Genetic Inheritance of Cytoplasmic Male-Sterility in Sudangrass

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Cytoplasmic male-sterility has been used in the commercial production of hybrid seed corn for a number of years. More recently it has been used in hybrid grain sorghum seed production. Since sudangrass (Sorghum vulgare var. sudanense Hitch.) has a perfect flower and is often self-pollinated, a male-sterile line is essential for the commercial production of hybrid sudangrass seed. Although only one cytoplasmic male-sterile sudangrass has been reported, it is likely that cytoplasmic male-sterility occurs more frequently than has been realized, and a systematic search may lead to the location of more promising types. The mode of inheritance is always important in evaluating any source of sterility. With these facts in mind, an inheritance study on the interaction of cytoplasm with male-sterility factors in sudangrass was conducted.

REVIEW OF LITERATURE

The first case of male-sterility due to gene-cytoplasm interaction was described by Bateson and Gairdner (1) in flax. Twenty-five percent of the offsprings were pollen sterile in the F2 whereas no pollen sterility was observed in the reciprocal cross. A similar dependence on the interaction between the nucleus and cytoplasm for male-sterility has been found in Nicotiana (5, 2), onion (7), sugar beet (10), Dactylis glomerata (9), and potato (6). Reports on the inheritance of sterility and the interaction of the gene and cytoplasm indicate differences within species as well as between species.

Rhoades (12) first described cytoplasmic male-sterility in corn. Reciprocal crosses showed that the pollinator had no apparent effect on the expression of sterility, transmitted through the maternal cytoplasm.

Working with grain sorghum, Stephens and Holland (13) reported a type of male-sterility resulting from the interaction of milo cytoplasm with the nuclear factors from kafir. They suggested that more than two pairs of genetic factors, in association with the cytoplasmic factors, were responsible for sterility. More recently, Maunder and Pickett (8) presented data to show that this same male-sterility was dependent on a single pair of recessive genes interacting with sterile cytoplasm. This hypothesis was true only when plants completely free of seed or having no more than two seeds per head were classified as male-sterile. In an inheritance study in which panicles were checked cytologically and all plants completely free from normal pollen were classified as sterile, Pi and Wu (11) obtained three different ratios. They found that a single pair of recessive genes interacted with the sterile cytoplasm in 5 crosses, 2 independent recessive genes were effective in 2 crosses, and 2 crosses could not be explained on a simple hypothesis.

Workers in Georgia (3, 4) reported the successful development and use of a male-sterile sudangrass. By a series of backcrosses the nonfertility restoring factors of Rhodesian sudangrass were transferred to the sterile cytoplasm of male-sterile Combine Kafir 60. Thirteen other varieties tested possessed factors for restoring fertility. Since no sterile segregates were observed in the F1 or F2 it was postulated that fertility is controlled by several factors.

MATERIALS AND METHODS

Crosses were made between 15 varieties of sudangrass (Tift, Ga. 337, Common, Greenleaf, Sweet 372, Sweet Common, Lahoma, Piper, Sweet 372 (S-I), Stoneville Sel., Stoneville Syn. 1, Georgia Common, Sahatra, PI 219759, and S. arundinaceum var. Rhodesian PI 156549) and male-sterile Combine Kafir 60 (CK 60) during 1957, 1958, and 1959 in an effort to develop a male-sterile sudangrass and to study the inheritance of sterility. CK 60, a cytoplasmic male-sterile which received its cytoplasm from Day Milo and its genes from Combine Kafir 60, was used as the female. The heads