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POST-HARVEST PHYSIOLOGY OF BRIGHT LEAF TOBACCO 1. COMPARATIVE BIOCHEMICAL CHANGES DURING THE YELLOWING AND DRYING PHASES OF CURING[1]

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Analysis of several tobacco leaf constituents showed that each changed quantitatively during both yellowing and drying phases of bright leaf curing. Nearly 10% of the sugar, 9% of amino acids, and 13% of polyphenols found in the cured leaf were generated during the dryng phase alone. These along with other changes indicate that the drying phase of bright leaf curing is not as inert as is generally believed.

Additional key words: Curing, Biochemical Changes, Yellowing, Drying.

INTRODUCTION

This report compares the yellowing and drying phases of bright leaf curing with regard to progressive biochemical changes since current literature lacks in such information on the latter.

MATERIALS AND METHODS

Tobacco (*Nicotiana tabacum* L. 'Coker 319') leaves comprising the third priming of the 1973 crop were grown at the Tobacco Research Station, Oxford, N. C. and were selected for approximate uniformity in color, size, and weight prior to automated curing (6). Three replicates, each consisting of 10 (for respiration study only) or six leaves were used for each study and data therefrom were averaged.

Initial moisture content and dry weight were determined by freeze-drying uncured leaves. Progressive moisture loss was determined by weighing the same leaf samples at selected curing intervals. Leaf respiration was measured using the $BaCO_3$ technique of Klein and Klein (7), and dry weight loss was estimated from the former. For biochemical analysis, leaf samples collected at various curing intervals were freeze-dried, ground and stored at −15C in air-tight containers. Two hundred mg of the freeze-dried sample were extracted with 80% ethanol (3), and the extract was used to determine total-sugar (4), -hexouronic acids (2), -amino acids (15), -polyphenols (12), -alkaloid (1), and -soluble nucleotides (10). Starch (5) and protein (8) were determined using additional freeze-dried samples. All biochemical changes were corrected for the estimated dry weight loss during the corresponding curing period.

RESULTS AND DISCUSSION

Data on progressive changes in various parameters (**Figure 1A-D**) clearly indicate that each constituent studied underwent changes in the drying phase in addition to changes associated with the yellowing phase. While data on the latter generally

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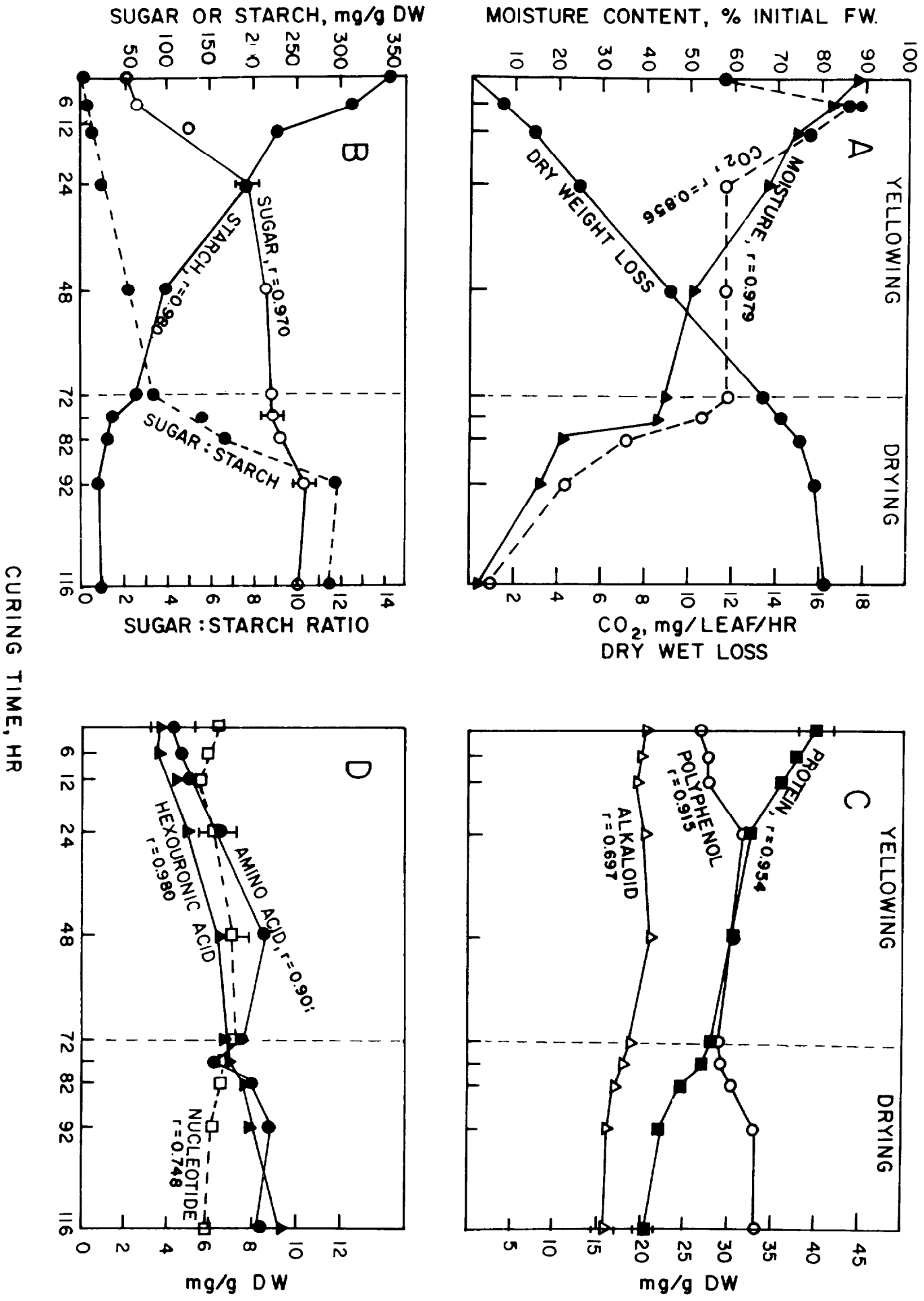

