OBSERVATIONS OF THE ARKANSAS MONITORING SYSTEM--PRODUCER PERSPECTIVE

Cecil Brooking
Cecil Brooking, Consultant
Ferriday, LA

Abstract

Ideas that are submitted in this discussion include (l) use of a modified Node Above White Flower (NAWF) technique, (2) use of weather data other than just DD60's for monitoring and (3) the possibility of earlier harvest. They are offered for the consideration of researchers, consultants and managers with the hope that current practices might be improved.

Accurate and efficient determination of cotton crop maturity is a problem facing consultants and growers. Recently, the NAWF technique has gained acceptance for determining yield potential (Hake and Stair, 1994) and cutout (Bourland et al., 1992; McConnell et al., 1993). However, strict use of only white blooms (day of antithesis) for the NAWF technique may be restrictive and time consuming. This can increase monitoring costs. An alternative to NAWF is the Nodes Above Bloom (NAB) approach. The NAB approach allows the monitor to use plants with any first position bloom.

Reliable identification of maturity may also be limited by the data used to predict maturity. Currently, heavy emphasis is placed on DD60's. However, sole reliance of DD60's means that other important weather data (i.e., solar radiation, pan evaporation, rainfall and wind) are not being used to their full potential. This paper will describe the possible advantages of the NAB technique and the potential for adding additional weather variables to those currently being used to predict cotton crop maturity.

Introduction

This presentation will address the Arkansas cotton monitoring system, with emphasis on the timing of termination of pest protection using the Nodes Above Bloom (NAB) method. Developmental research at the University of Arkansas has resulted in a multi-disciplinary system that addresses broader applications than will be covered in this paper.

The employment of the NAB approach presumes two basic procedures: (1) the use of a sampling technique that will adequately identify the appropriate stage of cotton's reproductive development and (2) the use of a reliable timing method that is appropriately calibrated. Using such a method in cotton production should increase accuracy and confidence in related management decisions.

Some of the ideas presented later are derived from observations and may not be supported by data at this time. The resulting opinions are considered to have merit; however, it is conceded that the value of opinions differ between individuals.

A developing cotton crop in the field represents an expression of interactions between environmental, cultural and genetic factors. A monitoring system can aid in the recognition of critical plant developmental stages so that appropriate management responses may be implemented on a timely basis. Timeliness is a vital component of profit and may be the most significant factor that contributes to success and competitiveness in both production and marketing.

The development of physiologically based crop monitoring systems, such as mapping and modeling, suggest that some crop responses may be signals. If we accept this premise, then our challenge is to better identify these signals and respond appropriately.

This task would be simpler if all plants in a field were clones and all parts of the field were similar. This is rarely true. Furthermore, the need to improve efficiency in farming has motivated producers to combine fields into larger units than were practical in the past. In some cases a single management practice for an entire field is inappropriate.

Field Variables

(1) Slow drying areas
(2) Variations in cropping history
(3) Soil texture changes
(4) Nutrient variation
  (a) Spoil banks
  (b) House sites
(5) Compacted areas
(6) Spotty pest areas
  (a) Nematodes and disease
  (b) Weeds
  (c) Insects

Plant Variables

(1) Variety
(2) Planting date
(3) Population density
(4) Boll positioning
  (a) Axillary
  (b) Fruiting branch positions
  (c) Combinations
  (d) Vegetative branches

Another variable is the comprehension and confidence level of the decision maker. The usefulness of the system will

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:953-955 (1997)
National Cotton Council, Memphis TN

depend on the manager's experience and his ability to understand the function of the program and its components.

Considering the multiplicity and complexity of the many variables involved, the chance of developing a specific regime that functions like a rule seems highly ambitious. However, a more general system used by an astute manager, combining logic and discretion, should be a valuable management asset. The degree of success will depend on both the tool and the artisan.

Observations

(1) The occurrence of NAB = 5 is best identified by plotting NAB vs. time.
(2) All NAB = 5 plants do not demonstrate the same vigor.
(3) Averaging NAB = 4 & 6 = 2(NAB = 5) seems acceptable.
(4) Averaging NAB = 3 & 7 = 2(NAB = 5) may be questionable.
(5) Bloom color at this stage of maturity does not seem to be significant. Not considering bloom color would increase efficiency.
(6) Stress contributes to maturity. Multiple stresses can magnify maturity differences.
(7) The NAB technique may not be as appropriate in skip-row or extremely thin stands of cotton due to the generation of more vegetative branches.
(8) The use of the DD60 technique as a timing system may need to be re-evaluated.

