USEFULNESS OF COTMAN SYSTEM OF PLANT MONITORING IN THE MISSISSIPPI DELTA

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Abstract

COTMAN (COTton MANagement) is a computerized plant monitoring system developed to assist with management decisions during the growing season. The usefulness of the COTMAN system of plant monitoring as an aid for terminating cotton (*Gossypium hirsutum* L.) insect control has been validated in the Mississippi Delta, but its use for other crop management decisions has had only limited study. COTMAN data were collected on a weekly basis from seven high-yielding fields in the central Mississippi Delta in 1997. Actual crop growth patterns were compared with the COTMAN generated target development curve. Growth pattern charts adequately reflected delayed early growth rates due to cold, wet conditions that occurred in April and May. COTMAN predictions of growth stage node above white flower equal to 5 were acceptable, with most fields reaching this stage between 29 July and 1 August. COTMAN appears to be a relatively simple and useful crop management tool, although further validation is necessary in the Mississippi Delta. Key benefits of COTMAN are its focus on earliness and insecticide termination at node above white flower equal to 5 + 350 heat units (base 60ºF).

Introduction

Plant monitoring, or plant mapping, can provide useful information concerning the dynamics of plant growth and fruiting patterns. Basic plant monitoring techniques have been widely used by researchers, industry personnel and consultants, but widespread grower use and acceptance have been limited in the Mississippi Delta (Robertson *et al*., 1997). A new technique known as COTMAN is a simple computerized system that utilizes plant monitoring information, current and historical local weather data, and farm and field parameters to facilitate an interactive process to assist with management decisions during the effective fruiting period (Benedict *et al*., 1997; Sandusky and Lloyd, 1997; Oosterhuis *et al*., 1996; Zhang *et al*., 1994).

A precise and practical method of deciding when to terminate cotton insecticide applications has been tested for four years in the Mississippi Delta (Harris *et al*., 1997a; Harris *et al*., 1995). As a result of this research effort, terminating insecticide applications at node above white flower (NAWF) equal to 5 + 350 heat units (HU's) (base 60ºF) has been used by some producers in the Mississippi Delta as a general rule of when cotton insect control can be stopped with little risk of reducing profit. Economic analysis of this decision rule in Mississippi projects a potential cost savings of $30.70 per acre, and a potential average reduction of 2.5 pounds of active ingredient per acre (Harris *et al*., 1997b). COTMAN has been developed to assist with the "when to quit insecticide treatments" decision that producers must make every year.

The COTMAN system consists of two components: 1) SQUAREMAN, which uses node and square retention data, and 2) BOLLMAN, which uses NAWF data (Robertson *et al*., 1996). Based on these fruiting parameters, a growth curve for each field is generated by COTMAN, which is interpreted by comparing these parameters to a target development curve. With experience, users should be able to quickly and accurately evaluate growth curves and react accordingly. A non-computer version of COTMAN exists (Bourland *et al*., 1997). The purpose of this paper is to evaluate the usefulness of COTMAN as a crop monitoring tool in the Mississippi Delta.

Materials and Methods

Data were collected weekly as outlined in COTMAN Computer User's Guide from a total of seven fields in the central Mississippi Delta, near Belzoni (Cochran *et al*., 1997). Data were entered into COTMAN program in a timely manner; output and decision rules were evaluated and communicated to producers. All fields were high yielding, with final lint yields greater than 900 pounds of lint per acre.

Results and Discussion

Guides to interpreting crop growth patterns generated by COTMAN have been published and will serve as the basis for this discussion (Bourland *et al*., 1997; Johnson and Bourland, 1996). Field GS was planted in 38-inch rows with 'Sure-Grow 125' on 12 May in an irrigated sandy loam soil. The actual development curve agreed with the COTMAN generated target development curve during early squaring, but the apogee of the actual curve was slightly less than the target development curve (Figure 1). This indicated low squaring nodes at first flower. Square retention was high in this field, with low actual square shed (<10%) through eight nodes above first square compared to

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1740-1742 (1998)
National Cotton Council, Memphis TN

COTMAN shed rate limit (Figure 2). This agreed with generally high early square retention throughout the Mississippi Delta in 1997.

