4. The effect of sh_2 on carbohydrate reserves in maize endosperm

Quantitative determinations of reducing sugars, sucrose, water-soluble polysaccharides and starch in mature endosperms indicate that the shrunken phenotype of sh_2 is associated with a striking difference from normal in carbohydrate reserves. To facilitate a valid comparison of the effect of the sh_2 factor with that of su_1 studies were carried out on the selfed progenies of plants heterozygous for both factors (Su su Sh sh). Four phenotypic classes are represented among the progeny: normal (Su Sh), sugary (su Sh), shrunken (Su sh) and sugary-shrunken (su sh). While normal kernels store carbohydrate predominantly in the form of starch there is a progressive decrease in this component among the other classes in the order named. Conversely, sugars are lowest in normal kernels (1.8%) and highest in the sugary-shrunken class (32.0%), the latter type having only one-tenth the normal amount of starch. The differences in sugar content are due primarily to sucrose which alone accounts for 28% of the dry weight of sugary-shrunken endosperms. Water-soluble polysaccharides which represent 30% of the weight of sugary (su Sh) kernels (a long established observation) are nearly absent in the other types. The following general interpretation of the action of these genes is suggested. In the development of normal (Su Sh) endosperms there is an uninterrupted conversion of sucrose and reducing sugars to starch. The su gene determines a partial block in synthesis at some point following the condensation of sugar residues but prior to the formation of starch. The unusually high sucrose and low starch levels of Su sh endosperms suggest that the sh_2 factor blocks synthesis at an earlier stage than does su and may be concerned with the enzymatic degradation of sucrose. The sh_2 factor may be of some value in the sweet corn industry either as substitute for, or in combination with, the su gene.

John R. Laughnan