

JUICINESS AND SWEETNESS IN SORGHUM STALKS.*

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Sorghum is a valuable grain crop. It is pre-eminently a food crop of the poor cultivators, and the dominant cereal of regions of low rainfall. The average yield of grain is about 700 pounds to the acre. The chief point in which sorghum scores over other cereals, is in its heavy yield of fodder. This fodder is on an average about four times the yield of grain. It is moreover considered to be the best straw among cereals. There is a distinct preference for this straw as a feed for milch cattle. In areas of favourable water supply, sorghum makes an excellent fodder crop, giving cuts of over 30,000 pounds per acre. The bulk of the fodder is so very nicely protected within the hard rind, that the keeping qualities of this fodder are much in its favour. For these reasons any improvement in the quality of this fodder is of great agronomic value.

The general economic condition of the bulk of the cultivators of sorghums in dry tracts, will not admit of crops grown purely for fodder purposes. Fodder can only be a by-product of grain. There are varieties and tracts, of minor importance, in which the purely fodder value of sorghum exists. But over an overwhelming area, sorghum is grown for grain and fodder, for man and beast respectively. Any improvement in the quality of this fodder is therefore very desirable. This paper confines itself to the stalks of the grain sorghums.

In the Ceded Districts of the Madras Presidency, the sorghum grower is familiar with the dull-midribbed, juicy and sweet-stalked (*Cheruku*) varieties, and the white-midribbed, non-juicy, insipid (*Bendu*) varieties. In other parts of the Presidency the sorghum varieties are mostly pithy-stalked, with leaves having a white midrib. Typical of this kind is the *Peria Manjal Cholam* of Coimbatore, reputed for its fodder value, in addition to being a producer of grain. The absence of juiciness has not therefore meant any very great depreciation of the value of this variety for its fodder. Feeding tests on work animals at the Millets Breeding Station showed that they consumed 50 per cent. more of the juicy-stalked fodder than the pithy-stalked one.

Attempts to grow many juicy-stalked (dull-mid-ribbed) varieties at Coimbatore have in most cases proved detrimental to grain production. Trials to grow the juicy-stalked *Tella Jonna* of Bellary in the adjacent Nandyal valley did not meet with success. A general review of the areas rich in juicy-stalked varieties shows, that this juicy stalk requires for its flourishing, a highly moisture-retentive soil, a certain

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elevation and freedom from rain in the stages of the emergence of the head and the setting of the grain. Most of the juicy-stalked varieties are heavy headed, and fall in the group of *Sorghum cernuum*. A fine modulation of soil and climatic factors of a particular type, seems a necessity for the thriving of these *cernuums* as dual grain and fodder varieties. This limitation has therefore acted as a drag to the desirability of combining juiciness in other local economic varieties.

In 1906, Benson and Subba Rao record the fact, well known to cultivators, associating a dull midrib with juiciness and sweetness, and a white midrib with pithiness and insipidity. In 1914, Annet was the first to find that the colour of the midrib made no difference to the sugar content. In 1916, Hilson corroborated the observations of Benson and Subba Rao and found the white-ribbed character with its pithiness, dominant to the dull midrib with its juiciness and sweetness. In 1931, Swanson and Parker, working on American sorghums, made for the first time a clear distinction between juiciness and sweetness. They found that it was sweetness more than juiciness that determined the susceptibility of a variety to covered kernel smut. They did not work out the mode of inheritance of this character for sweetness.

In the Annual Report of the Nandyal Agricultural Research Station for 1931-32, the rare occurrence of sweet stalks that are not juicy, and of juicy stalks that are not sweet is recorded. These are interpreted as cross-overs, from the popular belief that links sweetness with juiciness.

The study of the relationship between midrib colour and juiciness and other attendant relationships has been in progress at the Millets Breeding Station for a number of years. From the year 1930, a systematic recording of the taste of chewed stalks of varieties has been adopted. It was noted that all juicy varieties were not sweet, and that some of them were insipid. A separation in the pithy group also was attempted and a similar distinction found. All the four possible groups, namely, juicy and sweet, juicy but not sweet, pithy and sweet, and pithy and not sweet, were thus met with. The two latter were very few. The largest number were in the group, pithy and sweet. A few varieties had the ideal juiciness and sweetness. While at this examination it was noted that the juicy stalks were harder to cut than the pithy ones. The colour of the cut ends of stalks gave helpful clues to sweetness. If the central stalks are cut at the milky stage, they will be green in sweet juicy stalks and light yellowish green in juicy stalks that are not sweet. A similar difference in colour exists in pithy stalks also, but confined to the periphery because of the central pith. The sweetness of the stalks is more towards the rind. It would therefore seem clear, that the set of characters, juiciness and pithiness, is independent of the other set of characters, sweetness and insipidity. In the general progress of the evolution and perpetuation of economic

varieties, suited to each tract, the group with pithy stalks and sweetness seems to have had the best survival value. In favoured areas, juiciness and sweetness have gone together. The other two groups lacking sweetness have practically gone to the wall. They might linger in odd unfavourable areas, or as stray plants in a bulk crop.

In the breeding work on this line it has been noted by Hilson, that pithy stalks (white midribs) are a simple dominant to juicy stalks (dull midribs). Experiences at the Millets Breeding Station are in conformity with this. The extraction of juice was 17 to 20 per cent. in pithy stalks, but 33 to 48 per cent. in juicy ones. In families pure for juiciness, simple monohybrid segregations have been obtained for insipidity and sweetness, the former being dominant. Similarly in pithy varieties simple monohybrid segregations for insipidity and sweetness have been experienced. Analyses, kindly made by the Chemist, showed that the difference in Brix value between sweet and insipid was about $3\frac{1}{2}$ per cent. and the sucrose content kept up a similar difference. The insipid stalks had a greater amount of chlorine in their sap. In one instance, a di-hybrid segregation, proving the independent inheritance of these sets of characters, was also noted. It will thus be seen that there are two separate sets of factors determining juiciness and sweetness and they can be combined independently. Naturally, this genetic possibility of combining desirable characters will be conditioned by soil, climatic, and economic considerations, as grain production is also involved. Endeavours to build up both juiciness and sweetness into varieties that lack these characters, without impairing their grain yield, are in progress at the Millets Breeding Station.

Discussion.

Rao Sahib T. V. Rajagopalachari referring to the author's remark that the pithy sorghum was predominant in dry areas, wanted to know why it was that in the Deccan, which was quite dry the sorghum found was juicy.

Rao Bahadur G. N. Rangaswamy Ayyangar replied that in the Deccan the proper climatic factors prevail for the good growth of *S. cernuum* which gives a good grain along with sweet juicy fodder. All areas can grow pithy stalks, but only select favoured areas can have juicy stalked grain sorghums.

INCREASING THE YIELDS OF GROUNDNUTS.*

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Introduction.—The groundnut crop in Madras occupied, in 1932-33, about 9 per cent. of the total cultivated area. Madras has the distinction of being the biggest producer of groundnuts not only in India,

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