Field LS was planted on 11 May in 38-inch rows with ‘ST 474’ in an irrigated sandy loam soil. An optimum growth pattern was observed, but there is an indication of some condition that caused delayed squaring node initiation (Figure 3). In fact, this field had first fruiting node at node 7.3 compared to field GS at 6.4. First fruiting node differences in this case was probably due to variety, with ST 474 having a tendency to fruit higher on the plant than Sure-Grow 125.

Field RD was planted on 19 April in 38-inch rows with Sure-Grow 125 in a dryland sandy loam soil. A typical growth rate was observed, but with fruit initiation delayed about ten days (Figure 4). Early planting exposed this crop to more of the cold, wet conditions that prevailed in April and May of 1997. Emergence and early crop growth rates of April-planted cotton were slow and generally remained about ten days behind normal for the entire season. Field RP was adjacent to field RD, but it was irrigated and it was near electrical power lines that prevented aerial applications of insecticides. Historically, crops in this field had a more aggressive growth habit than in field RD. The growth pattern of this field was also delayed compared to the target development curve, but the apogee was higher, indicating a prolonged fruiting pattern (Figure 5). The extended fruiting period in this case was probably a result of soil type differences, rather than missed insecticide applications, because fruit retention rates were high in both fields.

COTMAN predictions of NAWF 5 were acceptable, with most fields reaching this growth stage between 29 July and 1 August. With unusually high heat unit accumulation in August and early September, it may have benefited producers to keep spraying insecticides past NAWF 5 + 350 HU’s, which occurred about 12 August. COTMAN’s projection of when to terminate insect control based on the NAWF 5 + 350 HU rule is a “bench mark” for decision makers. When conditions are anticipated that may allow later production, a change to a NAWF 5 + 450 HU rule or a weather based rule may be justified. However, in mid August when subsequent weather conditions are unknown, analysis of many years of weather data show low probability of profitable production gains by insect control after NAWF 5 + 350 HU’s. We need more information on conditions that may cause the termination rule fail. For example, how should heavy infestations of potential boll feeders moderate adherence to the NAWF 5 + 350 HU rule, and how does the rule apply to the occasional heavy infestations of foliage feeders?

Conclusions

COTMAN appears to be a useful crop management tool in the Mississippi Delta, although further refinement of target development curve and decision rules is needed. The commercial application of this program in the Mississippi Delta is unknown at this time. It remains to be seen if COTMAN will be used by growers. It is more probable that private consultants would incorporate COTMAN into their existing scouting programs. A key benefit of COTMAN is that it allows users to uniformly and objectively collect and interpret simple plant monitoring information at least once a week during the growing season. The insecticide termination component of COTMAN can benefit growers by possibly eliminating one or two late-season applications and by promoting earliness. Decision rules for plant-growth regulators, irrigation, shed rate limit, and defoliation deserve further research. Other locations in the north and south Delta, as well as narrow row spacings and skip-row patterns should be investigated in 1998.

Acknowledgments

The authors are grateful to L. J. Makamson, Gary Makamson, and Bud Rodgers for their cooperation, to collaborators at the University of Arkansas and Cotton Incorporated, and to Connie Morgan for data entry assistance.

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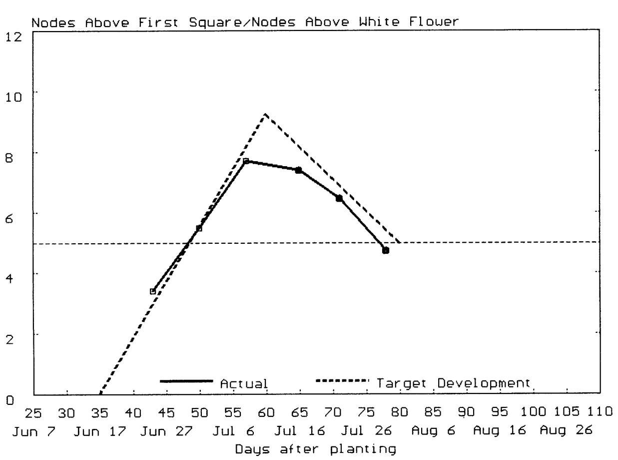

Figure 1. Actual nodes above first square/nodes above white flower as a function of days after planting for field GS, compared to COTMAN target development curve.