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agree with those reported by others (see reference 14 for review and additional references), comparison of the drying phase with the yellowing phase points to the following:

1. Respiration rate of the leaf increased followed by a decrease during the first 24 hours of the yellowing phase (**Figure 1A**). This is similar to the respiratory rise reported for senescing wheat leaves (13) and is probably expected since the yellowing phase represents continued but accelerated senescence. Although progressive decline in the respiration rate during the drying phase paralleled moisture loss, a detectable level of respiration was still maintained by the leaves at 67C and less than 20% moisture content.

2. While leaves lost 13% of the initial dry weight during the yellowing phase, additional 3% was lost during the drying phase (**Figure 1A**).

3. The sugar to starch ratio (**Figure 1B**) increased at a faster rate during the drying phase than during the yellowing phase because of reduced respiratory demand on total sugar along with continued starch hydrolysis (**Figure 1B**). Thus, the drying phase contributed nearly 20% of the total sugar found in the cured tobacco.

4. The polyphenol content increased in equal proportions during both yellowing and drying phases (**Figure 1C**). But the net loss in alkaloid content appeared to have occurred chiefly during the drying phase (**Figure 1C**).

5. The rate of proteolysis was relatively faster following the onset of the yellowing and drying phases than during the remainder of the curing process (**Figure 1C**). Consequent changes in the amino acid level also reflect this pattern (**Figure 1D**).

6. The hexouronic acid level in the cytoplasm increased continuously during both yellowing and drying phases (**Figure 1D**) indicating that the cell walls were probably being weakened progressively. This is consistent with the structural distortions reported earlier (9).

7. The soluble nucleotide fraction which has not been studied earlier with relation to tobacco curing, also underwent quantitative changes during both phases of curing. Physiological significance of this is not known at this time except that changes during the yellowing phase partially resembled that reported for other senescing leaves (11).

It is thus concluded that the drying phase of bright leaf curing is physiologically not as inert as is generally believed. Since most of the changes associated with this phase occurred during the first 24 hours of leaf drying, this period seems to be critical from the standpoint of curing management. The bright yellow color of the cured product indicated that biochemical changes discussed in this report did not result from mismanagement of the curing schedule.

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Figure 1. Progressive biochemical changes during the yellowing and drying phases of bright leaf curing. Correlation coefficient, 'r', for various parameters was calculated using linear (CO_2, moisture, protein, hexouronic acid, polyphenol), quadratic (total sugar, alkaloid, nucleotide, amino acid), or exponential (starch, polyphenol) regression equations.

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