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Aflatoxin Challenge Facing Farmers

Aflatoxin contamination in corn can be an annual problem for Southern corn producers, where contamination can endanger food supplies as well as the health of both people and livestock. The economic threats include market restrictions and possible price discounts that can exceed \$1.00 per bushel, or forced crop destruction impacting the livelihood of crop producers and numerous other feed and food industry participants.

Aflatoxins are primarily produced by the fungal strains *Aspergillus flavus* and *Aspergillus parasiticus*. They are soil-borne organisms, and as they grow on a food source, aflatoxin can be produced and build up (Horne et al. 1991). Aflatoxins are classified as a group 1 carcinogen (IARC 1993). Vardon *et al* (2003) estimated the annual cost of aflatoxin contamination in the U.S. at about \$500 million, while Robens and Cardwell (2003) calculated additional annual costs of aflatoxin management in the U.S. at \$20-\$50 million.



New Technology Receiving Attention

In the past several years, a new technology has been made commercially available to assist in preventing aflatoxin in the field. The new technology, atoxigenics, are commercially known as AF-36 and Afla-Guard®. AF-36 is produced by the Arizona Cotton Research and Protection Council and distributed in Texas by Double CT LLC, and Afla-Guard® is produced and sold by Syngenta.

Field Tests of Product Effectiveness

Both of the atoxigenics have been field tested to prove their effectiveness in decreasing aflatoxin contamination. Results from tests conducted on Texas corn have had mixed results. In 2007 and 2008, Afla-Guard® field studies were conducted in Texas to compare aflatoxin contamination levels in corn fields treated with Afla-Guard® to contamination levels in fields not treated with Afla-Guard®. The results showed that, on average, Afla-Guard® reduced aflatoxin contamination levels in treated fields by 85% in 2007 and 88% in 2008, when compared to non-treated fields. In 2008, the same type of study was conducted on the effectiveness of AF-36,

comparing aflatoxin contamination in fields treated with AF-36 to fields not treated with AF-36. Average contamination levels were decreased by 80-90% in fields treated with AF-36 compared to fields not treated. A Texas A&M AgriLife Extension Service trial conducted during the severe drought of 2011 across multiple Texas locations showed mixed effectiveness with reductions in aflatoxin levels ranging from near 0 to 94% reduction across locations and products. The research findings suggest that the products may not work as well in severe drought years.

Producers have been increasing the use of these products in recent years, and Southern Extension Economists are conducting economic research in an attempt to determine if these atoxigenics are economically beneficial for corn producers in the South, either by themselves or when combined with crop insurance options currently available to producers.

Aflatoxin is considered a quality discount for crop insurance purposes. Depending on the level of contamination, aflatoxin can affect the crop insurance indemnity payment.

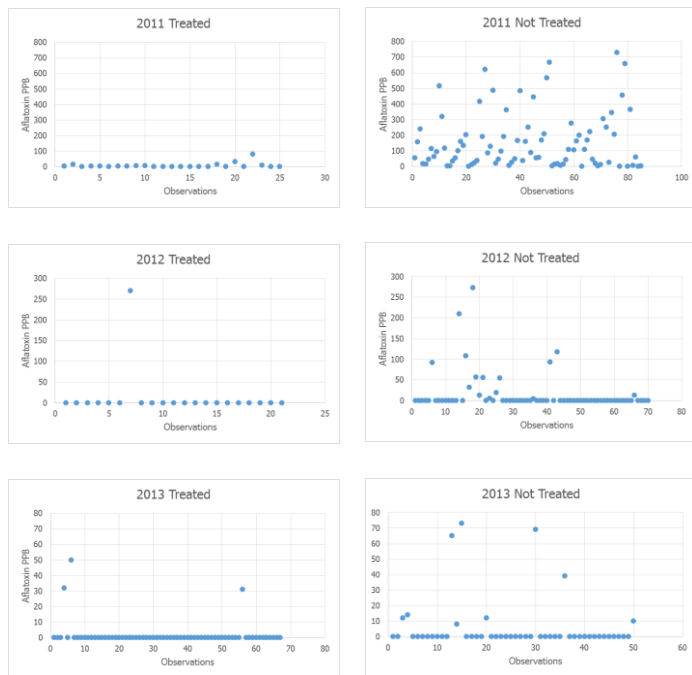
Test result variability can be costly to producers either in the form of a discrepancy between local elevator discounts and crop insurance payments, or the cost of time and money driving loads to additional elevators if the test is higher than anticipated at an elevator. While producer opinion of the atoxigenics seems positive, and use is increasing, many risky factors can influence producer net revenue.



Simulation Analysis

This simulation analysis considers risk in yield, regional market price, aflatoxin contamination, test result variability, and crop insurance indemnities. Historical producer farm level data specific to Central Texas was used to simulate 500 different possible yields, prices, aflatoxin test values, and crop insurance indemnity payments based on historical risk for these variables. The analysis assumed revenue protection at the 70% coverage level with enterprise unit coverage. The insurance base price

was assumed to be \$4.00/bushel. The APH for the treated and not treated cases was assumed to be 75 bushels per acre, however, the rate yield or the actual yield used to calculate insurance premiums was assumed to be 75 bushels for the treated scenario versus 50 bushels for the no treatment scenario.