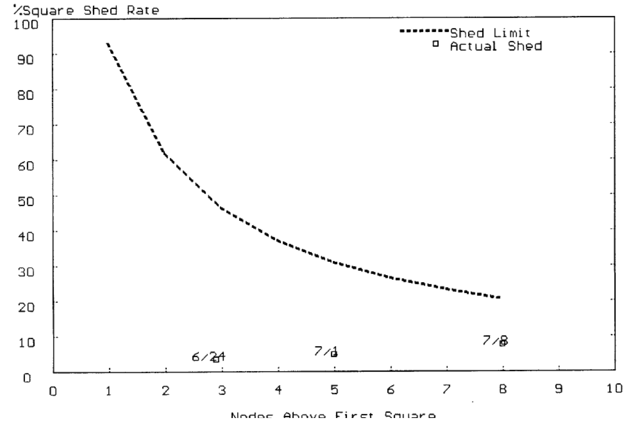

Figure 2. Actual square shed percentage as a function of nodes above first square for field GS, compared to COTMAN shed limit.

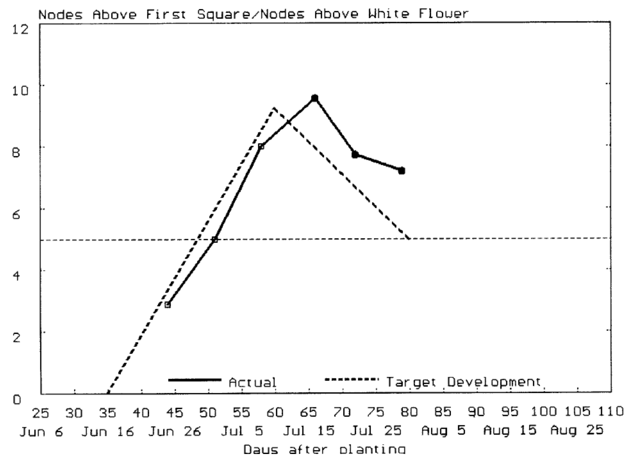

Figure 3. Actual nodes above first square/nodes above white flower as a function of days after planting for field LS, compared to COTMAN target development curve.

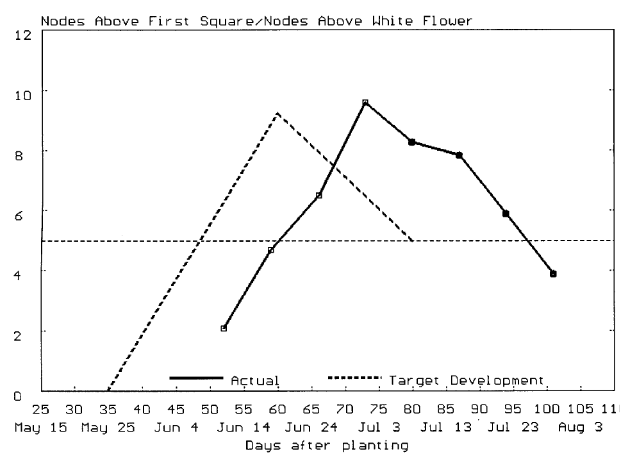

Figure 4. Actual nodes above first square/nodes above white flower as a function of days after planting for dryland field RD, compared to COTMAN target development curve.

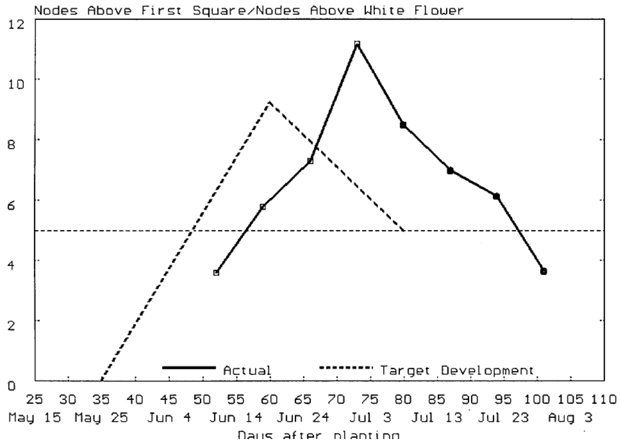

Figure 5. Actual nodes above first square/nodes above white flower as a function of days after planting for irrigated field RP, compared to COTMAN target development curve.