Can KY Soybean Yield be Increased with Foliar Fungicide and Insecticide Applications at R3?

Carrie Knott, Chad Lee, Carl Bradley, and Raul Villanueva

There are numerous reports across the United States that insecticide + fungicide tank mixes applied at R3 growth stage increase soybean yield. These yield increases occurred even when disease incidence and severity and insect populations have been less than the University recommended levels for pesticide applications. This phenomenon of increased yield following prophylactic insecticide + fungicide applications has been termed by some as a 'synergistic effect'.

Investigations of synergistic effects of prophylactic insecticide + fungicide applications at R3 in full season soybean (spring-planted soybean preceded by corn production the previous calendar year) have not been completed in Kentucky in recent years. Further, recent work in double crop soybean (soybean planted in early summer which was preceded by winter wheat in the same calendar year) found that prophylactic R3 applications increased soybean seed yield by 5 bu/a when insect populations were above thresholds known to cause economic damage. The goal of this project was to determine whether University recommended pesticide applications in soybean are more profitable than intensive, higher-input management strategies that incorporate prophylactic pesticide applications at R3 growth stage in Kentucky and if seed composition differed among the treatments.

Full season soybean trials were evaluated at three locations in Kentucky: one in Lexington and two in Princeton. Double crop soybean trials were evaluated at two locations in Princeton. Four treatments were evaluated: fungicide (Miravis Top, 13.7 oz/a) applied at R3 growth stage; insecticide (Warrior II with Zeon Technology, 1.92 oz/a) applied at R3 growth stage; fungicide + insecticide applied at R3 growth stage; and pesticides applied according to University recommendations, which based upon recommendations pesticide applications were not needed and were not applied. Net economic return was also determined.

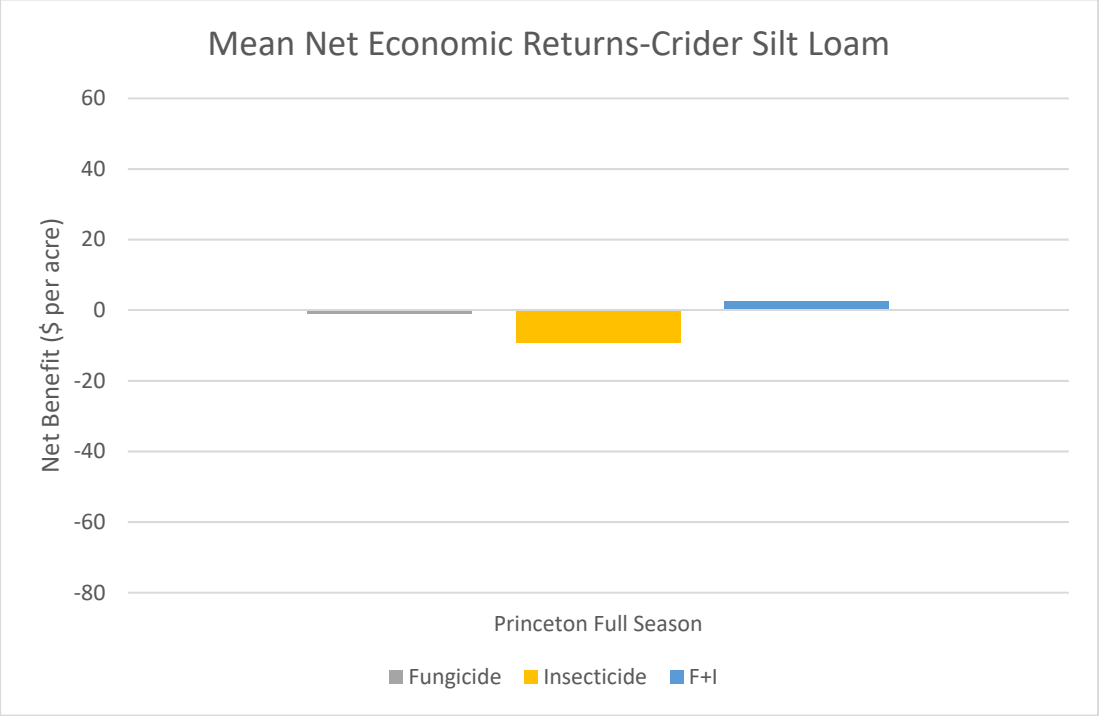
Seed yield and oil and protein concentration did not differ among any of the pesticide treatments for full season soybean (Table 1). This was not surprising given that insect populations and disease severity and incidence were well below the threshold for pesticide applications. It is also important to understand the profitability of a particular treatment. For full season trials, differences between University recommended treatment and the three pesticide treatments were not found (Figure 1).

