Seed Research, Vol. 37(1&2): 171-174, 2009

Short Communication

Studies on Methods of Pollination for Hybrid Seed Production of Bottle gourd (*Lagenaria siceraria* (Mol) Standl.)

B.S. TOMAR, PHAM DUC TUAN, BALRAJ SINGH AND KALYANRAO

Seed Production Unit, Division of Seed Science & Technology, Indian Agricultural Research Institute, New Delhi 110 012
bst_spu_iari@rediffmail.com

The bottle gourd (*Lagenaria siceraria* (Mol) Standl) is an important member of cucurbitaceous family and is grown extensively during *Kharif* and summer season across India, for tender immature and mature fruits. Its fruits are consumed in cooked form and also used for preparation of sweets. The flowers and fruit juice has many medicinal values. India is the second largest producer of bottle gourd in the world after China [1]. Pumpkin, squash and gourd are grown in India over an area of 0.36 million ha, which is highest in the world with the production of 3.50 million tones [1]. The average productivity of pumpkin, squashes and gourds is about 9.72t/ha in India, which is lower than the average world productivity of 12.7t/ha. The average productivity of pumpkin, squashes and gourd in Israel and Netherland is over 45.0t/ha, with the highest average productivity of 55.0t/ha in Netherland [1]. The higher productivity in these countries is due to the coverage of maximum area under hybrids where as OP varieties occupied major area in India and bottle gourd are being cultivated by resource poor farmers and use of self-saved seed is still popular among the bottle gourd growers. In order to enhance the productivity and make it comparable with the developed countries, the development of hybrid and supply of quality hybrid seed plays a vital role.

The field experiment was carried out during *Kharif* 2005 at Seed Production Unit farm of the Division of Seed Science and Technology. The two sets of experiments viz. natural pollination and hand pollination was carried out. The seed of parental lines of Pusa hybrid-3 was obtained from the Division of Vegetable Science, Indian Agricultural Research Institute, New Delhi. The seedlings were raised in controlled conditions (modern nursery at CPCT) and 25 days old seedlings (two leaves stage) were transplanted @ one seedling per hill at the spacing of 3.5m x 1m. Planting ratio of 3:1 was applied i.e. 3 female and 1 male. The twenty-eight replications experiment was designed for natural and hand pollination method, comprises of four blocks of seven sets in each block in both the methods of pollination. In natural pollination method, the male flowers were pinched from the seed parent before the anthesis, regularly with utmost care to avoid the chance selfing. The pollination is carried out by the natural pollinating agents. In hand pollination method, the male flowers in seed parent were pinched regularly before the anthesis. The female flowers likely to be opened next day, were covered with butter paper bag during morning hours in forenoon. On the same day, the male bud likely to be opened in after noon in the pollen parent was also covered with non moisture absorbent cotton to avoid any chance contamination. The male buds are collected and the anthers are rubbed gently over all the three stigmatic lobes. The female flower after the pollination was again covered with

Received June 2009 Revised October 2009 Accepted December 2009

butter paper bag and label is placed over the peduncle of pollinated female flower. The hand pollination was performed in the afternoon between 1-3 pm continuously for one month duration.

Recommended cultural practices and plant protection measures were carried out during the field experiment. The observations on number of fruit set per plant, number of mature fruits per plant, seed yield per fruit, seed yield per plant, number of seed per fruit, number of filled seed per fruit, number of unfilled seed per fruit, 1000 seed weight, seed length, seed width, seed thickness, germination per cent, seedling length, seedling dry weight, vigour index I and II, EC were recorded. The laboratory observations viz; germination percentage [2], seed vigour indexes [3], and electric conductivity [4] were carried out at Seed Testing Laboratory, Division of Seed Science and Technology, IARI, New Delhi. The data obtained was subjected to T-test analysis at Indian Agricultural Statistical Research Institute New Delhi.

Effect of methods of pollination on seed yield attributes

Result presented in Table 1 has indicated significantly higher number of fruit per plant in hand pollination (6.71) than the natural pollination (5.60). Higher number of fruits per plant in hand pollination is due to the abundance of pollen grains on the stigma that resulted in higher number of fruits where as the stigma could have received fewer pollen grains in natural pollination consequent upon the abort and drop of fruit number of unfilled seed per fruit (6.20) in hand pollination was lower than the natural pollination (7.50) where as the number of filled seeds per fruit (207.00) was higher in hand pollination than the natural pollination (167.00). The results are in agreement with Sundriyal *et al.* [5]. However, the results are not in agreement with Alam and Quadir [6] and Satish Kumar [7]. This could be explained in view of the limited availability of pollinators in natural method of pollination while adequate and timely pollination resulted less number of unfilled seeds and more number of filled seeds in hand pollination. Seed yield per fruit was significantly higher (32.20 g) in hand pollination in comparison to natural pollination (25.80 g), which could have resulted by higher number of filled seed in hand pollination. Seed yield per plant is a complex attribute and influenced by number of fruits per plant, filled seed per fruit and seed yield per fruit and seed weight. Seed yield per plant (215.60 g) was significantly higher in hand pollination than natural pollination (146.01 g). The increase in seed yield per plant in hand pollination is due to higher number of fruit per plant, filled seeds, seed yield per fruit and 1000 seeds weight (Table 1). 1000 seed weight was significantly higher (157.80 g) in hand pollination in comparison to natural pollination (143.60 g).

