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Tetraploid Grain Sorghum

by

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There are well over a thousand races of Grain Sorghums under cultivation all over the world. Without an exception all of them are diploid with 2n = 20 chromosomes. Haploids and triploids have been reported as rare occurrents (Brown 1943; Price and Ross 1955). Under experimental conditions Chin (1946) by colchicine treatment produced autotetraploids and octaploids. But these were partial steriles. There have been no naturally occurring tetraploids of Grain Sorghums reported so far.

In this laboratory numerous attempts were made to induce colchiploidy in Grain Sorghums. Though very promising initial responses characteristic of colchicine effect were observed it was found that no permanent changes had been produced and all later shoots were only diploid.

It was sought, therefore, to try to induce polyploidy by hybridization and for this purpose the interspecific hybrid of *S. halepense* (2n = 40) and *S. durra* (2n–20), (Krishnaswamy *et al* 1953) was utilized. This hybrid is triploid with 2n = 30 chromosomes. All of them exhibited pronounced *halepense* characters with loose panicles, elliptic spikelets and elliptic-ovate, brown grains. The stems were thin and leaves though long were more like the *halepense*. The F_2, of the 40–chromosomed plants behaved pure as to the chromosome number and remained essentially *halepense*–like.

Attempts were made to cross the hybrid back to the cultivated grain sorghums. In this, a sterile plant in which the sterility was induced by desynapsis (Krishnaswamy and Meenakshi 1957), was largely made us of as the stigma parent. Six plants were obtained which possessed thick stems, broad wavy leaves just as in the grain sorghum *durra (Peria manjal cholam)* type (Fig. 1). The plants are perennial and exhibit hybrid vigour. The estimation of the chromosome numbers gave 2n = 40 as the diploid number. This was therefore, an allotetraploid with several characteristics including grain size and shape like that of the grain sorghums combined with some *halepense* traits like perenniality, many tillers, deep purple pigment and loose panicle.

F_2 and F_3 progenies of those six back-cross hybrids were grown. The F_{2_1} population was pure for the tetraploid number of $2n=40$ but segregated for a number of Mendelian factors. Different degrees of recombinations of *halepense* and grain sorghum characters occurred. However, there were no plants fully like the *durra* or the *halepense* parents (Figs. 2 & 3). The F_3 of fiftysix selected plants again was pure for the tetraploid number but a number of recombinations approaching to the cultivated grain sorghums were obtained. These have yellow, bold grains, non-shattering, stems thick and leaves broad but pegrennial and tillering. Hybrid vigour has been evident in these progenies also.

Some of the selected 40-chromosomed back-cross F_2-plants were again crossed with another desynaptic grain sorghum plant *(Sen Cholum)*, the latter being used as the stigma parent (Krishnaswamy and Meenakshi l.c.). From these hybridisations a number of plants have been obtained all 40-chromosomed, perennial, rhizomatous, bold umbonate grained with vegetative characters like the common cultivated grain sorghums (Fig. 4). These also exhibit to a very large degree hybrid vigour, some of the plants being extra thick stemmed and 20 ft. tall.

Thus by a series of selective back crosses to the cultivated grain sorghums a tetraploid grain sorghum plant has been evolved. This apart a number of useful fodder types has also been selected. The plants are all highly fertile. Hadley and Mahan (1956) recommended as an excellent project the establishment of 40-chromosomed cytoplasmic male sterile lines so that 40-chromosomed hybrid grass sorghums could be produced and compared with 20-chromosome hybrids and that perennial types would be more easily established on the 40-chromosome level. In this study by utilizing certain sterile plants with peculiar cytological behaviour the establishment of a tetraploid, perennial grain and also fodder sorghum has been achieved.

The detailed account of the cytogenetics of these hybrids will be reported elsewhere. This general account is given here in order to draw the attention of the sorghum breeders to the potentialities of these remarkable nucleus plants from which it is possible to evolve by series of intercrossings economic types which may be suited to more diverse ecological conditions and fertility levels than are common with the diploid sorghums and solve some of the problems

Fig. 1 Fig. 2 Fig. 4

Fig. 3

EXPLANATION OF PLATES

Fig. 1. The first back-cross F_1 showing bybrid vigour. (1/27 Nat. Size).
Fig. 2. Some of the back-cross 40-chromosomed F_2., plants. (1.20 Nat. Size).
Fig. 3. Some of the panicles of the back cross 40-chromosomed F_2 plants. (1/4·5 Nat. Size).
Fig. 4. Plant with panicle from the second back-cross. (1/27 Nat. Size).

connected with the millets breeding programme since the hybrid vigour is kept on so long as the plant is allowed to grow and the possibility of their multiplication by asexual means. These plants are growing at the Millets Breeding Station, Agricultural College and Research Institute, Coimbatore.

I acknowledge the help given by my colleagues connected with this investigation.

Summary: The building up of a tetraploid grain producing sorghum plant by a series of hybridisations and the description of some of its characteristics have been given. These are perennial and serve dual purpose of grain and fodder plants.

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ERRATA

(Madras Agricultural Journal: February, 1957)

Page 59, Para 2, line 15, for 'ut of alarge' — Read as out of a large number.
,, ,, ,, ,, 21, for 'and Selection' — Read as and the section.
,, 60, ,, ,, 6, for 'Standard. Though — Read as standard as though.
,, 61, Below the tabie Para 1, line 6, for average 21 — Read as average 21, 23.
,, 62, Para 1, line 1, for Food rain — Read as food grain.
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