Environment and Ecology 37 (4) : 1180—1182, October—December 2019
Website: environmentandecology.com ISSN 0970-0420

Effect of Bee Pollination on Litchi Crop

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Received 24 April 2019 ; Accepted 29 May 2019 ; Published on 17 June 2019

ABSTRACT

Knowledge of bee behavior is very important for maintaining crop productivity and colony harvesting. The maximum number of flowers per panicle in litchi was recorded in open pollination (2388.0) followed by bee pollination (2231.5) and was least in pollination exclusion (2206.3) and showed non-significant variation. The fruit set was highest in the open pollination (3.12%) followed by bee pollination (3.01%) and lowest in case of pollination exclusion (2.41%). The number of fruits per panicle was 13.8, 11.7 and 9.6 in open pollination, bee pollination and pollination exclusion treatments, respectively. Again, it was highest in open pollination followed by bee pollination and least in case of pollination exclusion treatment. The yield was obtained maximum in open pollination (120.3 kg/tree), followed by bee pollination (118.4 kg/tree) and lowest in pollination exclusion (92.1 kg/tree). There was significant increase in all the parameters of bee pollination treatment, therefore, *Apis mellifera* might be used as pollinators of litchi crop for manage pollination program to increase the production and productivity of litchi crop.

Keywords Litchi, Pollination, Honey bee, Productivity.

INTRODUCTION

Insect pollination is crucial in the production of many commercially important crops. Enhancing the amount or quality of insect pollination can lead to increase in the crop value by decreasing the time of maturity of crop and also by its uniformity, quantity and quality. Foraging behavior of bee is an expression of the complex relationship between colony biology, other foragers, microclimate of the hive, the physiology of plants and other biological and environmental factors. The performance of partially or completely self incompatible crops can be enhanced by bee

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pollination. The foraging patterns of honey bees on economic crops are important.

Knowledge of bee behavior is very importat for maintaining crop productivity and colony harvesting. Litchi is excellent honey plant and seems to depend on insect for cross pollination. Work on bee pollination in India with *Apis mellifera* also revealed increase in fruit set. Pollination by honey bee is capable of enhancing the quality and quantity of several agricultural and horticultural crops. Honey bees have an edge over other pollinators because their population can be easily managed and precisely manipulated as per pollination is one of the best strategies for enhancing the crop production.

Pollinators play a key role in enhancing the vigor and growth, conserving plant diversity, mixing of gene pool of plants for increased survival and hybrid seed production (Sharma 2012). Deodikar and Suryanarayana (1972) pointed out that the yield increased in brinjal and onion to an extent of 25 and 100% respectively when honey bees were used for pollination. Pathanshetti and Prasad (1973) reported 500% increase in yield due to bee pollination in cardamom. Ahn et al. (1989) recorded a 9 times increase in fruit weight when bees were used in strawberry fields. Toit (1990) also recommended placement of four hives per hectare for effective pollination and for harvest of surplus honey. McConchie and Batten (1991) found that hand pollination in litchi of all the F flowers on a 'Bengal' inflorescence (225 flowers) produced only nine fruit, whereas pollination of only 47 or 48 flowers and removal of all other female flowers yielded 13 or 23 fruit for early and lateopening flowers, respectively. Eaton et al. (1997) reported that yield was significant correlation with honey bees and total pollinator number. Mahanta and Rehaman (1997) observed in litchi that the bee pollination resulted in an average yield of 64.75 fruits per branches that weighted 20.55 g, while the flower that had no visits yielded 26.49 fruits weighing 13.98 g per branch. Abrol and Kumar (2009) stated that there were 11.20% malformed fruits in open pollinated plots of litchi as compared to 17.44% in the control plots. The percentage of fruit set was much higher in open-pollinated plants than the control.