Table 1. Effect of methods of pollination (hybrid seed production) on seed yield attributes in bottle gourd cv. Pusa hybrid–3

Characters	Methods of hybrid seed production		(P = 0.05)
	Natural pollination	Hand pollination	
Mature fruits per plant	5.60	6.71	**
Seed yield per plant(g)	146.01	215.60	**
Seed yield per fruit (g)	25.80	32.20	**
No. of filled seed/fruit	167.00	207.00	**
No. of unfilled seed/fruit	7.50	6.20	**
1000 seed weight (g)	143.60	157.80	**

**is significant at 0.01 level

Effect of methods of pollination on seed quality attributes

The germination is considered as one of the important attributes of seed quality and germination percentage was higher (90) in hand pollination than natural pollination (85) as indicated by Table 2. The higher germination in hand pollination could be due to the sound development of fruit and seed that might result in high germination percentage.

Seedling length, seedling dry weight and vigour attribute, was found to be higher in hand pollination (Table 2). Seedling length was

Table 2. Effect of methods of pollination (hybrid seed production) on seed quality attributes in bottle gourd cv. Pusa hybrid–3

Characters	Methods of hybrid seed production		(P = 0.05)
	Natural pollination	Hand pollination	
Seed length (mm)	14.62	14.68	NS
Seed width (mm)	7.30	7.38	NS
Seed thickness (mm)	2.98	2.91	NS
Germination (%)	85	90	**
Seedling length (cm)	17.71	18.60	*
Seedling dry wt (mg)	0.6491	0.6669	NS
Vigour index-I	1504.10	1665.30	**
Vigour index-II	55.24	59.74	NS
EC (mmg/seed)	90.60	72.65	**

**is significant at 0.01 level; *is significant at .05 level; NS-non significant

Table 3. Flowering behaviour of parental lines during hybrid seed production of bottle gourd cv. Pusa hybrid-3

Characters	Methods of hybrid seed production		(P = 0.05)
	Natural pollination	Hand pollination	
Days to opening of first male flower in pollen parent (day)	47.8	47.7	NS
Days to opening of first female flower in seed parent (day)	51.5	51.7	NS
Number of male flower per plant in pollen parent	111.6	111.6	NS
Number of female flower per plant in seed parent	23.2	23.8	NS
Number of fruit set (45 days)	6.7	7.4	**

**is significant at 0.01 level; *is significant at .05 level; NS-non significant

significantly higher in hand pollination (14.68 cm) as compared to natural pollination (14.62 cm) and also seedling dry weight was significantly higher in hand pollination (0.6669 mg/seedling) as compared to natural pollination (0.6491 mg/seedling) which could be higher due to the higher 1000 seed weight (157.80 g) in hand pollination. Resultant vigour index-I (1665.30) and vigour index-II (59.47) was also higher in hand pollination than natural pollination. The superiority of seed quality attributes had indicated the sound development of seed in hand pollination than the natural pollination.

However, no significant differences were noted for seedling dry weight, vigour index II, seed length (mm), seed width (mm), and seed thickness (mm) among the methods of pollination.

Flowering behaviour of parental lines during hybrid seed production

The result presented in Table 3 showed that days to opening of first male flower in pollen parent and first female flower in seed parent showed non-significant difference between the methods of pollination. The number of male flower per plant in pollen parent and of female flower per plant in seed parent also showed non-significant difference among the methods of pollination. The above result indicates the homogeneity of the parental material and field fertility. The number of fruit set was significantly higher in hand pollination (7.4) compared to natural pollination (6.7 fruits).

ACKNOWLEDGEMENTS

The author acknowledge Dr Rajender Prasad, National Fellow of IASRI for providing necessary guidance and assisting in analysis of data.

REFERENCES

1. FAO database (2005). www.fao.org.
2. ISTA. (2004). Seed testing rules, Publ. *The International Seed Testing Association*-8303. barsserssorf, CH-Switzerland.
3. ABDUL-BAKI, A.A. & J.D. ANDERSON (1973). Vigour determination in soybean by multiple criteria. *Crop Sci.*, **13**: 630-637.

4. DADLANI, M. & P.K. Agrawal (1987). Techniques in seed science and technology. South Asian Publishers, New Delhi, 103-104 pp.

5. SUNDRIYAL, P., D.K. SINGH & A.K. GUPTA (2005). Study of time interval response on fruit setting by hand pollination at different time interval in bitter gourd (*Momordica chanratia*). In: *National Seminar on Cucurbits*, 22-23 Sept, GBPUAT, Pantnagar: 76-77p.

6. ALAM, M.Z. & M.A. QUADIR (1986). Role of honey bee in fruit and seed setting of bottle-gourd (*Lagenaria siceraria* (Mol.) Standl). *Punjab-Vegetable-Grower*, **21**: 32-34.

7. KUMAR SATISH (2005). Studies on pollination requirements for hybrid seed production in bottle gourd (*Lagenaria siceraria* M. Standl.). Ph.D thesis, P.G. School, IARI, New Delhi, India.