Mysore J. Agric. Sci., 50 (2) : 438-442, 2016

Influence of Pollination Intervals and Filler Materials on Seed Yield and Quality of Sunflower Hybrid KBSH-53

B. Manjunatha and B. C. Channakeshava

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bangalore-560065

Abstract

The study was conducted to determine influence of pollination intervals and filler materials on seed yield and quality of sunflower Hybrid KBSH-53. There were 25 treatment combinations comprising of five pollination intervals and five filler materials laid out in factorial randomized complete block design (FRCBD) and replicated thrice. The results revealed that hand pollination on alternate days' recorded significantly higher seed yield and quality components such as head diameter (16.53 cm), number of filled seeds/capitulum (786.60), Seed filling percentage (80.53), seed yield / plant (27.13 g) graded seed yield kg / ha (712.33), Germination (90.20%), Seedling length (26.91cm), Seedling vigour index (2430) and Oil content (36.95 %) and it was on par with the hand pollination daily. Among the filler materials, 100 per cent pollen recorded significantly higher seed yield and quality components such as head diameter (14.99 cm), number of filled seeds/capitulum (780.60), seed filling percentage (78.04), seed yield/plant (25.53 g) graded seed yield kg/ha (674.67), germination (89.50 %), seedling length (27.33cm), seedling vigour index (2449) and oil content (36.01%) but did not differ from 75 per cent pollen+25 per cent borax as filler material.

Oilseed crops occupy an important position next to food grains in Indian economy. The oil not only forms an essential part in human diet but also serves as an important raw material for manufacture of various products like flavor enhancers, lubricants etc.

A sunflower crop was introduced to India during 1969 as a supplement to traditional oilseed crops to bridge the gap of recurring edible oil shortage in the country. The commercial cultivation of sunflower started in India during 1972-73 with introduction of Russian varieties from USSR and Canada. Now, the crop is well adopted because of its desirable attributes such as short duration, photoperiod insensitivity, adoptability to wide range of soil and climatic conditions, drought tolerance, higher seed multiplication ratio(1:50) and high quality of edible oil (45-50%),which contains polyunsaturated fatty acid(PUFA).

Though the crop has gained important place among farmers, the productivity of sunflower in India is much lower than the world's average. The seed production yield in sunflower is largely dependent on proper pollination. Poor seed setting in sunflower is often considered to be a major reason for low seed yield. Some of the reasons for poor seed setting are self-incompatibility, absence of pollen vectors, insufficient nutrition and competition among developing seeds themselves (Sindagi, 1979). In majority of the cases the pollination is very much inadequate or not properly followed, the pollen theft by honey bees in the early morning before pollination, leading to non-availability of pollen to stigma resulting in poor seed set.

The seed production in sunflower hybrid KBSH-53 involves crossing of male sterile line *viz*., CMS 335A with fertility restorer line RHA95C-1 which is branching type besides being late to flower and maturity compared to female line. Availability of pollen grains in RHA95C-1 is vital during pollination for increasing seed yield. In hybrid seed production of sunflower, daily hand pollination is practiced by engaging labour during flowering period, which becomes a costly affair and the availability of pollen to the female parental line, may be insufficient due to diseases and insect damage to the plants. Sometimes parents may flower either early or late because of environmental stress resulting

in non-synchrony of parental lines during anthesis period and there will be scarcity of pollen when female parent attains receptivity. Hence, there is a need to improve the efficiency of pollination with the available or limited pollen for increasing the seed set. The quantum of pollens preferably used for pollination may be utilized or wasted due to excess, when 100 per cent pollens are used. Judicious use of pollen along with filler material with borax and Ragi flour may increase the pollen use efficiency and thus results in better seed set (Annon. 2000). The pollination intervals and quantity of filler material to be used and its effect on seed yield and quality needs to be studied since there is a lack of information on these aspects.

