Soybean Profitability Comparisons of "Automatic Applications" Versus "Treating as Needed" Approaches for Insect and Disease Control

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ABSTRACT

Arkansas soybean producers spend significant amounts of money on annual input costs. 2015 UA Division of Agriculture crop enterprise budgets estimated irrigated soybean average operating expenses at $328.75 per acre across Roundup Ready, Liberty Link, and conventional systems. Commodity market price declines, such as have been seen in late 2015, increase the importance of input cost evaluations to maintain profitable returns. This study compares "automatic applications" made on crop phenology versus "treating as needed" systems where applications are made based on scouting for insect and disease thresholds. Seven large block trial locations were initiated in 2015 with five treatments utilizing insecticides, fungicides, combinations of products, and application system approaches. Partial budgeting methodology is employed to estimate economic outcome under each system. Cost, yield, and profitability measures are calculated for each treatment. The agronomic and economic research results will be used to evaluate overall profitability of current state extension recommendations including treatment threshold levels.

Introduction and Background

Agronomic management of insecticide and fungicide inputs typically considers effectiveness of products and application timing relative to pest populations. An extensive body of research has been developed through the agricultural experiment stations associated with land grant universities and is distributed through cooperative extension service publications (Giesler, 2008; Robertson, et al. 2009). Many of these studies focus on single pest scenarios such as soybean aphid (Myers, et al. 2005; Johnson, et al. 2009) or Asian soybean rust (Johansson, et al. 2006) and may use an integrated pest management approach (Song and Swinton, 2009). Results from these studies generally show a yield benefit from treatments, but the economic profits of the treatments often are variable. Economic thresholds for initiating treatments have been established for a limited number of pest species and tend to be geographically specific (Ragsdale, et al. 2007; Bueno, et al. 2013). Another prominent question within these studies is cost-effectiveness of preventative, concurrent management approaches Johnson, et al. 2008 found limited value from preventive soybean aphid treatments. Tinsley, et al. 2012 saw no yield-benefit from resistant cultivars or seed treatments, but recognized that higher and longer sustained pest densities could provide justifications. An economic evaluation of soybean fungicide seed treatments in Arkansas found a robust economic benefit for the seed treatment (Poag, et al. 2005). Comparisons of site-specific versus uniform management approaches pose additional questions. Early estimations based on hypothetical scenarios prior to development of current, site-specific equipment for product applications indicated only slightly greater returns for the site-specific approach (Krell, et al. 2003). A more recent study by Henry, et al. 2011 indicated that yield increases were possible using below-threshold applications of fungicides and insecticides, but questioned their economic benefits.

This specific objective of this study was to make economic comparisons of the "automatic applications" made on crop phenology versus "treating as needed" systems where applications are made based on scouting for insect and disease thresholds. "Automatic" product combinations and single treatments mimic management practices frequently employed by producers. Identification of the most cost-effective treatment strategy can optimize chemical use and impact on the environment while increasing producer net returns.

Table 1

PRODUCTS & RATES		Crawfordsville Chuck Farr	Marianna Bobby Griffin	Lonoke Jason Fortner	Nelson Crow	Matt Miles	NEREC
Variety		Armor 55R22	Asgrow 4232	Asgrow 4632	Asgrow 4642	Pioneer 47T36	Asgrow 4710
Treatment							
Insecticide + Fungicide	Automatic @ R3	Prevathon 14 oz + Aproach Prima 6.8 oz	Prevathon 14 oz + Topaz 6.0 oz + Priaxor 4 oz	Prevathon 14 oz + Topaz 6.0 oz + Priaxor 4 oz	Prevathon 14 oz + Priaxor 4 oz	Prevathon 14 oz + Priaxor 4 oz	Prevathon 14 oz + Priaxor 4 oz
Insecticide Only		Prevathon 14 oz	Prevathon 14 oz	Prevathon 14 oz	Prevathon 14 oz	Prevathon 14 oz	Prevathon 14 oz
Fungicide Only		Aproach Prima 6.8 oz	Topaz 6.0 oz + Priaxor 4 oz	Topaz 6.0 oz + Priaxor 4 oz	Priaxor 4 oz	Priaxor 4 oz	Priaxor 4 oz
Treat Only as Needed		None	None	None	None	None	None
Insecticide + Fungicide at R3 followed by Fungicide Only at R5	R3 & R5		Prevathon 14 oz Topaz 6.0 oz + Priaxor 4 oz Priaxor 4 oz		Prevathon 14 oz Priaxor 4 oz Priaxor 4 oz	Prevathon 14 oz Priaxor 4 oz Priaxor 4 oz	

