INVESTIGATIONS INTO COTTON'S PHOTOSYNTHETIC DECLINE AT CUTOUT

W.T. Pettigrew
USDA-ARS
Cotton Physiology and Genetics Research Unit
Stoneville, MS

Abstract

One of the perplexing physiological dilemmas encountered during cotton (*Gossypium hirsutum* L.) production is the decline of leaf and canopy photosynthesis at cutout, a period of maximum boll loading and little vegetative growth. This large reproductive sink development would also seem to necessitate the production of copious amounts of photosynthate, but the opposite actually occurs. Reasons for this decline are unclear; simple canopy aging or to some environmental agent could be the cause. The objectives of this study were 1) to attempt to separate environmental from canopy age effects and 2) to identify some of the photosynthetic components that may be rate limiting during this period.

Field studies were conducted at Stoneville, MS during the 1995 and 1996 growing seasons using six genotypes ('DES 119', 'Dixie King', 'Hartz H1220', 'MD 51 ne', 'T-78 823-7354 X' [nonflowering], and 'T-78 BC_4F_4 87-8639 op' [flowering]) and two planting dates. The cotton was planted on 27 April and 19 May in 1995 and on 25 April and 22 May in 1996 to create two distinct cotton populations, reaching cutout at different times during the season. Gas exchange measurements, chlorophyll fluorescence measurements, chlorophyll and soluble protein assays, Rubisco assays, and assays for various carbohydrates were performed on each plot when the early planted cotton was approximately at cutout. These determinations were made on the fourth main stem leaf counting down from the top of the plant.

Late planted cotton exhibited greater CO_2-exchange rates (CER) than the early planted cotton indicating that leaf and canopy aging appears to be a primary reason for the photosynthetic decline at cutout . Chlorophyll concentration and the chlorophyll fluorescence variable to maximum ratio (Fv/Fm), an estimate of PS II activity, did not differ between planting dates, so it appears that the light harvesting system and parts of the electron transport system remained intact and thus have not contributed to the photosynthetic decline at cutout. Rubisco activities and soluble protein concentrations were greater in the late planted cotton (cotton not yet at cutout) than in the early planted cotton (cotton at cutout). Concentrations of various leaf carbohydrates were not consistently affected by varying the planting dates. Remobilization of the leaf's protein N, particularly from Rubisco, to supply the N demand of the developing seeds may be the underlying cause for the photosynthetic decline at cutout.

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