With this background, an investigation was undertaken to study the Influence of pollination intervals and filler materials on seed yield and quality of sunflower Hybrid KBSH-53

A field experiment was conducted during the *Kharif* 2015 at plot E-6 of Department of Seed Science and Technology, UAS, GKVK, Bengaluru. The experiment was laid out in randomized complete block design of factorial concept with three replications. Freshly harvested seeds of parental lines of KBSH-53(CMS 335A X RHA95C-1) were obtained from AICRP on sunflower, GKVK, University of Agricultural sciences, Bangalore and used for the study. The recommended package of practices was followed to raise the crop. Capitulum of both seed parent and pollen parent were covered with cloth bags before the anthesis and bags were retained up to completion of flowering. During the flowering period, hand pollination treatments were given to the female parent in addition to filler materials from initiation to completion of flowering *viz*., pollination intervals(P_1: Hand pollination daily, P_2: Hand pollination on alternate days, P_3: Hand pollination at three days interval, P_4: Hand pollination at four days interval and P_5: Hand pollination after complete flowering) and filler materials (F_1:100% pollen, F_2:75% pollen+25% borax as filler material, F_3:75% pollen+25% finger millet flour F_4:50% pollen+50% borax as filler material, F_5:50% pollen+50% finger millet flour). Pollens from the male parental lines were collected by opening the cloth bag and replaced in the same position after collecting the pollens. Collected pollens were transferred to the seed parental heads by opening the cloth bags and covered again with the same bag. The pollination was performed every day between 8 A.M.to 11 A.M. Five healthy and normal plants were selected at random in each plot and tagged with a label for recording various observations on seed yield parameters *viz*., Head diameter, Number of filled seeds / capitulum, Number of unfilled seeds / capitulum, Total number of seeds per capitulum, seed filling percentage, seed yield / plant and graded seed yield/ha. Seed yield obtained from each plot was computed and expressed in kg per hectare. The seeds were also subjected to seed and seedling quality evaluation.

The seed yield and quality components as influenced by different pollination intervals and filler materials are presented in Table I and II. Significantly higher seed yield and quality components such as Head diameter (16.53 cm), Number of filled seeds / capitulum (786.60), Seed filling percentage (80.53), seed yield/ plant (27.13 g), graded seed yield kg / ha (712.33), Germination (90.20 %), Seedling length (26.91 cm), Seedling vigour index (2430), and Oil content (36.95%) were noticed with the Hand pollination on alternate days. However, it was on par with the hand pollination daily, followed by Hand pollination at three days interval, hand pollination at four days interval and lower seed yield and quality components were noticed with the hand pollination after complete flowering (Table II). The percent seed set and number of filled seeds per head were more in hand pollination on alternate days compare to hand pollination daily. This was mostly due to prolonged period of stigma receptivity up to even three days (Kempegowda, 1993). Lower seed yield and quality components were noticed with hand pollination after complete flowering might be due to loss of stigma receptivity. In the present study, hand pollination daily resulted in less yields compare to hand pollination on alternate days. Which might be due to an injury to the stigmatic surface caused due to the rubbing of the pollen and this might have led to poor seed set. To overcome this injury, additional plant nutrients are required for the repair of the damage and this might have led to poor seed development. Further there would have been delay in seed development process leading to poor accumulation of

TABLE I

Influence of pollination intervals and filler materials on seed yield components of sunflower Hybrid KBSH-53