MATERIALS AND METHODS

To assess the effect of bee pollination on litchi crop cv Shahi, an experiment was carried out with three treatments and having seven replications in RBD. The first treatment i. e. T_1 was open to all pollinators (OP), the second treatment, T_2 was pollinator exclusion (PE) and the third treatment T_3 was caged with *Apis mellifera* colony (5-frame colony). In the pollinator exclusion treatment, panicles were covered with net/ cloth in order to avoid pollinators. The observations were recorded on the following parameters : Fruit set (per panicle) – By visual observation, Fruit weight (g) – By electronic balance, Fruit yield (kg/tree) – By electronic balance, Weight of pulp (g) – By electronic balance.

The percent increase in OP and BP over PE (control) was calculated to know the effect of pollination in litchi crop. The percent increase was calculated by using the formula :

$$\% \text{ Increase} = \text{OP or BP} - \text{PE/PE} \times 100$$

To assess the effect of bee pollination on litchi crop, an experiment was carried out at University Apiary during 2012. The experiment comprised of three treatments with seven replications. The data are presented in Table 1.

Table 1. Data is mean of 7 replications.

Treatments	No.of flowers per panicle	Fruit set (%)	No.of fruits per panicle	Fruit weight (g)	Yield (kg/tree)
Pollination Exclusion (PE)	2206.3	2.41	9.6	19.02	92.1
Bee Pollination (BP)	2231.5	3.01	11.7	22.05	118.4
Open Pollination (OP)	2388.0	3.12	13.8	23.06	120.3
SEm (±)	–	0.14	0.60	0.30	0.62
CD (p=0.05)	NS	0.41	1.76	0.89	1.81

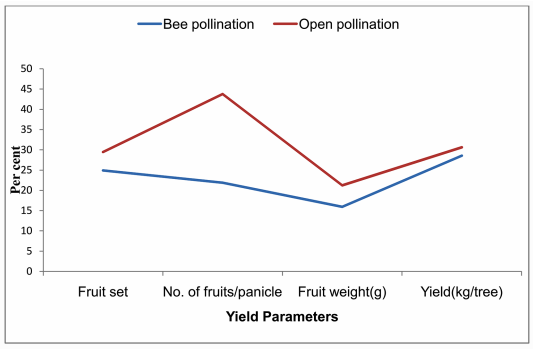

Fig. 1. Percent increase in yield parameters in bee pollination and open pollination over pollination exclusion (control) in litchi cv Shahi.

RESULTS AND DISCUSSION

The maximum number of flowers per panicle in litchi was recorded in OP (2388.0) followed by BP (2231.5) and was least in PE (2206.3) and showed non-significant variation. The fruit set was highest in the OP (3.12%) followed by BP (3.01%) and lowest in case of PE (2.41%).The number of fruits per panicle was 13.8, 11.7 and 9.6 in open pollination, bee pollination and pollination exclusion treatments, respectively. Again, it was highest in open pollination followed by bee pollination and least in case of pollination exclusion treatment. The yield was obtained maximum in OP (120.3 kg/tree), followed by BP (118.4 kg/tree) and lowest in PE (92.1 kg/tree) (Fig. 1).

Considering the results of above parameters it can be concluded that pollination is essential for better yield in litchi crop. There was significant increase in all the parameters except number of flowers per panicle in OP and BP treatments over PE.

CONCLUSION

The visit of pollinators increased the yield of crop in significant manner inspite having no significant difference in number of flowers per panicle in all the treatments. To know the impact of pollination, the data were again analyzed in terms of percent increase. The increase in fruit set percent, number of fruits per panicle, increase in fruit weight and yield was observed. The result indicated that there was 24.89% increase in fruit set in BP treatment while 29.46% in OP treatment. The number of fruits per panicle was higher in OP (43.74%) while it was 21.87% in BP treatment. The increase in fruit weight was 21.24% in OP while 15.93% in BP treatment. There was 30.61% increase in yield (kg/tree) in OP treatment while it was 28.55% in BP treatment. There was significant increase in all the parameters of BP treatment, therefore, *Apis mellifera* might be used as pollinators of litchi crop for manage pollination program to increase the production and productivity of litchi crop.

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