The cotton slide rule

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A tool for crop and insect management

Under normal growing conditions, growth and development of the cotton plant follows an orderly, predictable pattern. This pattern can be projected by mathematical models that take into account factors affecting growth, such as variety, length of growing season, climate (including solar radiation, temperature, light, wind, rainfall, dew), availability of nutrients and soil moisture, pests, and cultural practices.

Models based primarily on degree-days (accumulated heat units) have been developed for the cotton crop and for several of its major insect pests, but they have been difficult to implement in the field. The need for a practical means of utilizing complex mathematical models led to the development of a slide rule for easy calculation of critical pest, irrigation, and defoliation periods in cotton management.

Applying insecticides on a scheduled program may increase production costs, destroy beneficial insects, and hasten the development of insecticide resistance in targeted species. In contrast, the slide rule correlates development of the cotton plant and of its major pests to indicate when insecticide applications will be most effective.

Degree-days

Plants and pests require a certain amount of heat energy within a specific temperature range to progress from one stage to another in their life cycles. Temperatures above or below the thresholds can hinder survival and productivity. The term degree-days (DD) refers to the amount of heat units accumulated within these thresholds and can be defined as values derived from accumulated daily minimum and maximum temperatures required for completion of various biological processes in an organism.

The total number of heat units necessary for an organism to complete a given stage is a constant for that species. Accumulation of degree-days for each organism starts at a point in its development — the "biofix" — based on a biological event such as planting date, insect emergence or trap catch, or germination of plant pathogen propagules.

Field data collected over several years were used to verify growth and development models for Acala and Deltapine cotton varieties, as well as for lygus bugs, pink bollworm moth, and tobacco budworm moth, the chief cotton insect pests in California and Arizona. The models are based on a developmental threshold temperature of 60°F (DD-60).

The slide rule

The cotton slide rule has two sides, one for use in the San Joaquin Valley, the other for southern California and Arizona. Two inserts provide seasonal phenologies of cotton varieties SJ-2 and SJ-5 in the San Joaquin Valley and of Deltapine 61 and 70 in the lower desert valleys and Arizona.

All information incorporated in the slide rule is based on the cumulative daily total of DD-60 values from January 1. These values are derived from daily minimum and maximum temperatures, which the grower would obtain from the nearest reliable weather station to the field.

Using the insert for the cotton variety planted, the grower sets the slide rule (planting date arrow) on the accumulated heat units from January 1 to the planting date. The cotton crop is then monitored over the season using current local daily temperatures. Crucial periods for insect damage potential, irrigation, and defoliation are indicated on the slide rule, providing a means of judging the progress of a crop and making management decisions throughout the growing season.

The slide rule and a publication giving instructions for its use, *A Slide Rule for Cotton Crop and Insect Management*, Leaflet 21361, are available for $8.00. To order, send check or money order payable to: The Regents of the University of California. In the United States, price includes postage and handling. Foreign residents: please request a Pro Forma Invoice and indicate mode of shipment (surface or air mail) desired for postage charges.

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