Table 2

YIELDS		Crawfordsville Chuck Farr	Marianna Bobby Griffin	Lonoke Jason Fortner	Nelson Crow	Matt Miles	NEREC
Variety		Armor 55R22	Asgrow 4232	Asgrow 4632	Asgrow 4642	Pioneer 47T36	Asgrow 4710
Treatment		Yield bu/acre					
Insecticide + Fungicide	Automatic @ R3	76.0 a	48.1 b	67.2 a	74.0 a	77.8 a	85.8 a
Insecticide Only		74.9 a	48.9 b	60.4 b	63.7 b	74.5 a	88.1 a
Fungicide Only		75.2 a	48.1 b	60.0 b	72.7 a	68.6 a	84.1 a
Treat Only as Needed		76.7 a	41.4 c	54.7 c	63.1 b	73.56 a	84.2 a
Insecticide + Fungicide at R3 followed by Fungicide Only at R5			54.1 a		75.2 a	66.8 a	

Means followed by same letter do not significantly differ (P=.10, Duncan's New MRT)

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Methods

The information presented in this study was developed from a joint extension/experiment station project located on the UA Northeast Research & Extension Center at Keiser, Arkansas and fields of five cooperating Arkansas soybean producers. All locations used a furrow-irrigated production system with mostly Group IV RoundupReady cultivars. Specific cultivars used in the study were Armor 55R22, Asgrow 4232, Asgrow 4632, Asgrow 4642, Asgrow 4710, and Pioneer 47T36. Experimental design at all locations was a randomized complete block with four replications. Five treatments were employed: insecticide plus fungicide, insecticide alone, fungicide alone, insecticide plus fungicide at R3 followed by fungicide alone at R5, and a "treated as needed" treatment strategy (Table 1). Specific products varied across locations. Primary expected insects were soybean loopers and earworms. Frogeye leafspot was the major expected disease. Scheduled scouting reports showed no "treated as needed" plots reached treatment threshold levels and thus no insecticide or fungicide treatments were made. A partial budget approach was utilized to estimate net return differences between treatments. The UA Division of Agriculture cost-of-production budget for 2015 furrow-irrigated RR soybeans based on an Excel spreadsheet format was the basic tool used to calculate net change in economic returns across the treatments at individual locations. Yield measurements were adjusted to 13% moisture equivalents. The market price utilized in the economic analysis was the 2015 Arkansas soybean statewide average price. Price quotes from National Agricultural Statistics Service LRGR-111, Arkansas Daily Grain Report, were compiled for January 2-December 30, 2015, to generate a simple, statewide average. All treatments were assumed to be custom, ground applications for economic analysis. Net Returns were calculated by plot.

RESULTS

Results from this study begin with yield measures taken for all treatments in the study and are combined with product rates used by treatment and location to generate net return estimates. The three "Automatic @ R3" treatments had no statistically different yields at five of the six study locations (Table 2). Furthermore, no significantly different yields were found between the automatic and "Treat Only As Needed" strategies at the Farr, Miles, and NEREC locations. Griffin location had a significantly higher yield for the R3 and R5 multiple treatment, Fortner location had highest yield with "one-and-done" insecticide + fungicide treatment, and Crow had significantly higher yields across both of those treatments and the fungicide only treatment.

Addition of the applications and products cost factors (Tables 1 and 3) to the yields enabled net return estimates by treatment (Table 4). "Treat-Only-As-Needed" generated highest net returns for Farr and Miles. Griffin had highest yield with the combination R3 and R5 strategy, Crow had highest yield with fungicide only, and the NEREC high yield was for insecticide only. These yield and net return results for one year suggest that multiple years of study will be required to obtain a true picture of the strategy relationships.

Table 3

TREATMENT NUMBERS		Crawfordsville Chuck Farr	Marianna Bobby Griffin	Lonoke Jason Fortner	Nelson Crow	Matt Miles	NEREC
Variety		Armor 55R22	Asgrow 4232	Asgrow 4632	Asgrow 4642	Pioneer 47T36	Asgrow 4710
Treatment							
Insecticide + Fungicide	Automatic @ R3	1	1	1	1	1	1
Insecticide Only		1	1	1	1	1	1
Fungicide Only		1	1	1	1	1	1
Treat Only as Needed		0	0	0	0	0	0
Insecticide + Fungicide at R3 followed by Fungicide Only at R5			1 1		1 1	1 1	

Table 4

NET RETURNS		Crawfordsville Chuck Farr	Marianna Bobby Griffin	Lonoke Jason Fortner	Nelson Crowe	Matt Miles	NEREC
Variety		Armor 55R22	Asgrow 4232	Asgrow 4632	Asgrow 4642	Pioneer 47T36	Asgrow 4710
Treatment		$/acre					
Insecticide + Fungicide	Automatic @ R3	292.71	35.81	208.15	275.53	309.82	382.01
Insecticide Only		299.49	64.88	168.65	198.43	295.88	418.60
Fungicide Only		302.97	53.29	160.67	281.29	244.29	384.15
Treat Only as Needed		339.36	20.83	140.85	216.64	311.03	407.04
Insecticide + Fungicide at R3 followed by Fungicide Only at R5			67.97		264.38	188.59	

Means followed by same letter do not significantly differ (P=.10, Duncan's New MRT)

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Photo 1.

Furrow Irrigated Soybean Production System

Photo courtesy of C. R. Stark, Jr.

Photo 2.

Furrow Irrigated Soybean at Bloom Stage

Photo courtesy of C. R. Stark, Jr.

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