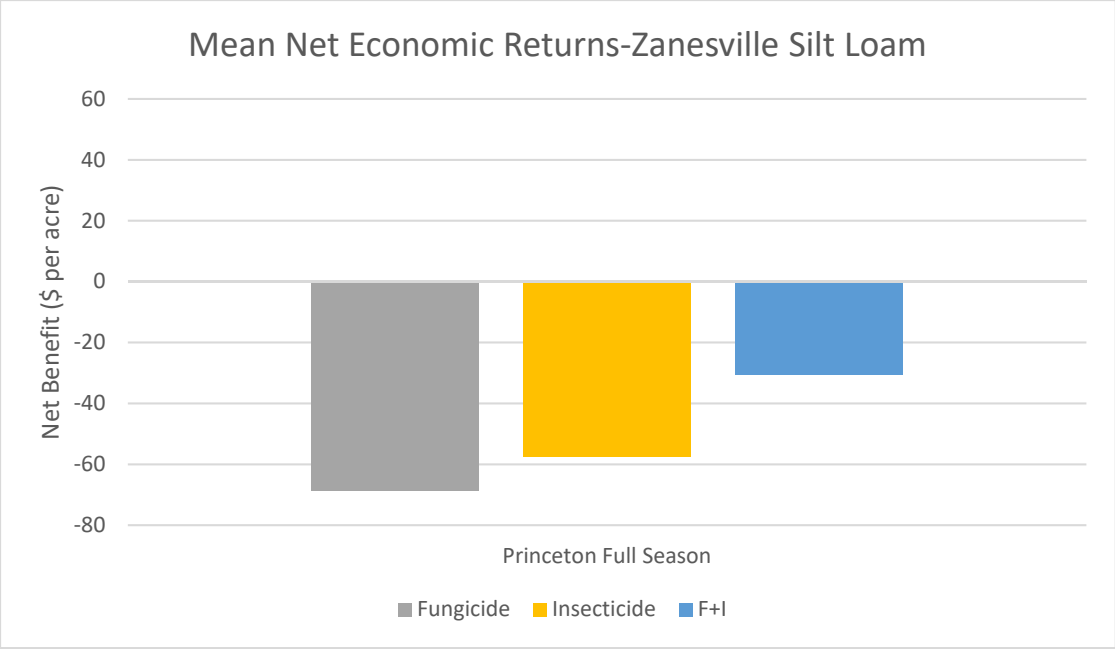
Table 1. Seed yield and percent oil and protein for full season soybean at two locations in Princeton and one location in Lexington, KY, for three pesticide treatments and a treatment that followed University recommendations, which did not apply pesticides.

