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Effect of Pollination Method on Fruit Set in Commercial Cultivars of Litchi

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A B S T R A C T

An experiment was conducted to study the effect of pollination methods on fruit set at Horticulture garden, BAU, Sabour. The effect of self, open and cross-pollination was studied in the four cultivars of litchi i.e. Deshi, Purbi, Bedana and Kasba. Five panicles/replication were bagged at flowering stage for selfing. Some panicles were tagged and left opened for open-pollination and some panicles having female flowers were bagged for making cross-combinations. It was clearly seen that in Deshi cultivar when open-pollinated having 222 female flowers, total fruit set was 47; in Purbi 314 flowers were kept for open-pollinated and in case of cv. Bedana when the number of female flowers were 141, the number of fruit set was 09 whereas in case of Kasba when 218 female flowers were left for open-pollination, the total number of fruit set was recorded to be 10. When five panicles were left for self-pollinated in all the four cultivars, the number of initial fruit set was maximum in case of Purbi (09) followed by Deshi (08), the minimum was found in Kasba (02). Due to the short time availability of flowers and lack of synchronization with respect to stages of flowering in four cultivars under study the possible cross-combinations were made. The numbers of flowers crossed in Deshi x Bedana were 60 and the number of initial fruit set was 17. Similarly Purbi x Bedana, Purbi x Deshi and possible crosses were made and it was observed that when 12 flowers were crossed in the combination Kasba x Bedana, the fruit set was nil. Similar was the case with Kasba x Purbi.

Introduction

Litchi, one of the most environmentally sensitive subtropical fruit crop, is adapted to areas of the world characterized by warm subtropics. China is the biggest producer of litchi, followed by India, Vietnam, and Thailand. Of the total production of litchi in India, 40% is contributed by Bihar. The major problem responsible for low economic potential of litchi cultivation is poor fruit set and inferior fruit quality (Gupta, 1991; Brahmachari *et al.*, 1997). Other factors such as irregular flowering, heavy fruit drop, poor fruit retention, shy bearing, fruit cracking, small fruit size, low and irregular yields are reported wherever litchi have been grown, hampering its development as a major

commercial crop (Menzel, 2001). These problems are attributed either failure to initiate flowers or failure to set fruit (Batten, 1986). Litchi flowering follows the pattern of "male-female-male". The ratio of male to female flowers varies with the environment and among its various cultivars. High temperature during flower initiation reduces the proportion of female flowers (Cronje, 2009). The pattern of flowering would be expected to promote cross-pollination and prevent self-pollination. However, male (M1 and M2) and female (F) flowering stages may overlap on the same tree or between trees of the same cultivar, thereby providing an opportunity for self-pollination (Stern and Gazit, 2003). The results of pollination studies carried by Degani *et al.,* (1995) indicated that pollen parent can have an effect on fruit-set, fruit retention and quality of litchi fruits.

Materials and Methods

The present investigation was carried out at Horticulture garden, BAU, Sabour during the year 2016-2017. Four cultivars i.e. Deshi, Purbi, Bedana and Kasba were chosen to study the effect of self, open and cross-pollination on fruit set in litchi. The experiment design used was Randomized Block Design with five replications per treatment. In self-pollination, total 2 randomly selected panicles were tagged and bagged in four different directions of the tree in each cultivar before anthesis and left as such upto the fruit set. Under open-pollination method, five panicles per replication were tagged in different directions and the number of fruit set was recorded in each treatment. The four cultivars were inter-crossed among themselves. 2 panicles were bagged with butter paper to avoid pollination with foreign pollen and the male flowers were removed by forceps every morning. Once the male flower opened, the pollens were collected for each combination in a Petridish and rubbed against the stigma of the bagged flowers.

Results and Discussion

The data on initial fruit set revealed that the pollination methods had pronounced effect on the fruit set of litchi. Fruit set was recorded to be highest in case of open-pollinated followed by cross-pollination. Poor self-compatibility was observed in all varieties under study.

From the table 1 it can be clearly seen that in Deshi cultivar when open-pollinated having 222 female flowers, total fruit set was 47; in Purbi 314 flowers were kept for open-pollinated and in case of cv. Bedana when the number of female flowers were 141, the number of fruit set was 09 whereas in case of Kasba when 218 female flowers were left for open-pollination, the total number of fruit set was recorded to be 10. When five panicles were left for self-pollinated in all the four cultivars as shown in the table 2. The number of initial fruit set was maximum in case of Purbi (09) followed by Deshi (08), the minimum was found in Kasba (02). Due to the short time availability of flowers and lack of synchronization with respect to stages of flowering in four cultivars under study following cross-combinations were made as depicted in table 3. The numbers of flowers crossed in Deshi x Bedana were 60 and the number of initial fruit set was 17. Similarly Purbi x Bedana, Purbi x Deshi and possible crosses were made and the result can be seen in table 3. When 12 flowers were crossed in the combination Kasba x Bedana, the fruit set was nil.

Similar was the case with Kasba x Purbi. Among the four cultivars, fruit set was recorded to be highest in case of open-pollinated followed by cross-pollination. There was poor fruit set by selfing. In contrary to this result Brijwal *et al.,* (2016) had reported that initial fruit set under self-pollination was significantly higher than all crosses and open-pollination methods.

Table.1 Effect of open-pollination on fruit set

Cultivars	No. of female flowers open-pollinated	No. of initial fruit set	% of fruit set
Deshi	222	47	21.17
Purbi	314	53	16.87
Bedana	141	09	6.38
Kasba	218	10	4.58
C.D at 5%	33.06		
C.V.	8.81		

Table.2 Effect of self-pollination on fruit set

Cultivars	Open/ Crossed/ Self pollinated	No. of panicles bagged /replication	No. of initial fruit set
Deshi	Self-pollinated	5	08
Purbi	Self-pollinated	5	09
Bedana	Self-pollinated	5	04
Kasba	Self-pollinated	5	02

Table.3 Effect of cross-pollination on fruit set

Cultivars	Open/ Crossed/ Self pollinated	No. of flowers crossed	No. of initial fruit set
Deshi x Bedana	Cross-pollinated	60	17
Purbi x Deshi	Cross-pollinated	23	02
Purbi x Bedana	Cross-pollinated	32	16
Bedana x Purbi	Cross-pollinated	32	08
Kasba x Deshi	Cross-pollinated	17	01
Kasba x Purbi	Cross-pollinated	12	00
Kasba x Bedana	Cross-pollinated	14	00

Forneman *et al.*, (2012) also reported the lower initial fruit set in all cross-pollination as compared to self-pollination in 'Wai Chee' litchi cultivar. Mc Conchie and Batten (1991) had suggested that the most appropriate time for fruit to be considered set is when most fruit left on a panicle reach maturity.

Fruit set was recorded to be highest in case of open-pollinated followed by cross-pollination. Poor self-compatibility was observed in all varieties under study.

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