It is likely that too much emphasis has been placed on using the DD60 technique for monitoring crop development. The DD60 method addresses time and temperature, but overlooks radiation, moisture and transpiration as components of crop development. DD60s also fail to account for extremely high temperatures that elevate the DD60 value but have a neutral or negative effect on cotton development. Sole use of the DD60 technique is similar to putting markings on an elastic tape and using it as a measuring tool to build a house.

These deficiencies can be corrected. Researchers at the LSU Agricultural Center, using the Louisiana AgriClimatic Information System, known as the LAIS, have implemented a network of sophisticated, automated, high-tech weather monitoring equipment that has vastly underutilized potential. These systems have the ability to record and transmit air and soil temperature, rainfall, wind and radiation data. Properly applied, a comprehensive crop development factor could be generated and calibrated to more closely depict cotton crop development.

The defoliation segment of the NAB program has significant influence on potential profits. Defoliation appears to be triggered earlier using NAB than would occur with the use of either the node above cracked boll or percent open methods. Assuming this timing to be acceptable, potential advantages would be significant, such as:

(1) Weather conditions should be more favorable for effective defoliation and harvest.
(2) Micronaire would be reduced, lessening the chances of incurring a penalty.
(3) An earlier harvest could increase the opportunity for sub-soiling and other fall work.

If earlier termination is acceptable, the use of higher rates of boll opener may be required. However, more favorable ambient conditions could be an advantage that offsets the need for increased rates. Management decisions are always the result of compromise, and each case should be decided based on existing conditions.

Summary

(1) The most significant component of this system is the identification of the highest positioned boll that will contribute to profit.
(2) Flower color may not be consequential at this stage of maturity.
(3) The result is influenced by crop uniformity (% of first position boll set).
(4) Additional climatic information should be used to formulate a factor that would more accurately track crop development.
(5) The comprehensive economic effect should be researched.

Some factors that could affect this technique's accuracy as a way of identifying the last effective fruiting position are:

(1) Extremes in field variabilities
(2) Percent of first position boll set
(3) Human errors (sampling)--some sampling techniques sacrifice accuracy for speed
(4) DD60 inconsistencies
(5) Questionable damage potential of some pests

The potential for reducing the use of insecticides is limited by the availability of effective and comprehensive survey techniques that are combined with well calibrated treatment levels. Systems that recognize the interdependence of pest population dynamics and host plant physiology offer a higher level of accuracy and confidence to able managers than systems relying on only one of these factors. Research priorities directed toward these areas should offer significant rewards.

Modeling programs could provide the seminal research from which more precise management enhancing practices evolve. The NAB technique appears to be a sound method for estimating maturity in a cotton field and determining the conclusion of late season pest management. This method

should be an effective tool for managers, but its potential will be in question until it is in the hands of producers.

Acknowledgements

Appreciation is expressed for technical cooperation from researchers in Texas, Louisiana, Arkansas and Mississippi, especially to Merritt Holman with the Northeast Louisiana Experiment Station in St. Joseph, who contributed hands-on, on-site guidance.

References

Bagwell, R.D. and N.P. Tugwell. 1992. Defining the period of boll susceptibility to insect damage in heat-units from flower. Proc. Beltwide Cotton Conf., National Cotton Council of America, Memphis, TN, pp. 767-8.

Bernhardt, J.L., J.R. Phillips and N.P. Tugwell. 1986. Position of the uppermost white bloom defined by node counts as an indicator for termination of insecticide treatments in cotton. J. Econ. Entomol. 79:1430-8.

Bourland, F.M., D.M. Oosterhuis and N.P. Tugwell. 1992. Concept for monitoring cotton plant growth and development using main-stem node counts. J. Prod. Agric. 5:532-8

Bourland, F.M., D.M. Oosterhuis, N.P. Tugwell, M.J. Cochran and J.P. Zhang. 1993. Timing cotton defoliation by nodal development. Proc. 1993 Cotton Research Meeting. University of Arkansas, Arkansas Experiment Station Special Report 162. pp. 32-8.

