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Cost of commercial seed production in hybrid sesame

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Abstract : The floral biology of sesame, despite its autogamous nature, is favourably suited for developing hybrids. To produce hybrid seeds in sesame, different techniques are tried. In the present study, attempt were made to produce large quantities of hybrid seed by hand emasculation and pollination method. It was found that 98.64 per cent of the total cost of hybrid seed production was spent towards emasculation and crossing. On an average, one labour could attend 450 and 275 flower buds respectively for emasculation and pollination in an hour. Only 57 per cent capsule set was recorded and the number of seeds formed in the crossed capsule was also less. The production cost of hybrid seeds was worked out to be Rs. 534.00 per kg. (***Key Words :*** *Sesame, Hybrid seed production, Hand emasculation and Pollination).*

Sesame (*Sesamum indicum L.*) is an important and ancient oil yielding crop originated probably in Africa (Osman, 1985) and cultivated extensively in India, China, Japan, Africa, and Mediterranean regions. Sesame, though a self pollinated crop, the study of insect aided natural out crossing (Brar and Ahuja, 1977) and the release of two hybrids from China (Sharma, 1994) have opened up the possibility of commercial exploitation of heterosis. The success of commercial exploitation of hybrids depends on the economics of hybrid seed production. Prasad (1994) is of opinion that since the seed requirement of sesame is very low, exploitation of hand emasculation and pollination technique is possible for commercial seed production. The present study was undertaken to estimate the cost of hybrid seed production by adopting hand emasculation and pollination method.

Materials and Methods

The study was carried out in Cotton and Oilseeds Farm, Tamil Nadu Agricultural University, Coimbatore during kharif-1996. The ovule (VRI.1) and pollen (Si.3214) parents obtained from

germplasm collection of RRS, Vridhachalam were sown on the same day in 4 : 2 row ratio with a border row of pollen parent, all around the experimental plot (80 m²). The length of each row was 3m. The distance between plants of ovule parent was 45 cm while the distance between pollen parent was 30 cm. The distance between ovule *versus* pollen parent was 45 cm. The distance between plants in female and male rows was 30 cm and 15 cm respectively. An isolation distance of 100m was maintained for the experimental plot. Recommended package of practices was followed.

Improved method of hybridization (Manivannan and Ganesan, 1995) was followed Emasculation of well-matured flower buds was done in the previous day evening of anthesis, by holding the gamopetalous corolla between the index finger and thumb and smoothly slipped out by gentle pull. As the stamen are epipetalous they got themselves simultaneously removed along with the corolla. The emasculated flower left uncovered. On the following morning of emasculation, healthy and robust flowers of male parent were collected, by smooth slipping of the corolla column as done for emasculation and brushed on the stigma of the emasculated flowers. Care was taken to emasculate and pollinate all flowers produced on a particular day. After pollination flowers were left uncovered. Any left out flowers that missed emasculation were removed without any omission.

With the initiation of flowering in both ovule and pollen parents, the process of hybridization started and continued for another 25 days. Emasculation was done between 1500 and 1800 hours and pollination was done between 0600 and 0900 hours. Records of various inputs applied in the experimental unit from sowing to harvest were maintained. Cost per kilogram of hybrid seed was computed from the total expenditure and quantity of hybrid seed obtained from 80 m² and the results are projected for a hectare.

Results and Discussion

Cost of cultivation

In addition to cost of cultivation for growing sesame under high care condition, hybrid seed production technique involved expenses on additional labour upto 6836 mandays (one manday equivalent to eight hours of work per day) per hectare for emasculation and crossing for a period of 25 days. The total cost of cultivation (including land preparation, seeds & sowing, manures & manuring, irrigation, weeding, plant protection, harvesting & processing and emasculation and pollination) was estimated to be Rs.2, 47,876.00 per hectare and out of which the labour cost. The production of hybrid seeds per hectare was 461 kg and seed yield from pollen parent was 100 kg. The return per hectare (@ Rs.20 per kg for 100 kg seed yield from pollen parent) was worked out to be Rs.2,000.00. Thus the production cost of 461 kg of hybrid seeds was Rs.2,45,875.00 and the production cost per kilogram of hybrid seed was Rs.534.00 as against Rs.200.00 per kg of hybrid seeds reported by Manivannan and Ganesan (1995), Rs.300.00 per kg by Barwale and Panchabhaya (1994), Rs.300.00 to Rs.400.00 by Thangavelu (1994), and Rs.1218.00 by Bavbiskar (1994). Wider variation fro the cost of seed production might be due to variation in the labour cost and success in crossing.

Labour use in hybrid seed production

Hybrid seed production in sesame was a labour intensive process and this required 6930 mandays per hectare from sowing to harvest. The details are given below.

Operation	Labour use (mandays)	Percentage
1. Land preparation	14	0.20
2. Sowing	12	0.17
3. Fertilizer application	07	0.10
4. Weeding	21	0.31
5. Irrigation	08	0.15
6. Spraying	02	0.03
7. Harvesting & processing	30	0.43
8. Emasculation & crossing	6836	98.64

It was evident that 98.64 per cent of total labour was used for emasculation and pollination. The remaining was shared for other operations viz., land preparation, sowing, fertilizer application, weeding, irrigaion, spraying harvesting and processing.

Success in crossing

To enhance success in crossing, trained labourers were employed. One labour could attend 450 and 275 flower buds for emasculation and crossing, respectively in an hour. On an average there were 33 seeds per crossed capsule and the

hybrid seed yield was 461 kg per hectare. The number of seeds formed after hand emasculation and pollination was less (33 seeds per capsule) as compared compared to the normal capsule (54 seeds per capsule). This might be due to injury caused to floral parts in the process of emasculation and pollination. In the present study, 54 per cent capsule set was recorded as against the earlier report of 80 per cent by Manivannan and Ganesan (1995). The deviation might be due genetic diversity among the selected parents and environmental conditions.

Economics of hybrid seed production

Worldwide research in under way to develop F_1 hybrids for commercial exploitation of heterosis in sesame. The pre-requisites for such programme in self pollinated crops like sesame are : (i) Sufficient yield heterosis to take care of additional seed costs and benefit the growers and ii) economic and reliable seed production technique. In the present study the cost of producing hybrid seed by hand emasculation and pollination method was worked out to be Rs.534.00. This cost is quite high and ultimately it becomes the major negative factor discouraging the ready acceptance of hybrid by the farmers.

Therefore, the cost of hybrid seeds must be reduced by development of CMS based hybrids. This warrants immediate search for male sterility, restorer genes and other requisites like supplementary pollination for the production of hybrid seeds in sesame. Another option for popularising hybrids would be the utilization of F_2 seeds, provided if the F_2 shows low inbreeding depression.

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