SUGARS IN DEVELOPING COTTON (*GOSSYPIUM HIRSUTUM* L.) SQUARES

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Abstract

The objective of the project was to determine the composition of particular sugars and starch during development of cotton (*Gossypium hirsutum* L.) flower bud (square) and flower. The nonstructural carbohydrate composition was determined through late development of first-position squares on Deltapine 50 plants grown in 1997 at Mississippi State University. Soluble sugar, not starch, was the dominant nonstructural carbohydrate component of the buds throughout development. Sucrose hydrolysis, but not starch hydrolysis, contributed to a more negative osmotic potential during rapid petal expansion. There is a sharp decline in soluble-sugar (glucose, fructose, plus sucrose) content of the flower during senescence, possibly due to 1) a respiration climacteric, and 2) remobilization from petals to the young boll or other plant parts.

Introduction

1. During the last week of development before bloom, the rate of elongation of the bud increases (Stewart, 1986 and references therein). This change in rate is thought to be due to a shift from cell-division activity to cell expansion. During early bloom of some types of flowers there is a rapid increase of cellular osmoticum, including soluble sugars, which is thought to attract additional water into the bud. The resulting increased cellular turgor pressure would aid in the stretching of the cell walls that is requred during cell expansion. 2. Redistribution of sugars from senescing petals to the developing boll could enhance the carbohydrate status of the boll during its early stages, and so possibly enhance boll set and early fiber elongation.

Materials and Methods

The nonstructural carbohydrate composition was determined through late development of first-position squares on Deltapine 50 plants grown in 1997 at Mississippi State University. Sugars were removed for analysis through repeated extraction of the diced material with hot 80% (v/v) ethanol (Hendrix, 1993). Starch in the residue left after sugar extraction was gelatinized by heating for 8 h at 80 °C in distilled water. The gelatinized starch was digested at 55 °C for 2 h with amyloglucosidase from *Aspergillus niger*.

Results and Discussion

Soluble sugar (about 86% of nonstructural carbohydrate weight 3 d before bloom), not starch, was the dominant nonstructural carbohydrate component of the buds throughout development. Sucrose and its hydrolysis products, but not starch hydrolysis, contributed (ca. -0.2 MPa) to a more negative osmotic potential during rapid petal expansion. There is a sharp decline in soluble-sugar (glucose, fructose, plus sucrose) content (from 20 to 6% of total dry weight in 24 h) of the flower during senescence, possibly due to 1) a respiration climacteric, and 2) remobilization from petals to the young boll or other plant parts.

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References

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