MANAGEMENT AND ENVIRONMENTAL EFFECTS ON COTTON FRUITING

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Abstract

Cotton growth and development is driven by canopy temperature and will be modulated by water and nutritional supply. Since commercially grown cotton cultivars are bred photoperiod insensitive, floral or first square formation is very sensitive to temperature. The time from emergence to the observation of first square, 3 mm in length, expressed as rate, the reciprocal of days, is temperature dependent and exhibited a quadratic response. The base temperature for this event is 15°C, the maximum rate occurred at 30°C, and progress at temperatures above 30°C was slower than at 30°C extending the vegetative period at high temperatures. Cultivars differed in their response to this event; mid-season cultivars took more time to reach this event compared to early-season cultivars. Similarly, the rate of progress from square formation to flower was sensitive to temperature; maximum rate was observed at 27°C. Daily progress from flower to mature fruit (boll maturation period, BMP), on the other hand, was linear from 15 to 35°C. Warmer temperatures, therefore, causes faster BMP resulting less time for assimilates to fill the sinks. Developing mainstem and fruiting branch leaves and appearance of squares on first position up on the mainstem and out on fruiting branches are important aspects of cotton development because these processes determine the number of leaves produced and thus canopy development and interception of photosynthetically active radiation before the canopy closure, and also the addition of squares which later transform into bolls which are active sinks for carbon and mineral nutrients. Similar to the responses of emergence to square formation and square to flower formation, the rates of fruiting structure (square) formation on the first position on branches up on the mainstem and other fruiting sites out on the fruiting branches were increased with increase in temperature. At 30°C, only 2.2 days were required to produce a fruiting structure up on the mainstem, whereas at 20°C, 5 days were needed to produce a fruiting structure up on the mainstem. Adding squares out on the fruiting branches, on the other hand, required 6 days at 30°C, and 9.5 days at 20°C to add a fruiting structure. The rate of fruiting structure addition on fruiting branches is much slower than that of the first fruiting structure formation on the branches up on the mainstem. Even though, the rates of fruiting appearance on branches up on the main stem and out on the fruiting branches is temperature dependent, any factor that controls/limits the carbon and nitrogen acquisition modulates this response to temperature. Therefore, for an example, plants grown at elevated carbon dioxide produced more fruiting structures because of additional carbon available through increased photosynthesis at a range of stress conditions. Similarly, any factor that limits carbon and nitrogen availability to the plant either through stress conditions or through intra-plant competition, also modulates the fruiting structure formation and temperature response functions.