Impact of Fruit Bagging with Different Coloured Non-woven Polypropylene Bags on Yield Attributes in Grapes

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ABSTRACT

Background: Grape (Vitis vinifera L.) is one of the most important fruit crops cultivated in India. The grape bunches during growth stages are adversely affected by various biotic and abiotic factors which in turn affects the yield and quality. In addition, high usage of agrochemicals in grape cultivation increased concern over pesticide residues among consumers. Therefore, an alternative technique of fruit bagging to enhance the yield and quality as well as to minimize pest and disease infestation is emphasized. Bagging of grape bunches also aids in preventing the agrochemicals entry into the fruits.

Methods: A field experiment was conducted to study the impact of fruit bagging on yield attributes in grape cv. Muscat Hamburg at Coimbatore during winter (August - December, 2018) and summer seasons (January - May, 2019). The grape clusters were covered with non-woven UV stabilized polypropylene bags of different colours viz., blue, white, yellow, red and green immediately after fruit set and were removed before harvest. The unbagged clusters were treated as control.

Result: In the present study, the grape clusters covered with white colour non-woven UV stabilized polypropylene bags was found to be superior for yield attributes viz., bunch weight (255.03 g and 294.80 g), berry diameter (15.39 mm and 15.97 mm), berry weight (4.30 g and 4.85 g), pulp weight (3.88 g and 4.44 g), peel weight (0.28 g and 0.31 g) and yield per vine (7.7 kg and 8.8 kg) in both summer and winter season crops respectively. Hence, the present study emphasizes that fruit bagging improves the yield attributes in grapes.

Key words: Fruit bagging, Grape, Muscat Hamburg, Yield attributes.

INTRODUCTION

Grape (Vitis vinifera L.) is one of the most important fruit crops cultivated in India. The fruits are used for table purpose and also processed into raisins, wine, juice and canned products. In India, nearly 80% of the grapes cultivated are mainly utilized for table purpose. Globally, 16 per cent of total fruit production is contributed by grape production. In India, it is grown in an area of 1.36 lakh ha with an annual production of 26.83 lakh MT. Maharashtra, Tamil Nadu, Karnataka and Andhra Pradesh are the major grape growing states in India (INDIASTAT, 2018).

Grape bunches during their developmental phases undergo several physical and chemical changes and are susceptible to various biotic and abiotic factors that in turn reduce the marketable yield and quality of the bunches. Moreover in grape cultivation, several agrochemicals are used to control various pests and diseases (Sharma, 2009). Nowadays, consumer awareness on the adverse effects of residues of agrochemicals used in viticulture has increased. Hence, development of alternative techniques to enhance the appearance and quality of fruit, to minimize disease and pest infestation and also to improve yield is more emphasized (Sharma et al. 2014). Fruit bagging can protect fruits during growth stages and also aids in improving the marketable yield. Bagging of grape bunches after fruit set until harvest aids in preventing the agrochemicals not to reach the fruits in a direct way (Signes et al. 2007).

Preharvest fruit bagging acts as a physical protection barrier against mechanical and physical damage caused by various intercultural operations during bunch development and also protects the fruits from the damage caused by bats and birds (Hofman et al. 1999). However, studies on the effect of fruit bagging in grapes is very limited and hence the present study has been taken up to understand the influence of different coloured non-woven UV stabilized polypropylene bags on improving bunch and berry attributes in grape cv. Muscat Hamburg.

MATERIALS AND METHODS

The present investigation was conducted during 2018-19 at farmer’s field, Mathipalyam village, Thondamuthur Block, Coimbatore. The vines were pruned during the second fortnight of August, 2018 and first week of January, 2019 for winter and summer season crops respectively. Preharvest
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Fruit bagging treatments were imposed on eight-year-old grape vines of cv. Muscat Hamburg grown in a spacing of 4 m × 2 m. The experiment was laid out in a Randomized Block Design consisting of six treatments and four replications with three vines per replication. Bagging of the grape clusters (fifteen numbers per vine) were done during both the seasons after fruit set by using different coloured non-woven UV stabilized polypropylene bags as detailed below;

- **T1**: Control (without bagging).
- **T2**: Fruit bagging with blue colour bag.
- **T3**: Fruit bagging with white colour bag.
- **T4**: Fruit bagging with yellow colour bag.
- **T5**: Fruit bagging with red colour bag.
- **T6**: Fruit bagging with green colour bag.