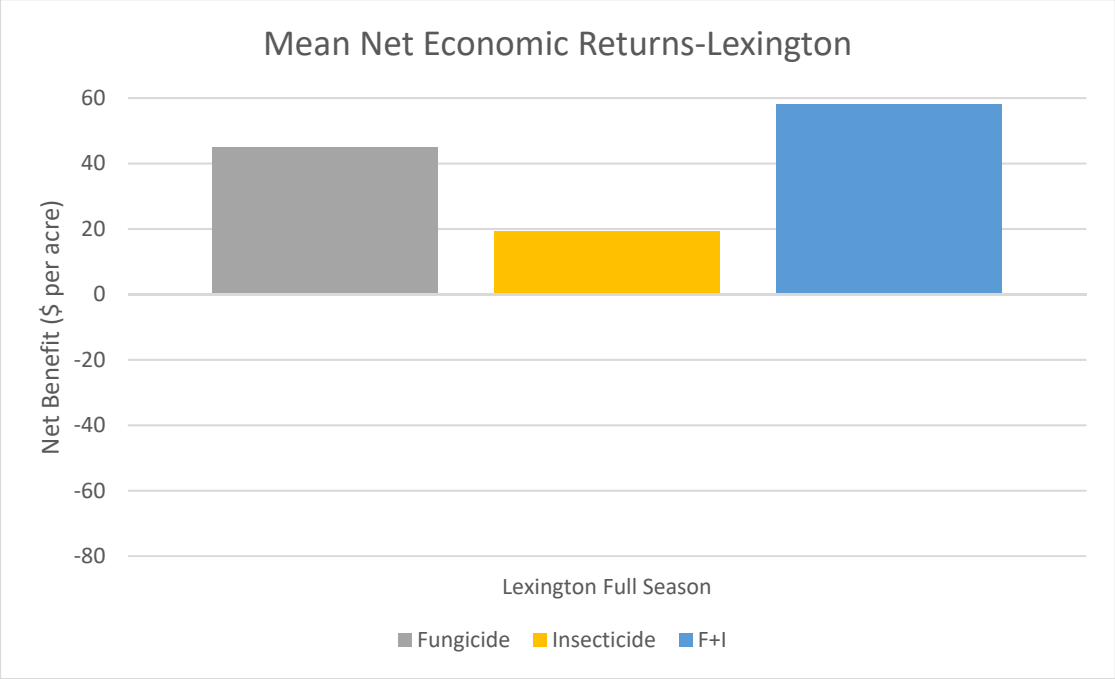
Treatment†	Princeton-Crider Silt Loam			Princeton-Zanesville Silt Loam			Lexington		
	Yield (bu/acre)	Oil (% dry basis)	Protein (% dry basis)	Yield (bu/acre)	Oil (% dry basis)	Protein (% dry basis)	Yield (bu/acre)	Oil (% dry basis)	Protein (% dry basis)
Univ. Rec.	65	15.1	38.8	51	15.3	39.8	68	19.8	40.1
Fungicide	67	15.9	38.6	47	15.2	40.1	75	19.6	40.2
Insecticide	65	16.1	38.9	47	15.3	39.8	71	19.9	40.2
Fungicide + Insecticide	68	15.9	38.9	51	16.2	40.2	77	19.8	40.4
P-value	0.1251	0.2629	0.9642	0.3946	0.2167	0.0525	0.0673	0.4158	0.3997

†University Rec.; University of Kentucky recommendations for fungicide and insecticide applications (Bradley, 2019; Villanueva, 2018); pesticides were not applied at any location because insect and disease populations were less than recommended for pesticide applications.

Figure 1. Mean net economic returns for three pesticide treatments examined for full season soybean at Princeton on two soil types and at Lexington on one soil type. Statistical differences ($P < 0.05$) were not detected for any location among the pesticide treatments and the University Recommended treatment for which pesticides were not be applied.







