

Field Technique of Commercial Hybrid Seed Production of Sorghum (*Sorghum vulgare* Pers.)

by

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The evolution of 'Hybrid *Sorghum*' is an outstanding achievement in the planned programme of plant breeding. In the programme of the development of *Sorghum* hybrids, CK. 60A (male sterile) was used as the female parent. Among the many male fertile pollinators tested for their combining ability the three male fertile lines namely, I.S. 3687, I.S. 3555 and I.S. 84 were used as male parents in the production of *Sorghum* hybrids. Hybrids like ms x I.S. 3687, ms x I.S. 3555 and ms x I.S. 84 were tested in the important *Sorghum* growing districts of the Madras State to find out their suitability and adaptability. Hybrid ms x I.S. 84 has performed uniformly well in all the centres giving an average hectare yield of 5218 kg. of grain and 15,280 kg. of fresh straw as against the grain yield of 3597 kg. and 17,330 kg. fresh straw of the standard strain of the irrigated *Vellai Cholan* of the Madras State and also proving as a suitable hybrid for the *Sorghum* growing areas of the Madras State for the summer season under irrigated condition.

The cultivation of hybrid *Sorghum* enables the cultivator to go for a special type of seed which shows extra vigour and yield. This concept of producing seed is different from ordinary method. Seed producers require more than the normal amount of training and skill. The planting of two varieties in alternative lines (in each block of a field) requires technical training and supervision. More than ordinary knowledge is required to provide proper culture, plant protection and irrigation to enable the crop to produce a high yield of good quality seed. Every step from sowing to harvest is watched carefully. To produce hybrid seed, pollination must be properly controlled. Isolation of seed production plots is very essential.

This paper outlines the field techniques followed in producing the hybrid seed at the Millet Breeding Station, Coimbatore.

Previous literature: In grain *Sorghum*, in general, the stigmas come out first sometimes as early as 15 to 36 hours before the appearance of the stamens and normally the panicle of *Sorghum* takes nine days to complete

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Received on 28-12-1966.

the anthesis (Ayyengar and Rao 1931; Quinby and Stephens 1934). Cytoplasmic male sterile lines studied under American and Indian conditions showed receptivity of stigma for a period of ten days (Ross 1957, Mahudeswaran 1959) indicating that the receptivity and behaviour of the stigma in the male sterile and normal are similar.

Material and methods: The materials consisted of a male sterile line CK. 60A and a pollinator line I.S. 84 obtained from the Rockefeller Foundation, New Delhi. The studies were conducted during the month of June, 1964.

C. K. 60 A: CK stands for combine kafir, a variety produced for machine harvest. It is a cytoplasmic male sterile line of American origin with the genetic constitution of "ms ms" on sterile cytoplasm. The male sterility is a character of considerable economic importance and is used as an aid in the production of hybrid seed with the expectation of using as first generation hybrid for the commercial crop production. This male sterile line also possesses high female fertility comparable to that of normal grain *Sorghums*.

I. S. 84: I. S. stands for an Indian *Sorghum* of American origin with the genetic make up of "Ms Ms" on normal cytoplasm. The grains are pearly in colour and the endosperm is yellow. This is a pollinator line of good combining ability in producing a bumper first generation crop.

The salient features of the two lines are given below:

	Indian <i>Sorghum</i> Yellow endosperm faterita - 84	Combine Kafir 60A
Height (cm)	128.0	118.0
Number of leaves	12	13
4th leaf length (cm)	43.0	49.0
4th leaf breadth (cm)	4.8	4.7
Panicle length (cm)	26.0	15.0
Panicle breadth (cm)	7.2	5.0
Peduncle thickness (cm)	0.5	0.7
Duration (days)	97	105

An acre of land isolated from other *Sorghum* varieties was chosen. All round in the one acre land and in the centre block from South to North the pollinator parent I.S. 84 was sown on 15-6-1964. The remaining

blocks were divided into small beds of 5.1 metres x 2.7 meters and for every two lines of CK. 60A in the beds one line of the pollinator was sown. The male sterile line was sown on 21-6-1964 and the pollinator two days later in beds as the parents differ in duration by eight days. To provide continuous pollen and to ensure good seed set the pollinator line was sown on different dates.