The bunches were harvested after ripening during December, 2018 for winter season crop and during May, 2019 for summer season crop. The fruits were evaluated for various bunch characters viz., bunch weight (g), circumference (cm) and length (cm). The weight of bunches harvested from three vines per replication in each treatment was recorded and average yield per vine was worked out and expressed in kilograms (kg). Berry characters viz., berry weight (g), berry length (mm) and berry diameter (mm) were also recorded. Pulp weight (g) and peel weight (g) were recorded after separating from seeds. The statistical analysis of data recorded was done by using the method outlined by Panse and Sukhatme (1985). The various comparisons were made after working out the ANOVA and standard error deviation and critical difference at 5 percent level of significance.

**RESULTS AND DISCUSSION**

The observations on bunch length and bunch circumference were found to be non-significant among different treatments in both winter and summer seasons. The mean values of bunch length in winter and summer seasons ranged from 13.60 cm to 14.86 cm and 13.43 cm to 15.83 cm respectively.

Similarly, the mean values of bunch circumference ranged from 22.21 cm to 26.35 cm and 24.06 cm to 26.66 cm in winter and summer season crops respectively. The bunch weight (g), berry length (mm), berry weight (g), berry diameter (mm) and berry volume (cm³) were significant among different treatments (Table 1 and 2). The highest bunch weight (255.03 g and 294.80 g) was observed in bunches covered with white colour non-woven UV stabilized polypropylene bag (T3) in winter and summer seasons respectively. The bunch weight is an important trait as it directly influences the yield of the crop and thereby results in higher returns to the growers. In the present study, irrespective of the seasons, significant improvement in bunch weight was registered in bunches bagged with different coloured non-woven UV stabilized polypropylene bags over control (without bagging). The results are in line with the earlier findings in grape and datepalm (Karajeh, Table 1: Effect of fruit bagging on bunch attributes and yield in grape.

| Treatments                     | Winter season (August-December 2018) | Summer season (January-May 2019) |
|-------------------------------|--------------------------------------|----------------------------------|
|                               | Bunch weight (g) | Bunch circumference (cm) | Yield per vine (kg) | Bunch weight (g) | Bunch circumference (cm) | Yield per vine (kg) |
| Control (without bagging)     | 189.04          | 13.92               | 22.70              | 22.735           | 13.43               | 24.06              |
| T1: Fruit bagging with blue colour bag | 217.43          | 13.60               | 22.05              | 266.65           | 15.81               | 25.21              |
| T2: Fruit bagging with white colour bag | 255.03          | 14.86               | 22.71              | 294.80           | 15.61               | 25.56              |
| T3: Fruit bagging with yellow colour bag | 245.32          | 14.77               | 26.35              | 281.20           | 14.74               | 25.94              |
| T4: Fruit bagging with red colour bag | 230.38          | 14.77               | 26.35              | 270.80           | 15.83               | 28.44              |
| T5: Fruit bagging with green colour bag | 205.85          | 14.12               | 24.97              | 259.45           | 14.81               | 25.94              |
| T6: Fruit bagging with green colour bag | 119.01          | 13.92               | 22.70              | 119.01           | 13.43               | 24.06              |

**SEd** 5.59  0.70  1.74  0.17  4.03  1.19  1.55  0.12

**CD (p<0.05)** 11.91* NS NS 0.38* 8.55* NS NS 0.25*

*Significant at p<0.05; NS- Non Significant at p=0.05.
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Table 2: Effect of fruit bagging on berry attributes in grape.