Treatments	Head diameter	Number of filled seeds / capitulum	Number of unfilled seeds/ capitulum	Total number of seeds per capitulum	Seed filling percentage	Seed yield/ plant (g)	Graded seed yield kg/ha
Pollination intervals							
P_1	16.37	778.07	190.13	968.20	80.33	26.83	711.80
P_2	16.53	786.60	189.67	976.27	80.53	27.13	712.33
P_3	14.23	750.40	233.33	983.73	76.14	22.53	672.33
P_4	11.13	678.00	282.33	960.33	70.39	20.63	610.33
P_5	8.73	629.33	336.67	966.00	65.04	16.70	480.33
S Em±	0.43	21.88	10.73	25.05	1.01	0.47	17.87
CD (P=0.05)	1.21	62.22	30.50	NS	2.86	1.34	50.81
Pollen and Filler materials							
F_1	14.99	780.60	219.07	999.67	78.04	25.53	674.67
F_2	14.70	772.40	223.40	995.80	77.52	24.70	663.00
F_3	13.21	736.20	233.00	969.20	75.87	23.83	635.33
F_4	12.59	668.27	271.33	939.60	71.14	20.93	617.67
F_5	11.49	664.93	285.33	950.27	69.85	18.83	596.47
S Em±	0.43	21.88	10.73	25.05	1.01	0.47	17.87
CD (P=0.05)	1.21	62.22	30.50	NS	2.86	1.34	50.81
Interactions (P x F)							
S Em±	0.95	48.93	23.98	56.02	2.25	1.05	39.96
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	12.29	11.70	16.86	9.99	5.23	8.01	10.86

NS: Non significant

P_1: Hand pollination daily

P_2: Hand pollination on alternate days

P_3: Hand pollination at three days interval

P_4: Hand pollination at four days interval

P_5: Hand pollination after complete flowering

F_1:100 per cent pollen

F_2:75% pollen+25 per cent borax as filler material

F_3:75% pollen+25 per cent finger millet flour

F_4:50% pollen+50 per cent borax as filler material

F_5:50% pollen+50 per cent finger millet flour

TABLE II

Influence of pollination intervals and filler materials on seed quality of sunflower Hybrid KBSH-53

Treatments	100 seed weight (g)	Germination (%)	Seedling length(cm)	Seedling vigour index	Oil content (%)
Pollination intervals					
P_1	5.79	90.10	26.83	2419	36.55
P_2	5.70	90.20	26.91	2430	36.95
P_3	5.41	85.47	26.18	2239	35.70
P_4	5.31	83.47	25.46	2128	34.57
P_5	5.17	82.87	24.21	2007	34.11
S Em±	0.07	0.94	0.20	27.34	0.38
CD (P=0.05)	NS	2.68	0.56	77.74	1.08
Pollen and Filler materials					
F_1	5.51	89.50	27.33	2449	36.01
F_2	5.53	88.20	27.21	2403	35.99
F_3	5.48	85.73	25.38	2180	35.61
F_4	5.42	84.53	24.85	2103	35.40
F_5	5.43	84.13	24.81	2089	34.86
S Em±	0.07	0.94	0.20	27.34	0.38
CD (P=0.05)	NS	2.68	0.56	77.74	NS
Interactions (PxF)					
S Em±	0.16	2.11	0.44	61.14	0.85
CD (P=0.05)	NS	NS	NS	NS	NS
CV (%)	5.14	4.22	2.96	4.72	4.12

NS: Non significant

P_1: Hand pollination daily

P_2: Hand pollination on alternate days

P_3: Hand pollination at three days interval

P_4: Hand pollination at four days interval

P_5: Hand pollination after complete flowering

F_1:100 per cent pollen

F_2:75 per cent pollen+25 per cent borax as filler material

F_3:75 per cent pollen+25 per cent finger millet flour

F_4:50 per cent pollen+50 per cent borax as filler material

F_5:50 per cent pollen+50 per cent finger millet flour

photosynthates in the seed. Consequently leading to poor seed set, seed yield and other quality attributes as compared to supplemented with hand pollination on every alternate day (Singh *et al.,* 2001).The results are in agreement with Ganapathi *et al.* (1997).

