

Tennessee Farm-Level Economic Implications of Soybean Rust



Asian Soybean Rust (here after referred to as “rust”) is a potentially devastating crop disease. It now afflicts soybean production in the Eastern Hemisphere and in the Western Hemisphere south of the equator. The first case of rust in the continental United States was confirmed on November 10, 2004. While the extent of the outbreak is not known, concern over the long-range impact of rust on U.S. soybeans has grown as a result of the confirmation.

Many federal and state agricultural agencies have begun preparations for such an outbreak. Defined protocols have been developed in some states for better agency interaction and information release to growers.

Because of rust’s ability to over-winter in the southern United States, it will be difficult, if not impossible, to eliminate rust once it has been established. Therefore, there may be permanent and significant changes in regional cropping systems. The South may lose soybean acres due to rust’s ability to overwinter in warmer areas. Also, even in Northern areas, the risk of soybean rust outbreaks may change crop-planting decisions. While these regional crop-planting decisions are not the main focus of this publication, they are important considerations in the study of potential soybean rust impacts.

The objective of this publication is to analyze the financial impact on soybean farmers after a rust outbreak. While a different analysis might include a probability study regarding the chance of having rust on a particular farm or in a particular field, this analysis will focus on farming with rust as a known pathogen. Therefore, changes in operating expenses can be analyzed and compared to other competing crops.

Yield Impacts

Data from countries that are currently infested with rust allow some insight into its effect on yields. Yield losses have been reported as high as 80 percent in countries where soybean rust is present



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(Illinois Department of Agriculture). But where a fungicide program is in place, yield losses are estimated to average 4.3 percent, with a range of a 9.5 percent yield loss on the high end to a gain of 0.9 percent on the low end (Livingston, et.al.). Depending on the severity and timing of the rust infestation, from one to three fungicide applications may be necessary to control the rust. A positive yield response can occur, due to the impact that rust fungicides have on other soybean diseases.

Because rust grows best in warm, wet environments, yield loss can vary significantly based on location and timing of the rust outbreak. Rust will not survive cold and must over-winter on live plant hosts. Host plants will generally survive at temperatures greater than 28 degrees F. Based on the 28-degree temperature constraint, rust was shown to have the possibility to survive winters every year in Southern Florida, and 50 percent of the winters in Central Florida and Southern Texas. A third of the time, the rust could survive in Southern Louisiana (Borchart, et.al.). Therefore, only the southernmost areas of the United States could over-winter rust, and rust spores would have to migrate north during the growing season to infest soybeans.

Rust Treatment

Rust has the potential to devastate soybean yields. Once a rust infestation has been identified, fungicide treatments are used. In Brazil, during the 2003-2004 growing season, it was estimated that 95 percent of soybean acreage was sprayed between one and three times for rust, depending on whether the variety was short- or long-season (Iowa State University). In areas where rust is known to exist and over-winter, farmers may choose to spray as a preventative measure even before rust is found. For that reason, if rust is found in the United States, there may be a permanent shift in soybean production costs. Even if rust-resistant soybean varieties

are eventually produced, there will still likely be a significant increase in cost for their use.

There are other possible impacts due to the possibility of rust infestation. Over time, if rust becomes a chronic problem, farming systems may evolve, using different row spacing, equipment, etc. This analysis assumes that, in the short run, farming systems will not change.

Treatment Cost and Budget Comparisons

Fungicide applications require 6 ounces of fungicide per acre per spraying (Newman). At a price of \$2/oz, the fungicide itself would cost \$12/acre per spraying. As more fungicides are evaluated and approved for spraying rust, costs could change. Fuel, operating capital and machinery repair expenses would add another \$1.06 per acre, or \$13.06/acre for each spraying, including the cost of the fungicide, if the farmer owned the spraying equipment. Because spraying rust in its early stages of infestation is critical, an additional cost for scouting has also been included. Based on local reports from Extension agents in West Tennessee, scouting charges of \$2.50 per acre were used. There would also be another \$0.91/acre increase in long-run cost due to depreciation and capital charges on the spraying equipment (Gerloff).

For comparison purposes, a budget for soybeans grown in Tennessee without risk of rust infestation was calculated using no-tillage technology. Total variable expenses were \$87.90 per acre. Adding depreciation and machinery capital costs of \$25.24/acre increased total costs to \$113.14/acre, not including labor and land costs (Gerloff).

Two fungicide applications and scouting would cost \$28.62 (\$13.06 per spray @ 2 sprays, plus \$2.50 for scouting), bringing total variable expenses to \$116.52 per acre (\$87.90 + \$28.62). Including the additional fixed costs of \$0.91/acre would increase total costs to \$142.67 per acre (\$113.14 + \$28.62 + \$0.91).

