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Improvement of Grain Sorghum (*Sorghum subglabrescens* Schweinf *et.* Ashers) Through Intraspecific Hybridization*

by

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Synopsis: From progenies of cross between Co. 18 x K_2 to improve the straw of the latter, a *Vellai cholam* variety combining the white pearly grains and ovate compact earheads of K_2 and the juicy stalks of Co. 18 has been evolved. The recombined type showed a potential for giving increased yield over K_2, the better yielding parent in initial yield trial. The variety awaits confirmatory yield trials, prior to release for cultivation.

Sorghum subglabrescens Schweinf *et* Ashers. (irrigated *Vellai Cholam*) is grown as an irrigated food crop cultivated during summer season. The early crop sown in January – February is known as the *Thai pattam cholam* and the late crop sown in March–April as the *Chitrai pattam cholam*. The improved irrigated *Vellai Cholam* strain K. 2 released from the Agricultural Research Station, Kovilpatti is suited for both the sowings. The strain has pearly white grains a desirable trait for edible sorghum but the straw is not favoured for fodder on account of its pithy nature. The strain being very popular in the Southern districts of Tirunelveli, Ramanathapuram and Madurai improving its straw quality by inducing juiciness would be an additional desirable character.

Materials and method: Cholam Co. 18 an irrigated *Vellai Cholam* strain evolved at Coimbatore was used as the basic material for the improvement. This was crossed with K_2 and from the F_2 population selections combining the qualities of juicy straw of Co. 18 with the pearly white grains and compact earheads of K_2 were selected, screened for purity in the F_3 and advanced to yield trials in the subsequent generation. This improvement has to be resorted to as Co. 18 with its red wash in the grains is not suited for direct introduction in the southern tracts where irrigated types with pearly white grains are preferred.

The midrib of sorghum leaf is an index of the straw quality. White midrib indicates pithy straw and a dull one juicy straw. The former behaves as a simple dominant over the latter (Hilson 1916). Co. 18 was used as the ovule parent and K. 2 as the pollen parent. The technique of mass emasculation (Stephen 1933) and controlled pollination was employed to effect hybridization. The cross was effected in 1956 summer season and the F_1 studied in the following year. The F_2, F_3 and F_4 progenies were raised and studied in the succeeding years.

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Data and discussion: The important characters of the two parents that went into the cross are listed below.

Characters	*Co. 18*	*K_2*
Sheath.	Reddish purple.	Reddish purple.
Midrib.	Dull.	White.
Straw.	Juicy.	Pithy.
Grain.	Pearly, red wash, exposed.	White, pearly, exposed.
Panicle.	Medium, compact, cylindrical	Ovate, compact.
Duration.	90–95 days.	90–95 days.
Grain yield per acre.	2,400–3,000 lbs.	2,400–3,000 lbs.

The F_1 plants were similar to Co. 18 except for having white midrib. The hybrids appearded to be more vigorous than either of the parents. To confirm the observation and to ascetain the extent of manifestation of hybrid vigour, the growth and performance of parents and hybrids were measured. The data are presented in the following table.

TABLE I.

(Plant measurements — average of six observations)

Variety	Plant height cm	Nodes No.	Panicle Length cm	Panicle Breadth cm	Peduncle thickness cm
Co. 18	206·50	10·33	9·08	4·58	0·74
K_2	202·50	10·00	8·00	5·53	0·89
F_1: Co. 18 x K_2	223·50	11·68	10·42	5·67	1·78

The earhead and grain weights were statistically analysed and the results are as follows.

TABLE II.

(Grain yield — average of 20 observations)

	Earhead weight in gm			Grain weight in gm		
	Co. 18	K_2	F_1	Co. 18	K_2	F_1
Mean yield of single plant	54·29	60·08	68·50	44.34	49·82	56·57
Standard difference	8·34	10·71	12·80	6·99	8·99	10·58
Standard error	1·86	2·39	2·86	1·56	2·01	2·36
Coefficient of variance	3·43	3·82	4·50	3·52	4·03	4·16
S. E. of difference:						
1. Co. 18 & F_1	3·42	Difference significant		2·82	Difference significant	
2. K_2 and F_1	3·73	Difference significant		3·15	Difference significant	

The Table II shows that F_1 hybrids were significantly superior to the parents with 26 percent and 14 percent increased yield over Co. 18 and K_2 respectively. The hybrid vigour manifested in this case may be placed in the first group of Karper and Quinby (1937) in which the hybrids are more vigorous than either of the parents.

Selection for fixing the desired character combination viz. the pearly white grain and compact earheads of K_2 and juicy stalk of Co. 18 was initiated from the F_2. Twenty F_2 families with a population of over 7700 plants were studied, which also revealed the factors controlling tillering in sorghum (Divakaran 1960). Only 57 single plant selections with the desirable character combinations could be fixed in the F_3. The very limited number of recombined types (with pearly grain and dull midrib) may be indicative of high linkage between pigmentation of grain and midrib colour. After the characters were confirmed in the third generation, 57 single plant selections from families that do not segregate were advanced for replicated yield tests in the F_4 generation. They were compared with K_2 as control. The other parent Co. 18 was eliminated from yield trials as previous trials with the strain have proved that K_2 is the better yielder under Kovilpatti conditions. Thirty nine out of the 57 selections were better than K_2 with 5 to 133 percent increased grain yield.

The results of the preliminary yield test showed that the recombined types with pearly white grains, compact earhead and juicy straw have the potential for heavy yield. It only remains to be confirmed whether the initial performance will be seen in advanced yield trials. It is also observed that the recombined selections attained remarkable uniformity for stand, duration and flowering even in the F_4 generation. Chewing tests showed that the recombined types were not pure for sweetness of the stalks. This conforms to the earlier findings that juiciness and sweetness of stalks in sorghum were controlled by separate factors (Ayyangar *et. al.* 1936; Hilson 1916; Swanson & Parker 1931).

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