Among the filler materials, 100 per cent pollen recorded significantly higher seed yield and quality components such as Head diameter (14.99 cm), Number of filled seeds / capitulum (780.60), Seed filling percentage (78.04), seed yield/plant (25.53 g) graded seed yield/ha (674.67), germination (89.50 %), Seedling length (27.33cm), Seedling vigour index (2449), and Oil content (36.01%). However, it was on par with 75 per cent pollen+25 per cent borax as filler material, followed by 75 per cent pollen+25 per cent finger millet flour, 50 per cent pollen+50 per cent borax as filler material, and lower seed yield and quality components such as head diameter (11.49 cm), Number of filled seeds / capitulum (664.93), Seed filling percentage (69.85), seed yield / plant (18.83 g) graded seed yield / ha (596.47), Germination (84.13%), Seedling length (24.81cm), Seedling vigour index (2089), and Oil content (34.86 %) were noticed with the 50 per cent pollen+50 per cent finger millet flour. The results are in agreement with (Salma and Rajendra 2005) and (Sumathi *et al.*,2005). The availability of pollen grains for pollination was entirely fulfilled when 100 per cent pollen has used and hence the fertilization might be maximum resulting in high seed filling percentage. In turn it reflected in the high seed number per head. It is evidenced from the results that when the pollen percentage declined to 75 and 50 per cent the seed number also declined, since the availability of the pollen has insufficient to pollinate all the stigmas. Borax is known to improve the pollen viability and fertilization and thereby improving the number of filled seeds. Narkhede and Patil (1989) reported that borax application alleviated the nutrient stress and increased the seed filling percentage. The seed yield and quality components were non-significant due to interaction effect of pollination intervals and filler materials.

This study clearly indicates that the treatments were significantly different from each other. All the traits studied recorded superior performance only with hand pollination on alternate days along with 100 per cent pollen availability; the seed yield increased only with an assured availability of sufficient pollen for fertilization. Though the seed yield did not increase to that extent while supplementing with filler material, it is concluded that instead of hand pollination daily with 100 per cent pollen hand pollination on alternate days and 75 per cent pollen with 25 per cent borax as filler material may be used without affecting the economic yield much in the case of pollen scarcity/pollen insufficiency / pollen theft. Borax can be used as a supplement at the time of pollination. Use of filler material helps in uniform spreading of pollen on the stigma and economic use of pollen grains in case of pollen theft, especially in tropical/subtropical countries like India where bee activity is brisk from early morning and before pollination.

References

ANONYMOUS, 2000, Annual report of All India Co-Ordinated National Seed Projct, IARI, New Delhi. pp: 65-66.

GANAPATHI, K. L., VYAKARANAHAL, B. S., PATIL, S. A., GIRIRAJ, K, SHASHIDHARA, S. D. AND SHEKHARAGOUDA, M., 1997, Impact of hand pollination on seed yield attributes and parents of KBSH-1 sunflower hybrid. *Karnataka Journal of Agricultural Sciences* **10** (2): 404 - 407.

KEMPEGOWDA, H., 1993, Effect of planting design and staggered sowing of parental lines on seed yield and quality in KBSH-1 HYBRID SUNFLOWERS (*Helianthus annuus* L.), *M.S.c..(Agri.) thesiss, University of Agricultural sciences, Bangalore.*

NARKHEDE, P. L. AND PATIL, A. J., 1989, Response of sunflower to foliar application of nutrients under drought condition. *Indian Agric. Chem*. **22**: 197-200.

SALMA SULTANA AND RAJENDRA PRASAD, S., 2005, Effect of filler material on pollen efficiency in hybrid seed production of sunflower *(Helianthus Annuus L.*), *Journal of oil seeds research*, **22**(1): 22-24.

SINDAGI, S. S., 1979. Poor seed set in sunflower and means to alleviate it. *Oilseeds J.***10**: 28-32.

SINGH, G., KASHYAP, R. K., KHAN, M. S. AND SHARMA, S. K., 2001, Effect of pollination modes on yield and quality of hybrid seeds of sunflower, *Helianthus annus* L. *Seed Science and Technology,* **29**: 567-74.

SUMATHI, P., NIRMALAKUMARI, A. AND MURALIDHARAN, V., 2005, Pollen Use Efficiency of Sunflower (*Helianthus Annuus L.*) lines CMS 234 A and RHA 6D-1, *Helia,* **28**(43): 99-106

(*Received :* May, 2016 *Accepted :* June, 2016)