000 seeds/a and the average profit increase for all outcomes was >\$17/a at seeding rate between 80,000 and 120,000 seeds/a. Furthermore, the lowest risk (0.89) and largest average profit increase for all outcomes (\$20/a) with CruiserMaxx was at its EOSR (94,000 seeds/a).

Figure 2. Partial profit per acre of the three seed treatments across all seeding rates.





When the grain sale price was increased to \$12/bu (Table 2), ApronMaxx and the UTC required higher seeding rates (>120,000 seeds/a) to achieve break-even probabilities >0.50. Furthermore, we again saw trivial average profit increases for all outcomes (<\$2/a) with ApronMaxx and the UTC. The lowest risk ApronMaxx treatment combination (0.52) was at its EOSR. However, this only attained a \$1/a average profit increase for all outcomes and a wide range of possibilities existed when accounting for the average positive (\$19/a) and negative (-\$18/a) outcomes. CruiserMaxx showed relatively high break-even probabilities (>0.76) for seeding rates between 80,000 and 140,000 seeds/a, with the lowest risk (0.87) and largest average profit increase for all outcomes (\$25/a) at its EOSR (100,500 seeds/a).

grain sale price of \$9/bu

Table 1. Seeding rate by seed treatment economic risk table for all locations with a grain sale price of \$9/bu.

Treatment combination ¹		Break-even probability ²	Average profit increase over base case ³		
Seed treatment	Seeding rate (seeds/acre)		Positive outcomes	All outcomes	Negative outcomes
			-----(\$/acre)-----		
UTC	120,000	0.91	3	3	-2
	100,000	0.69	5	2	-5
	80,000	0.26	4	-8	-12
	60,000	0.01	2	-34	-34
	40,000	0.00	na ⁴	-94	-94
ApronMaxx	140,000	0.46	14	-2	-15
	120,000	0.54	15	2	-13
	100,000	0.51	14	1	-13
	80,000	0.28	10	-9	-17
	60,000	0.02	6	-36	-37
	40,000	0.00	na	-98	-98
CruiserMaxx	140,000	0.71	18	10	-11
	120,000	0.83	21	16	-9
	100,000	0.89	23	20	-8
	80,000	0.86	21	17	-8
	60,000	0.51	14	0	-15
	40,000	0.01	5	-51	-52
ECONOMICALLY OPTIMAL SEEDING RATES (EOSR)					
UTC	111,500	0.84	4	3	-3
ApronMaxx	111,000	0.54	14	2	-13
CruiserMaxx	94,000	0.89	23	20	-8

¹Treatment combination includes all possible seed treatment and seeding rate combinations for comparison to the base case.
²Break-even probability is the probability a treatment combination will at least provide the same profit/acre as the base case.
³Base case is untreated seed at 140,000 seeds/acre.
⁴na, no outcomes are possible.

Table 2. Seeding rate by seed treatment economic risk table for all locations with a grain sale price of \$12/bu.

Treatment combination ¹		Break-even probability ²	Average profit increase over base case ³		
Seed treatment	Seeding rate (seeds/acre)		Positive outcomes	All outcomes	Negative outcomes
			-----(\$/acre)-----		
UTC	120,000	0.77	3	2	-3
	100,000	0.44	4	-2	-7
	80,000	0.08	3	-17	-19
	60,000	0.00	1	-55	-55
	40,000	0.00	na ⁴	-138	-138
ApronMaxx	140,000	0.49	19	-1	-20
	120,000	0.52	19	1	-18
	100,000	0.44	17	-3	-19
	80,000	0.20	13	-18	-26
	60,000	0.01	8	-57	-57
CruiserMaxx	140,000	0.76	27	17	-14
	120,000	0.84	29	23	-12
	100,000	0.87	30	25	-11
	80,000	0.80	26	18	-12
	60,000	0.38	16	-8	-22
	40,000	0.00	6	-79	-79
ECONOMICALLY OPTIMAL SEEDING RATES (EOSR)					
UTC	119,500	0.76	3	2	-3
ApronMaxx	119,000	0.52	19	1	-18
CruiserMaxx	100,500	0.87	30	25	-11

¹Treatment combination includes all possible seed treatment and seeding rate combinations for comparison to the base case.

²Break-even probability is the probability a treatment combination will at least provide the same profit/acre as the base case.

³Base case is untreated seed at 140,000 seeds/acre.

⁴na, no outcomes are possible.

References

De Bruin, J.L. and P. Pedersen. 2008. *Soybean seed yield response to planting date and seeding rate in the upper Midwest*. *Agron. J.* 100: 696-703.

Epler, M. and S. Staggenborg. 2008. *Soybean yield and yield component response to plant density in narrow row systems*. Online. *Crop Management* doi:10.1094/CM-2008-0925-01-RS.

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Conclusion & Recommendations

Our study found differences in yield, profitability and economic risk due to seed treatment and seeding rate. Growers should account for their expected grain sale price and seed treatment use when determining their seeding rate and additionally, the components of the seed treatment should be considered. We found that reducing seeding rates when using no seed treatment or a fungicide only seed treatment (ApronMaxx) may be too risky and provided minimal profit gains. In contrast, this study also showed that a fungicide/insecticide seed treatment (CruiserMaxx) reduced economic risk and increased profit across an array of environments, seeding rates (80,000–140,000 seeds/a), and grain sale prices (\$9/bu and \$12/bu). Furthermore, to realize the lowest risk and highest profit increase with CruiserMaxx, producers should consider lowering their seeding rates to the EOSR according to their expected grain sale price. The EOSR for CruiserMaxx ranged from 94,000 to 101,000 seeds/a and was on average, 16% (18,000 seeds/a) less than ApronMaxx and the UTC across grain sale prices of \$9/bu and \$12/bu.