A partial budget was used to calculate 500 different possible net revenues incorporating the risky yield, regional market price, aflatoxin test variability, and crop insurance indemnities. Net revenues were calculated under two scenarios, one scenario assuming atoxigenics were not used on the representative field and one scenario assuming atoxigenics were used. In the scenario where the field was treated with atoxigenics, a cost of \$16 per acre was applied to the budget to account for product and aerial application cost. The budget assumed the atoxigenic cost \$11 per acre and aerial application cost \$5 per acre.

The risky aflatoxin test variability affects two test points, at the local elevator and for insurance purposes. In net revenue calculations these points were separated. First, each representative semi load of corn was “tested”, in the model, to determine any market discounts at the local elevator for corn testing over 20 ppb. Second, the representative field was “tested”, in the model, to determine how aflatoxin would affect the insurance indemnity payment.

A key point concerning aflatoxin test results is that historical data was only available from field test results used for insurance purposes. Preliminary results listed below used the insurance aflatoxin test result data and created a new set of representative local elevator test result data. A previous study concerning the variability between local elevator and insurance aflatoxin test results documented on average insurance test results are 53.8% higher than local elevator test results.

Gross revenue consisted of market revenue, less any aflatoxin discounts per semi load, and a crop insurance indemnity payment calculated based on the specific crop insurance option. Total costs came from a representative corn production budget for Central Texas, and included general production costs with the addition of an atoxigenic and application costs for the treated scenario calculations. Crop insurance premiums for 70% revenue insurance with enterprise unit coverage were included in the budget. Net revenue was then simulated for 500 possible outcomes for both the treated and non-treated scenarios.

Preliminary Simulation Results

Preliminary results for the effects of atoxigenics on producer net revenue are broken down into three categories: market revenue, crop insurance premiums, and net revenue.

1. Market Revenue

Market revenue consisted of market price in \$/bu multiplied by the total production of corn for the representative field, less any aflatoxin discounts by semi-truck load of corn. Market revenue was simulated over 500 different possible outcomes, for the treated scenario and again for the non-treated scenario. Preliminary results show a clear difference between the two scenarios, in dollars of total market revenue and the percentage of semi-truck loads that tested over 20 ppb.

The average of the 500 simulated market revenues for the treatment scenario that used atoxigenics was \$18/acre higher compared to the not treated scenario. Less the cost of the atoxigenics and aerial application of \$16/acre, the atoxigenics provided additional market revenue of \$2/acre compared to not using atoxigenics.

Additionally, the representative semi-loads of corn from the no treatment scenario were 30% more likely to test over 20 ppb for aflatoxin at the local elevator, compared to the semi-loads from the treatment field.

2. Crop Insurance Premiums

Crop insurance premiums are influenced historical yield volatility (i.e., the probability an indemnity payment will be made), the coverage level, and the value of the crop. Crop insurance indemnity payments are based on the specific crop insurance option and the percentage of price and average yield insured. Indemnity amounts are calculated by the difference between the guaranteed yield or revenue of the crop insurance option and the actual production or revenue in that crop year.

Insurance premiums for the treated versus non-treated scenarios were \$1.50 per acre lower due to less assumed deterioration of the farm’s insurance yield resulting from quality loss adjustments from aflatoxin. Historical data was used to

simulate 500 possible outcomes of crop insurance indemnities and the probability of payment, in a treatment and no treatment scenario for all crop insurance options for corn produced in Central Texas (specifically Williamson County). Results showed that the average indemnities for crop insurance options under the treatment scenario were higher on average and more frequent. This result can be interpreted as evidence that atoxigenics help producers maintain a higher insurance yield which allows them to protect a larger portion of their crop. Protecting a larger portion of their expected crop means that a small loss would be more likely to trigger a payment under the treatment scenario than the non-treated scenario which increases the average size and probability of receiving an insurance indemnity.

3. Net Revenue

Net revenue was then analyzed to see, overall, if atoxigenic treatment was economically beneficial for corn producers. Again, the historical data and resulting market revenue and crop insurance indemnities were used to simulate 500 possible outcomes of net revenue, for treated and non-treated scenarios. In all treatment scenarios, the cost of the atoxigenic and aerial application was applied to the budget.

Overall results indicated that corn producers were slightly better off treating with the atoxigenic than the no treatment scenario. The potential impact on receipts from lower net prices due to aflatoxin discounts offset the cost of the atoxigenic. Further, the impact of sustained quality adjustments on crop insurance yields would lead to significant differences in crop insurance results in favor of using an atoxigenic.

Additional Research

The true cost of aflatoxin contamination to corn producers in Central Texas is more than just the market discount at the local elevator. For more accurate results, further research must be conducted to better value the true cost of aflatoxin and therefore better value the true benefit of atoxigenics.

Decision Aid Software

An on-line decision tool has been developed and placed on the web, so that producers can conduct their own analysis. The tool is designed so that producers can enter their own yield, cost, and insurance information, and run their own simulation analysis to determine the cost-effectiveness of treatment in their specific situation. The web link to the decision tool can be accessed through the Agricultural Economics Extension website at the following link:

(<http://agecoext.tamu.edu/resources/aflatoxin/>).

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