Chapter 12:

Costs and Benefits of COTMAN

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Many potential benefits may be realized through the use of COTMAN™. Decision rules contained in BOLLMAN are primarily directed toward the management decisions of insecticide and irrigation termination and harvest initiation. Harvest initiation rules can be employed at both field and farm level. In fact, many experienced users find much of the value of BOLLMAN rules to be in ranking fields by physiological maturity so that harvest can be sequenced and pickers used more efficiently. SQUAREMAN rules can be used to assist in critical management decisions of irrigation initiation, early-season insect control, plant growth regulators, and foliar fertilization. These rules are diagnostic in nature and are designed to identify fields that are under stress. Considerations to remedy these stresses are listed to assist growers in determining a course of action.

Evaluations of the insecticide termination rules have been structured to identify:

1. any yield losses from terminating boll weevil, bollworm, and plant bug control at NAWF=5 + 350 additional heat units (HU);
2. performance of the rules in actual grower fields with significant late-season pest infestations;
3. potential insect-control cost savings by eliminating insecticide applications that do not protect bolls to be harvested; and
4. costs of data collection.

Yield Losses Associated with Insecticide Termination

A series of small-plot research trials in the states of Arkansas, Louisiana, Mississippi, Virginia, and Texas was conducted in 1995 and 1996 to examine the impact on lint yields of various termination thresholds varying from NAWF=5 (physiological cutout) to NAWF=5 + 650 HU (Cochran et al., 1996, 1998). The following conclusions from these multi-state small plot trials can be reached:

- in no small plot trial was there ever a significant yield loss observed by terminating insecticide applications at the recommended NAWF=5 + 350 HU;
- in 6 of 7 1995 trials, the numerically highest yield was associated with termination at either NAWF=5 + 200 HU or NAWF=5 + 350 HU; however, these yield advantages were not always statistically significant; and
- in 1996 trials in Arkansas, Louisiana, and Mississippi, no significant differences in lint yields were observed between termination at NAWF=5 + 350 HU and later termination. In 5 of 7 trials, lint yields were highest with termination at NAWF=5 + 350 HU.

Validity of Insecticide Termination Rules Under Heavy Infestations

Performance of the COTMAN termination rule in grower fields was monitored in 1995 and 1996 in Arkansas, Mississippi, and Texas. These fields were selected because they were felt to present strong challenges to early termination. Net revenues were contrasted for the COTMAN rule and full-season control following grower's normal action thresholds. Therefore, differences in yields and control costs were considered. In 1995, when data from all fields were analyzed as a group, regression analysis showed that the termination rule of NAWF=5 + 350 HU resulted in statistically higher net revenues, between $46 and $53 per acre. Eight grower fields were monitored in 1996. No statistically significant differences were observed between COTMAN termination and full-season insect control for lint yields, revenue adjusted for fiber quality discounts/premiums, or net revenues above insect control costs.

Potential Insecticide Treatment Savings

In 1995, insecticide application data were collected across three states: Arkansas, Louisiana, and Mississippi. COTMAN information was also collected so inferences could be drawn on potential cost savings that could arise from adoption of the termination rule. Cost savings were defined as the cost of insecticide applications made after a field reached NAWF=5 + 350 HU. Based upon the small-plot trial information, yields were assumed to be unaffected by terminating at NAWF=5 + 350 HU. The potential savings varied by region of the state and reflected differences in late-season insect pressure. In the Northeast, cost savings were estimated at $7.77/acre. In the Eastern/Central region and Southeast region, the savings were calculated to be $13.54/acre and $21.20/acre, respectively (King et al., 1996).

Harris et al. (1997) summarized results from experiments on insecticide termination in Mississippi from 1993 through 1996. On average, 2.1 additional insecticide applications were applied after NAWF=5 + 350 HU at a cost of $14.62/acre/application, resulting in an additional production cost of $30.70/acre with no increase in yield and thus a reduction in income. These costs could have been avoided by following the COTMAN termination rules.

Over a four-year period from 1995 through 1998, insecticide application data were collected in Arkansas, Louisiana, Mississippi, and Texas to validate insecticide termination at NAWF=5 + 350 HU and define cost savings to producers from using the termination rule (Cochran et al., 1999). Cost savings were defined as the cost of applications made after a field reached NAWF=5 + 350 HU. Based upon small-plot trial information, yields were assumed to be unaffected by terminating at NAWF=5 + 350 HU (20 out of 20 trials yields were unaffected after 350 HU). Thirty-three large-plot research trials were conducted in Arkansas, Mississippi, and Texas over the same four-year period. Over all these large-plot trials, a difference of less than 2 pounds of lint/acre was observed between full-season treatment and termination at + 350 HU. An average of $19.62/acre was spent on additional control costs not resulting in increased yields (Cochran et al., 1999).

