Cotton Root Rot Return to Treatment Calculator:
A Producer Decision Aid
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Abstract:

Cotton Root Rot (CRR) is a fungal disease that essentially eliminates harvestable cotton on affected acres. In 2012, the fungicide TopGuard®, active ingredient Flutriafol (11.8%), received a section 18 emergency use exemption label for use in Texas. It is estimated that TopGuard® was applied to nearly 170,000 acres in 2012 and increased usage is expected. TopGuard® has proven to be an effective control for CRR, but that control can cost in excess of $40 per acre. Texas A&M AgriLife Extension has developed a spreadsheet based decision aid to assist producers in evaluating their cotton root rot options by identifying economic thresholds for expected yields and percent of field affected by CRR. This decision aid can be found at: http://sanangelo.tamu.edu/extension/west-central-agricultural-economics/analytical-tools/.

Methods:

The Texas A&M AgriLife Extension Service Root Rot Return to Treatment calculator only measures per acre changes to gross revenue (GR) directly attributable to the application of TopGuard®. Most other production practices are assumed to remain unchanged. As a result, this calculator only requires input of 10 variables by users. The decision aid calculates return to treatment as:

$$1) \; Return \; to \; Treatment = \Delta Gross \; Revenue \, (GR) - \Delta Production \; Costs \, (PC) - Cost \; of \; Treatment$$

$$2) \; \Delta GR = Gross \; Revenue_{Treated} - Gross \; Revenue_{Untreated}$$

$$3) \; GR = (Lint \; Yld * Lint \; Price) + (Seed \; Yld * Seed \; Price)$$

Producer input in the revenue calculations includes the expected lint yield in the absence of root rot and the anticipated yield response to the TopGuard® treatment. Practical field trials suggest that numerous extraneous factors can influence the efficacy of the TopGuard® treatment, thus a producer's experience based input is sought for this variable. It is assumed that the effective yield of both saleable lint and seed is zero in acres that are affected by Cotton Root Rot. Producer price expectations are also required; the expected net price per pound of lint and the net price per ton of produced cotton seed. The seed yield is calculated as a function of the lint yield.

Production costs in the context of this decision aid are limited to harvest costs, ginning and associated costs and possibly additional fertilizer costs.

$$4)\ Production\ Cost_{Treated\ and\ Untreated}$$

$$= \left(Lint\ Yld_{\frac{lbs}{ac}} * harvest\ cost\right) + \left(Lint\ Yld_{\frac{cwt(seed\ cotton)}{ac}} * Gin\ and\ Haul\ cost\right)$$

$$+ \left(Lint\ Yld_{\frac{Bale}{Ac}} * Bag\ and\ Tie\ Cost\right) + \left(Nitrogen_{\frac{Units}{ac}} * Fert.Cost\right)$$

Harvest costs can consist of either a custom stripping or picking charge per pound of cotton, or a producer calculated cost per pound to strip or pick and build modules with owned or leased equipment and labor. The decision aid also provides flexibility in accounting for differences in how various ginning costs are assessed to producers. The input of a "0" in any of these ginning cost fields will cause that variable to be ignored.

If a producer makes the decision to increase fertilizer because of the decision to apply TopGuard®, then a price per pound of applied nitrogen will be entered into the calculator. Again if a "0" is entered into this field, the variable will be ignored.

$$5)\ Treatment\ Costs = \left(Cost\ of\ TopGuard®_{\$/unit} * Application\ Rate_{Units/ac}\right) + \$1.76$$

The last factor on Equation 5 is a nominal expense to account for a variety of other per acre expenses incurred applying TopGuard®. These expenses include additional fuel and labor hauling water and chemical to the field/planter, and amortized planter modifications.

Results and Discussion:

The output of the Return to Treatment Calculator is presented in the form of a sensitivity table and allows users to see the impact yields above and below their expectations will have on the return to treatment. The vertical axis of the table displays varying percentages of field assumed to be affected by root rot in five percent increments from five to thirty-five percent. The sensitivity table allows producers to quickly identify economic thresholds for expected lint yields and percent of field affected by CRR.

Sample output from an evaluation of a non-irrigated field is presented in Figure 1. From the sensitivity table on Figure 1 we see that at an expected yield of 400 pounds of lint per acre, the return to treatment does not turn positive until 20% or more of the field is affected by cotton root rot. The sensitivity table also illustrates that if yields increase to 550 pounds of lint per acre, treatment becomes profitable at affected rates above 10%. Similarly, if the yield drops to 250 pounds of lint per acre, control of root rot would not be profitable until more than twenty-five percent of the field is affected by CRR.

Key Assumptions

Key to the calculation of return to treatment is the assumption that producers will make application decisions; 1) prior to each field being to planted to cotton, and 2) if TopGuard® is applied it is applied to the entire field. The adoption of site specific farming technology will render this decision aid un-necessary.

Fertilizer is included in the decision aid on the premise that some producers may limit fertilizer applications on a particular field because the presence of root rot limits overall yield potential. If a fertilizer price is input into the calculator, the decision aid will apply additional nitrogen fertilizer at a rate of .104 pounds per additional pound of lint (50 lbs. N per bale).

Ongoing Research and Extension Activities

Several other agronomic factors have been identified as being critical to the accurate measurement of a return to treatment. Ongoing research is being conducted by Texas A&M AgriLife Research and Extension to quantify the impact the use of TopGuard® has on; 1) harvest efficiency, 2) lint turnout and 3) lint quality. As empirical data becomes available, this Return to Treatment Calculator will be revised. Work is also underway to modify this decision aid to one or more mobile devise platforms and make it available in various App Stores.

Cost of Topguard (flutriafol) ($/Gal)	$207.00
Intended Application Rate (Pints/ac)	1.5
Cotton Price ($/lb of Lint)	$0.77
Seed Price ($/ton)	$295.00
Strip/Pick Cost ($/lb of Lint)	$0.09
Cost to Bag and Tie Lint ($/Bale)	$5.00
Cost to Gin and Haul ($/cwt)	$2.50
Nitrogen Fertilizer ($/lb of N)	$0.63
Yield Response to Treatment	85%
Expected Yield without Root rot	400

$ 40.80 Treatment Cost ($/Ac)

Treatment costs includes cost of chemical, hauling water to field for planting and the amortization of planter modifications.

Sensitivity Analysis. Sesitivity of Return to Treatment to Changes in Yield Potential and Percent of Field Affected by Root Rot.

Expected Cotton Lint Yield (Lbs/Ac) without Root Rot

Percent Affected by Root Rot		250	300	350	400	450	500	550
	5%	($32.40)	($30.72)	($29.04)	($28.48)	($26.94)	($25.40)	($23.86)
	10%	($24.01)	($20.65)	($17.29)	($16.16)	($13.08)	($10.00)	($6.92)
	15%	($15.61)	($10.57)	($5.53)	($3.19)	$0.78	$5.40	$10.02
	20%	($7.21)	($0.49)	$6.23	$10.45	$14.64	$20.81	$26.97
	25%	$1.19	$9.59	$17.99	$24.08	$29.32	$36.21	$43.91
	30%	$9.59	$19.66	$29.74	$37.72	$44.66	$51.60	$60.85
	35%	$17.99	$29.74	$41.50	$51.35	$60.00	$68.65	$77.79

Figure 1. Example output from Cotton Root Rot Return to Treatment Calculator.