Impact on Net Income

Net income would be impacted by rust in two ways – the added cost of fungicide spraying and the impact on yields. With the average 4.3 percent yield reduction cited above, a Tennessee soybean farmer averaging 34 bushels per acre (5-year state average), would experience a drop of 1.46 bushels per acre. The current farm program sets a floor for soybean prices in Tennessee of approximately \$5.50 per bushel, including the loan rate plus counter-cyclical payments. Using that floor price with the reduction in yield, gross revenue would decline \$8.04 per acre (\$5.50/bu. x 1.46 bu./acre). Therefore, the impact on net cash income would be a reduction of \$36.66/acre (two fungicide applications and scouting would cost \$28.62 plus \$8.04 drop in revenue).

Impacts, Given Yield Variations and Spray Applications

Table 1 includes the impact of rust on net cash income, varying the number of fungicide applications and yield response to a rust infestation. Even with little or no loss in yields, net cash income would fall \$13.88 per acre with only one spray, to as much as \$40.00 with three sprays. In a situation where yields fell 9.5 percent, net cash income could fall as much as \$59.44 per acre if three applications were needed.

Table 2 compares net cash returns and return to land and labor for soybeans after rust, with soybeans, wheat, corn and cotton for Tennessee farms. Output prices used are based on farm program provision floor prices (direct payments were not included). No tillage budgets were used to calculate net cash incomes for soybean, cotton and corn. A conventionally tilled wheat budget was used for comparison.

Using Table 2's results, soybean net cash returns per acre drop from \$99.10 per acre to \$85.22 per acre using only one spray. If three sprays are used and 9.5 percent yield loss is experienced, returns drop to \$39.66 per acre. The latter return also drops below the cash return for wheat. While most wheat in Tennessee is double-cropped with soybeans, it demonstrates the degree of impact that rust could have on soybean returns under an extreme yield-loss scenario.

Returns to land and labor in Table 2 are calculated by subtracting fixed machinery costs (depreciation and capital charges) from net cash returns. Soybean returns to land and labor under the three-spray and low-yield scenario are comparable to wheat.

While soybeans will not likely be completely eliminated from a corn/soybean/wheat crop-rotation farming system under even the severest rust scenario, acreage shifts of up to 300,000 acres in soybean production occurred in Tennessee during the 1990s. These acreage shifts generally reflected the comparable profitability and financial risk of growing soybeans relative to other row crops. Similar shifts could occur if permanent changes in soybean yields and/or production costs drop returns significantly.

Table 1.
Net Cash Income Impact, Per Acre,
Varying Yield Response and
Number of Fungicide Applications,
Including Scouting Cost.

	.9% Yield Increase	4.3% Yield Decrease	9.5% Yield Decrease
One Spray	-\$13.88	-\$23.60	-\$33.32
Two Sprays	-\$26.94	-\$36.66	-\$46.38
Three Sprays	-\$40.00	-\$49.72	-\$59.44

Table 2.
Net Cash Return/Acre for Soybeans with Rust, Soybeans, Wheat, Corn and Cotton.

Crop ¹	Variable Cost/Acre	Net Cash Return/Acre ²	Fixed Machinery Cost/Acre	Return to Land and Labor
Soybeans (Rust-Infested), 1 spray, 0.9% yield gain)	\$103.46	\$85.22	\$26.15	\$59.07
Soybeans (Rust-Infested), 2 sprays, 4.3% yield loss)	\$116.52	\$62.44	\$27.06	\$35.38
Soybeans (Rust-Infested), 3 sprays, 9.5% yield loss)	\$129.58	\$39.66	\$27.97	\$11.68
Soybeans 34 bu. yield	\$87.90	\$99.10	\$25.24	\$73.86
Wheat 51 bu. yield	\$116.53	\$49.22	\$34.75	\$14.47
Corn 125 bu. yield	\$137.18	\$156.57	\$30.35	\$126.22
Cotton 748 lb. yield	\$308.00	\$155.76	\$74.85	\$80.91

¹Yields used are 5 year average Tennessee yields, 2000-2004 (projected).

²Does not include land or labor expenses. Output prices used were: corn, \$2.35/bu.; soybeans, \$5.50/bu.; cotton, \$0.62/lb.; and wheat, \$3.25/bu.

Conclusions

Rust's financial impact on individual farmers could be significant. It has been shown that net cash income per acre could drop as much as \$59 per acre in Tennessee. Even with an "average" expected yield loss of 4.3 percent accompanied by two fungicide applications, net cash income could drop more than \$36 per acre. With more than 1.1 million acres of soybeans in Tennessee, the impact could be as high as \$39 million to Tennessee farmers.

Over time, soybean acreage would likely decline, as farmers change to other crops. Also, there could be higher prices for soybeans, at least in the short run, as the domestic supply drops due to lower yields. Using current farm program provisions to define output floor prices, it appears that wheat net cash income would surpass soybeans if three fungicide sprays were required and the worst scenario soybean yield losses occurred.

For now, it appears that rust could have a major financial impact for Tennessee soybean farmers. Preparation and training may help to offset some of the negative impacts of soybean rust. Also, research into rust-resistant varieties may hold the key to diminishing the potential impacts of soybean rust in the long run.

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