An economic analysis was conducted in 2004 using anecdotal data (not a replicated experiment) from producer and consultant records over a period of four years from 2000 through 2003 and extending across a total area of 63,615 acres of cotton (Hogan and Robertson, 2004). The ad hoc analysis indicated an average $18.23 would have been spent in additional production costs that did not contribute to increased yields. This analysis assumed an additional 1.68 pesticide applications would be made after cutout + 350HU (Cochran et al., 1999). These producer and consultant records included wages and salaries of plant mappers/scouts, related federal and state employee costs (federal and state withholding, FICA, Medicare, unemployment, etc.), daily travel expenses to and from fields, radio and computer equipment, bonuses, and miscellaneous expenses incurred.

Costs of COTMAN Data Collection

To contrast projected benefits from using COTMAN with costs of collecting the data, a study was conducted by the Arkansas Cooperative Extension Service (Robertson et al., 1997). Efforts were made to record the amount of time that data collection, travel, and analysis for COTMAN can take. Data were obtained from one grower and three crop advisors. Each group collected data in a slightly different manner, particularly in regard to frequency of plant monitoring and coordination with insect scouting. This study showed approximately 16 to 23 minutes per field per week are required to collect data. Cost per acre across the four operations ranged from a low of $1.06/acre/yr to a high of $3.08/acre/yr. The higher estimate included time for both COTMAN and insect scouting. If it is assumed that personnel assigned to scout insects are also assigned to do plant monitoring and that all travel costs are allocated to insect scouting, then the cost of data collection for COTMAN is reduced from $3.08/acre/yr to $0.88/acre/yr. Further results from the above-mentioned ad hoc analysis showed an increase in data-gathering costs to $1.65/acre/yr by the end of 2003. Although these costs have increased in an absolute sense, percentage cost savings from using the COTMAN system are still quite high.

Irrigation Termination Cost Savings

Research was initiated in 2000 to determine if a COTMAN relationship could be established that would specify irrigation termination at NAWF=5 + certain accumulated HU. Evidence has accumulated to suggest, in Arkansas at least, that NAWF=5 + 350 additional HU is a good rule of thumb for irrigation termination in the northeast; + 400 to 450 additional HU in the central section; and + 450 to 500 additional HU in the south and southeastern portions of the state. Furthermore, if it is a dry year or if projected cotton prices for harvest are high, termination could be delayed by as much as 50 to 100 HU from the above rule of thumb. A wet year or low projected cotton prices would indicate the need for a shortened irrigation season.

Individual producers have various systems to determine when to terminate irrigation on their own operations in a manner that works for them. With that in mind, cost savings through irrigation termination utilizing COTMAN rules can be fairly spectacular. Each additional acre-inch of water that is applied above the minimum required will cost \$2.72 per acre-inch and \$5.67 per acre-inch when applied with furrow and center-pivot irrigation, respectively.

Defoliation

Economic evaluations of COTMAN have focused primarily on the BOLLMAN recommendations. Harvest initiation rules have been addressed in Chapter 10 and are based on the determination of the flower date of the last effective boll population and the number of additional HU necessary for these bolls to mature. Both lint yields and gross revenues begin to plateau at 850 HU so that in most cases little will be gained (yield or revenue) by delaying harvest to accumulate additional HU past this point. However, much can be gained through the benefits of earliness.

Miscellaneous Benefits

Additional anecdotal evidence continues to accumulate that suggests:

- Some farm managers are able to oversee a greater total cotton acreage with the use of COTMAN technology than without it.
- COTMAN can be used to target the crop to a specific, desired harvest window. Benefits of this could include:
  - » Better harvest weather.
  - » Better lint quality and a better loan price received.
  - » Less field work after harvest (repairing damaged fields).
  - » Increased likelihood of finishing all fall field work.
  - » Time provided to plant fall cover crops.
- Good COTMAN records could add credibility in dealing with conservation issues —i.e., runoff, Total Maximum Daily Loads (TMDLs) as stipulated in the Clean Water Act—and quantity of water use (irrigation termination is decided by what the plant needs rather than by a less scientific method).
- Earliness and tracking crop development have become the major benefits of COTMAN, while insecticide and irrigation savings are just added benefits.

Concluding Remarks

With the advent of *Bt* cotton and the boll weevil eradication program, the value of BOLLMAN to reduce insecticide costs has been somewhat reduced. However, savings with regard to other cotton pests still exist.

Most economic data have been compiled from BOLLMAN observations. We continue to see that the BOLLMAN component allows the producer to save money on input costs (chemicals and irrigation water) and overhead (to manage more acres with the aid of COTMAN), while the SQUAREMAN component may have potential to increase net revenue through insights leading to increased square retention and early detection of problems in plant structure.

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