A basal dose of 10 tonnes of compost, 36 kg. of nitrogen and 28 kg. of phosphoric acid per acre was applied. Another 54 kg. nitrogen was applied as top dressing. Fifteen pounds of "Thimet" was applied at the time of sowing in the seed furrows against the *Sorghum* shoot-fly (*Atherigona indica*). A mixture of 7 kg. of Endrin and 14 kg. of Sevin was sprinkled on the young seedlings five days after sowing against leaf eating insects. A spraying of metasystox and endrin was given 10 days after sowing against insects. During the time of flowering B. H. C. 10% was dusted against the *Sorghum* earhead bug (*Calocaris angustatus*) at the rate of 14 kg. per acre. A mixture of 4.5 kg. of 5% D. D. T. and 4.5 kg. of 50% D. D. T. was dusted against the *Sorghum* Midge.

Results: In the one acre production plot the area occupied by the male sterile parent was 0.19 hectare and an yield of 304 kg. of hybrid seed was obtained. The pollinator parent occupied 0.212 hectare and gave an yield of 888 kg. of seed. The hybrid seed showed 95 per cent germination.

Discussion: The layout of the field and the parental seeds sown in 2:1 ratio and the technique followed in the hybrid seed production were found to be ideal. The previous studies on the stigma receptivity of the male sterile line under American and Indian conditions have shown that the behaviour and the receptivity of stigma are almost similar to that of normal grain *Sorghum* and the stigma is found to be receptive for 10 days. Hence, it is found necessary to sow the pollinator line at least in two different dates at the interval of 10 days so as to ensure continuous pollen to pollinate the stigmas and to effect seed set in the maximum number of spikelets per head of the male sterile *Sorghum* (female parent). In the present study there is a difference of 8 days duration between the parents and hence the pollinator line was sown two times i.e. on 15-6-1964 and 23-6-1964. In the present experiment 2:1 ratio of male sterile and pollinator line was adopted and this has been found to result in fairly appreciable amount of hybrid seeds, yet experiments adopting different ratios should be tried so as to arrive at the most suitable ratio. The assured and adequate isolation of the hybrid seed production block is necessary, since the pollen from varieties other than the pollinator may also produce fertile plants in the seed rows. These seeds in the following year will contaminate the hybrid crop. It will

also impair with the uniformity of the hybrid *Sorghum* raised in the farmers' fields. It has been recommended that there should be a minimum isolation of 200 metres with modification down to 100 metres and the distance depends also upon the varieties. A safe maximum distance of 400 metres has also been indicated (Anon. 1958).

The cost of hybrid seed production from one acre of land is nearly four times that of the ordinary seed production. The cost of cultivation worked out to Rs. 846/- as against Rs. 231/- of the strains. After deducting the value for the seeds and straw of pollinator and straw of male sterile line, the net cost to produce 304 kg. of hybrid seed from 0.19 hectare amounted to Rs. 267.17 costing 88 P. per kg. for the hybrid seed as against the present cost of 67 P. per kg. of seed of the improved variety. This hybrid has registered an average yield of 1620 kg. per acre over the standard *Vellai Cholan* strain Co. 18 for an acre from the results of the trial plots conducted in Madurai, Tiruchirapalli and Coimbatore districts and it is sure to replace the four lakhs of acres under the summer varieties of the Madras State. The produce of 304 kg. of hybrid seed is sufficient to cover 24 hectares of irrigated land.

Summary: A brief outline of the field technique followed in producing hybrid seed at the Millet Breeding Station, Coimbatore is reported. The parent materials are the cytoplasmic male sterile line combine kafir 60-A and the pollinator line Indian *Sorghum*, yellow endosperm *faterita* 84. The two parents were sown in 2:1 ratio of male sterile and pollinator. The pollinator line was sown on two different dates so as to ensure continuous pollen to pollinate the stigmas and to effect seed set in the maximum number of spikelets per head of the male sterile parent. The seed set was satisfactory and an yield of 34 kg. of hybrid seed was obtained from 0.19 hectare of land. The cost of production works out to about 88 P. per kg. of hybrid seed.

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