STUDIES IN THE ANATOMY OF SUGARCANE STALK

V. Pith and Cavity Development

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INTRODUCTION

Owing to the scattered arrangement of vascular bundles in the stem of Monocotyledons, the ground tissue cannot be marked off into cortex and pith, homologous to those of a dicot stem. Pith in any plants of the former group, e.g., maize consists of thin-walled parenchymatous matrix in which vascular bundles are embedded. In sugarcane this term is used only when ground tissue consists of loosely packed parenchymatous cells and a few vascular bundles found amongst them and is unable to discharge its function of storing sugar properly.

Occurrence of hollow stems in Angiosperms, especially among the annuals, is quite a common feature both in Monocots and Dicots and the presence of a cavity in them is a means devised by them to meet the peculiar conditions of their growth and development. According to De Bary, cavities within the submerged parts of hydrophilous plants are of great importance, so far as respiration in them is concerned. The extent of development of hollowness in wheat stems materially affected its lodging tendency (Percival, 1921), while Canfield (1923) found cavity formation to be associated with some of the fodder grasses which occurred in moist and sheltered places. But in sugarcane, cavity as well as pith is an undesirable character because both of them not only reduce the sugar content but also lower the yield to the extent to which they develop. Varieties otherwise promising, have at times to be discarded just because they develop or are prone to develop these features in adverse circumstances.

The present paper gives a summarised account of investigations carried on at the Station to study the problem in its various details over a number of years (Khanna, 1933, 1934, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950 and 1951).

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II. REVIEW OF LITERATURE

Although both pith and cavity have attracted attention of various workers, so far little precise work as regards their origin, development and the various factors responsible for their formation, has been done. One of the authors (Khanna, 1934) found that varieties developing pith and cavity early in season were not only poorer in the quality of juice, sustaining loss of 7.32 to 17.84% of total sugar which would have been stored provided pith and cavity had not developed, but also deteriorated, when kept cut, more rapidly than those with a solid core. He also noticed that varieties having large cavity appeared to suffer more from dryage in field towards the end of the season than those with none or a small one. In 1941-42, he found the less in tonnage due to dryage resulting from free circulation of air within cane-stalks, to be as high as 13.7% at harvest in February. Though the girth values of individual stalks were not affected, the cane progressively lost in weight and in the quality of its juice. The yield record of 1933 and 1938 confirmed this finding because the actual weight on harvesting was found to be 30% less than the yield estimated in October (Khanna, 1942). In 1950-51 season when certain factories worked as late as second week of May, Co 453 a highly cavity forming variety lost as much as 27% on weight-basis as against a loss 4-6% in B.O. 11 which normally has a solid core.

That the development of these features is a varietal character, is universally known. Sometimes it is so characteristic of a variety that it can be used as one of its diagnostic features. For instance, the stalks of Co 331 and Co 299 which resemble to a very great extent, those of B.O. 11 and Co 513 respectively in their outward appearance, can be easily distinguished from them by the presence of a cavity (Khanna and Sharma, unpublished). Another well-known phenomenon is that all the varieties develop pith in the upper internodes when they pass from the vegetative to the reproductive phase.

As regards the factors influencing the extent of development, Mathur (1941, 1942) found that progressive increase in the application of nitrogenous manures, resulted in correspondingly greater amount of pith up to 200 lb. per acre beyond which it became ineffective. Irrigation, on the other hand, was found to retard its formation. At Shahjahanpur, average pithiness fell from 6.5% to 4.7% and 4.5% respectively, when irrigation were increased from 3-5 in number to 9 and 11. At Anakapalle, however, in the same season, no appreciable difference in the amount of pith due to different treatments of manure and irrigation was found to be present. Rege