

Seed Production Potential of Multiplier Onion under Honey Bees Rearing Condition in the Dry Zone of Sri Lanka

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INTRODUCTION

Insect pollination is essential for the production roughly about 70% - 87% of the 124 food crops grown worldwide for human consumption (Klein *et al.*, 2007). Among many insect pollinators, honey bees (*Apis mellifera* L.) play a vital role in the production of seeds of many fruits and vegetables (Malerbo-Souza, 2004). To facilitate this process of insect induced cross polination, it is important to create an environment which favors the development of pollinator (insect) communities. Potts *et al.*, (2003) have recently shown that there is a positive relationship between bee diversity and plant diversity (primarily annuals) in a non-agricultural setting. However, studies that examined the relationship between pollinator communities and their environment are scanty. This study investigates the effect of different pollinating conditions on pollination of seed producing cluster onion (*Allium cepa*), which is known as multipliers, on *Thirunelvely Multiplier* No. 6 (TVM 6), in the dry zone of Sri Lanka. TVM 6 is an advanced breeding line of cluster onion issued by Regional Agriculture Research and Development Centre, Kilinochchi. It is a high yielding line with high flowering response and having higher degree of tolerance to Anthracnose and Bulb rot disease. It also demonstrates high response to vernalization and produces more productive flowers and seeds (Arasakesary *et al.*, 2016).

MATERIALS AND METHODS

An experiment was carried out in three different environments and those environments have been considered as three treatments (T1, T2 and T3). They are as follows: T1 Onion bulbs were planted and plants were grown in a covered insect proofing net; T2 Onion bulbs were planted and plants were grown in uncovered condition T3. both these plots were applied with inorganic fertilizer and managed under chemical free conditions. A honey bee box, with maximum honey bee population developed within the hives was laid just inside the field in order to facilitate maximum cross pollination through these bees. T3 Recommended inorganic fertilizer applied and minimum chemical spray to control onion pest.

**** Short Communication**

Experimental design was Randomised Complete Block Design (RCBD) with three replications. Bulbs were planted in each plot in *Maha* 2017/18 with the spacing of 10cm x10cm, so as to accommodate 100 bulbs per plot. Covering was made by an insect proof net (mesh 50) at flowering stage. Average temperature and light density of uncovered and covered fields were respectively 33.20°C and 31.20°C, 129 klx and 74.6 klx. All Management practices in the inorganic fields were followed as per the recommendation of Department of Agriculture. The average seed yield and bulb yield parameters viz; Umbel diameter, Stalk length, Number of seeds per plant, Seeds weight per plant, Seed yield (kg/ha) and Bulb yield (kg/ha) were recorded from a samples of 10 plants taken from each plot. Data were analysed according to the ANOVA using statistical package SAS-9.1 and mean comparison was performed using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

The results of the study are given in Table 1 and Figure 1. Plants in uncovered condition (T2) showed significantly ($p<0.05$) higher seed weight (1.2 g/plant), and number of seeds per plant (387/plant) than those of plants in covered conditions that are applied with inorganic fertilizer and managed under chemical free condition. There is no significant difference between umbel diameter and Stalk length of plants that are subjected to Tretmnet 2 and 3. However, Umbel diameter of plants grown under uncovered condition (5.9 cm) is higher than that of plants grown under covered condition (T1).

Table 1. Average Seed yield parameters observed in advance breeding onion line TVM-06 under three different pollinating conditions.

| Treatment | Umbel diameter (Cm) | Stalk length (cm) | Seed Number / plant | Seeds weight(g)/ plant |
|-----------|---------------------|--------------------|---------------------|------------------------|
| T1 | 4.58 ^b | 62.93 ^a | 196 ^b | 0.533 ^b |
| T2 | 5.90 ^a | 62.00 ^a | 387 ^a | 1.200 ^a |
| T3 | 5.37 ^a | 60.23 ^a | 277 ^{ab} | 0.866 ^{ab} |
| LSD | 0.68 | 5.34 | 117.6 | 0.413 |
| CV % | 5.68 | 3.81 | 18.1 | 21.06 |

Means in each column with the different letters indicate significant different at $P<0.05$ with coefficient of variability (CV). T1-Cover + Inorganic fertilizer + No spray; T2-Uncover + Inorganic fertilizer + No spray and T3- Uncover + inorganic fertilizer + Chemical Spray.

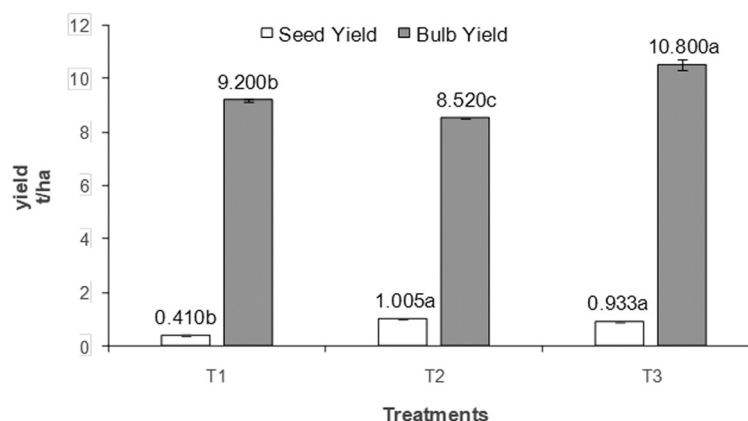


Figure 1. Average Seed yield and Bulb Yield of advance breeding onion line TVM-06 under three different pollinating conditions.

Means in each vertical bars with the different letters indicate significant different at $P < 0.05$ with coefficient of variability (CV). T1-Cover + Inorganic fertilizer + No spray, T2-Uncover + Inorganic fertilizer + No spray and T3- Uncover + inorganic fertilizer + Chemical Spray.

Plant subjected to T2 and T3 had shown significantly a higher seed yield (1.005 t/ha, 0.933 t/ha) than that of plants subjected to treatment T1. However, plants subjected to T1 gave a higher bulb yield as compared to plants subjected to T2. The bulb yield of plants grown in inorganic field condition (T3, 10.800 t/ha) was recorded the highest yield as compared to other plants. Comparison between T1 and T2 indicates that there is a trade off between bulb yield and seed yield.

Bulb yield also showed a significant difference within the covered and uncovered condition. The reasons may be due to that energy used for flowering could be high in uncovered plants although covered plants had different micro environments with insect and disease free conditions.

The seed yield difference between T2 and T3 indicates the importance of chemical free conditions for insect pollination and thereby the seed yield. Therefore the results of this experiment has revealed that the chemical free environment with enough honey bee population will facilitate more seed production.

The advance breeding line, TVM 6 used in this experiment has field tolerance to major fungal diseases including *Anthracnose* (Arasakesary *et al.*, 2016). The results of this experiment indicate that TVM 6 can be promoted as a potential breeding line to produce high seed yield by providing a favourable environment (creating chemical free environment) for the development of to pollinating agent (Honey bee) community.

CONCLUSION

Significantly high seed yield was received from the plots that are uncovered and that have been applied with inorganic fertilizer. Among the two uncovered plots, plots that are grown in the field alone with a honey bee box indicates a higher seed yield than the plots grown without honey bee box near by. Therefore this study concludes that the increased seed production of multiplier onion line TVM 6 could be achieved by placing honey bee boxes with adequate honey bee population under chemical free conditions.

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