Cochran, M.J., N.P. Tugwell, D.M. Danforth, C.D. Klein and J.P. Zhang. 1994. The economic potential of plant monitoring to guide the termination of late-season insect control in Arkansas. Proc. Beltwide Cotton Conf., National Cotton Council of America, Memphis,TN. pp. 914-5.

Cochran, M.J., N.P. Tugwell, F.M. Bourland, D.M. Oosterhuis, E.M. Holman and R. Bagwell. 1996. **Cotman System** version 3.0. University of Arkansas, Arkansas Agricultural Experiment Station Software.

Hake, K. and K. Stair. 1994. Yield probability forecasts using plant monitoring. Proc. Beltwide Cotton Conference, San Diego, CA, Natl. Cotton Council of Am., Memphis, TN, p.1279.

Harris, F.A., F.T. Cook, Jr., G.L. Andrews and R.E. Furr, Jr. 1996. Monitoring node above white flower as basis for cotton insecticide treatment termination. Unpublished manuscript MAFES. Delta Regional Extension Center, Stoneville, MS.

Heitholt, J.J. 1996. Cotton Physiology and Genetics Unit, USDA-ARS, Jamie Whitten Delta States Research Center, Stoneville, MS (Personal Communication).

Holman, E.M., N.P. Tugwell, D.M. Oosterhuis and F.M. Bourland. 1994 . Monitoring plant response to insect damage. Proc. Cotton Research Meeting. Arkansas Ag.Exp. Station Special Report 166:54-6.

Jenkins, J.N., J.C. McCarty, Jr. and W.L. Parrott. 1990. Fruiting efficiency in cotton: Boll size and boll set percentage. Crop Sci. 30:857-860.

Jenkins, J.N. and J.C. McCarty, Jr. 1995. Useful tools in managing cotton production: End of season plant maps. MAFES Bulletin 1024.

Kerby, T.A. and D.R. Buxton. 1978. Effect of leaf shape and plant population on rate of fruiting position appearance in cotton. Agron. J. 70:5358.

Lewis, H. 1995. Producer-scientist. Dell, AR. (Personal Communication).

Mauney, J.R. 1986. Vegetative growth and development of fruiting sites. In Cotton Physiology, J.C. Mauney and J.M. Stewart (eds.). The Cotton Foundation, Memphis, TN. pp. 11-28.

McConnell, J.S., W.H. Baker, D.M. Miller, B.S. Frizzell and J.J. Varvil. 1993. Nitrogen fertilization of cotton cultivars of differing maturity. Agron. J. 85:1151-1156.

Meredith, W.R., Jr. and R.R. Bridge. 1973. Yield, yield components and fiber property variation in cotton within and among environments. Crop Sci. 13:307-312.

Muller, R.A., J. Grymes, III and K. Robbins. 1996. Southern Regional Climate Center. Louisiana State University, Baton Rouge, LA. (Personal Communication)

Oosterhuis, D.M., F.M. Bourland, N.P. Tugwell and M.J. Cochran. 1993. Terminology and concepts related to crop monitoring, maturity and defoliation. Proc. 1993 Cotton Research Meeting. University of Arkansas, Arkansas Agricultural Experiment Station Special Report 162. pp. 239-49.

Phillips, J.R. 1991. University Professor, Dept. of Entomology, University of Arkansas. (Personal Communication).

Shumway, C.R. 1994. Evaluation of cotton defoliants under several production systems. 1994 Summary of Cotton Research in Progress. Arkansas Experiment Station Special Report 166. pp. 197-9.

Supak, J.R., T.A. Kerby, J.C. Banks and C.E. Snipes. 1993. Use of plant monitoring to schedule chemical crop termination. Proc. Beltwide Cotton Conf., National Cotton Council of America. Memphis, TN. pp. 1194-6.

Vories, E.D., C.M. Bonner, R.G. Wells, D.M. Oosterhuis, C.B. Guy and R.E. Glover. 1992. Yield and quality effects of Prep timing. Proc. 1992 Cotton Research Meeting. Arkansas Experiment Station Special Report 158. pp. 38-42.

Williams, M.R., T.L. Wagner and J.L. Willers. 1993. Revised protocol for scouting arthropod pests of cotton in the mid-south. Mississippi Cooperative Extension Service. Mississippi State, MS.