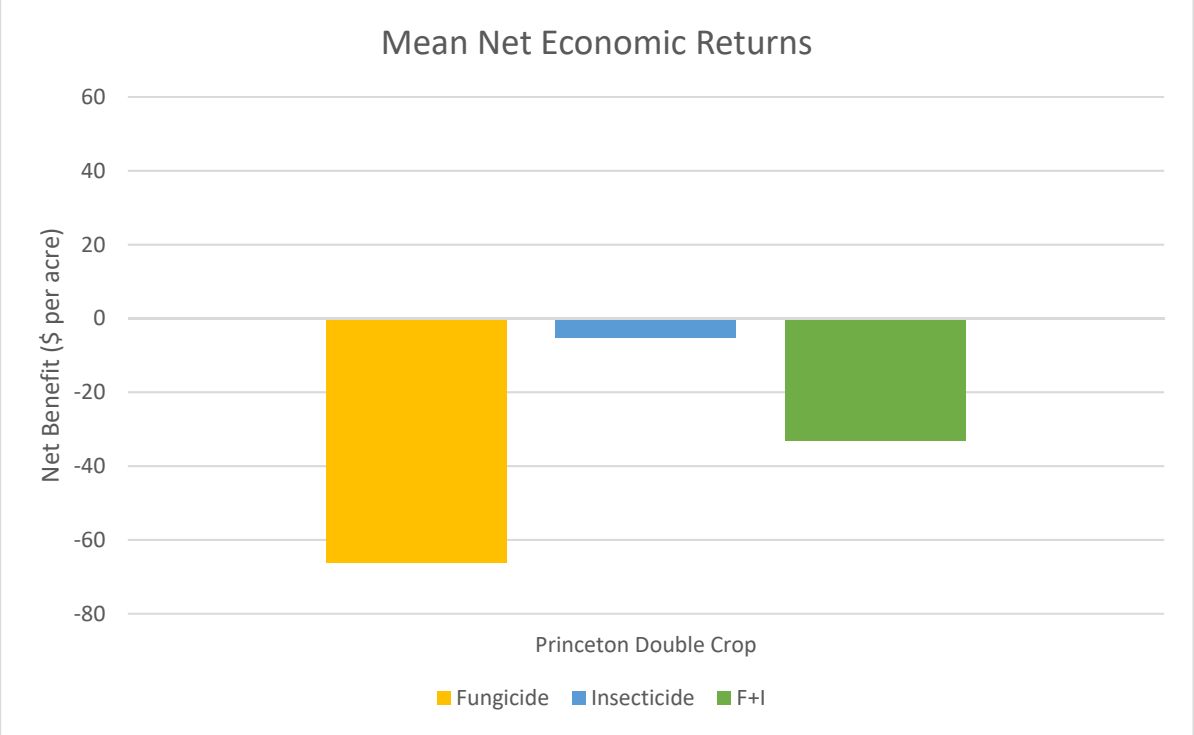
For the double crop trials, differences between the University recommended treatment and the three pesticide treatments were not found (Table 2). For profitability of double crop soybean, one difference was found between the University recommended treatment and the fungicide treatment. The mean net economic return for the fungicide treatment for double crop trials was -$66.26 per acre (Figure 2). Although the insecticide and fungicide + insecticide treatments also resulted in a negative net return, neither differed from the University recommended treatment.

Table 2. Seed yield and percent oil and protein for double crop soybean at two locations in Princeton, KY, in 2021 for three pesticide treatments and a treatment that followed University recommendations, which did not apply pesticides.

Treatment†	Princeton-Crider Silt Loam			Princeton-Zanesville Silt Loam		
	Yield (bu/acre)	Oil (% dry basis)	Protein (% dry basis)	Yield (bu/acre)	Oil (% dry basis)	Protein (% dry basis)
Univ. Rec.	52	15.9	15.3	38	14.6	15.1
Fungicide	50	16.6	15.2	33	14.6	15.9
Insecticide	52	16.1	15.3	40	14.0	16.1
Fungicide + Insecticide	51	16.1	16.2	37	14.6	15.9
P-value	0.7471	0.8387	0.2167	0.1831	0.7447	0.2629

†University Rec.; University of Kentucky recommendations for fungicide and insecticide applications (Bradley, 2019; Villanueva, 2018); pesticides were not applied at any location because insect and disease populations were less than recommended for pesticide applications.

Figure 2. Mean net economic returns for three pesticide treatments examined for double crop soybean at Princeton on two soil types. The fungicide treatment had the greatest ($P < 0.05$) loss than any other treatment. The insecticide and fungicide + insecticide did not impact ($P < 0.05$) net economic return when compared to University recommendation.



This work provides further evidence that University recommendations result in the greatest profitability, particularly in the absence of insect and/or disease populations.

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