| Treatments                                      | Winter season (August-December 2018) | Summer season (January-May 2019) |
|------------------------------------------------|--------------------------------------|----------------------------------|
|                                                 | Berry length (cm) | Berry diameter (cm) | Berry weight (g) | Pulp weight (g) | Peel weight (g) | Pulp peel ratio |
| Control (without bagging)                      | 13.11                | 14.39                | 3.00              | 3.18            | 15.19            | 14.70          |
| Fruit bagging with blue colour bag             | 14.68                | 15.75                | 3.08              | 3.35            | 15.97            | 15.42          |
| Fruit bagging with white colour bag            | 11.10                | 13.86                | 3.22              | 3.04            | 15.53            | 15.26          |
| Fruit bagging with yellow colour bag           | 13.75                | 16.53                | 3.24              | 3.24            | 16.22            | 15.97          |
| Fruit bagging with red colour bag              | 14.39                | 15.64                | 3.08              | 3.08            | 15.38            | 15.66          |
| Fruit bagging with green colour bag            | 13.86                | 15.75                | 3.04              | 3.04            | 15.64            | 15.66          |
| Control (without bagging)                      | 14.39                | 15.64                | 3.00              | 3.18            | 15.19            | 14.70          |

Recent evidence has suggested an unexpected role of light and auxin on improved bunch attributes. Light which penetrates through the bags manipulates auxin concentration at the tissue level in the grape berry and is responsible for cell elongation which in turn results in superior berry size. The penetration of light might be higher in white bags compared with other colour bags (Fiorucci and Fankhauser, 2017). Irrespective of the seasons, bagging with white colour non-woven UV stabilized polypropylene bag (T4) recorded the highest berry length (15.42 mm and 16.53 mm), berry diameter (15.39 mm and 15.97 mm), berry weight (4.30 g and 4.85 g) and berry volume (3.20 cm³ and 3.98 cm³) whereas, the lowest berry length, berry diameter, berry weight and berry volume were registered in control (without bagging). Bagging provides suitable microclimate for the growth and development of fruit (Xu et al. 2008) and this might be considered as the reason for improvement in the size and weight of the berry. In the present study, when bunches were bagged with white colour non-woven UV stabilized polypropylene bags, the berry weight increased markedly. Increased berry volume might be due to the optimal light penetration. Lower temperature prevailing inside the bag might have inhibited GA3 degrading enzyme activity and increase in berry size could be attributed to elongation in mesocarp tissues by GA3. Moreover, lower temperature prevailing inside the bag reduces the chlorophyll degradation and inhibits the GA3 degrading enzyme activity. Therefore, increase in berry size and thereby increase in volume could be attributed to the GA3 stimulated elongation in mesocarp tissues. The findings on improvement in berry volume due to the effect of phytohormones are in close conformity with earlier reports (Meena et al. 2016).

Highest pulp weight (3.88 g and 4.44 g), peel weight (0.28 g and 0.31 g), pulp peel ratio (13.86 and 14.32) and yield per vine (7.7 kg and 8.8 kg) were also observed in bunches bagged with white colour non-woven UV stabilized polypropylene bag in winter and summer seasons respectively (Table 1 and 2). While, lowest values for pulp weight, peel weight, pulp peel ratio and yield per vine were registered in T1 (without bagging). Bagging improved microclimate around fruit and it might have helped for improvement of pulp weight. Fruit bagging increased the flesh weight and pulp peel ratio over control in date palm cv. Barhee and mango cv. Alphonso (Awad and Al-Qurashi, 2012 and Nagaharshitha et al. 2014).

CONCLUSION

Fruit bagging with non-woven UV stabilized polypropylene bag immediately after fruit set as a physical protection has positively improved yield attributes in grapes. However, light reflectance, absorbance and transmission patterns of different colour bags used for fruit bagging are to be studied and are essential for understanding the scientific background of bagging on improvement in yield.
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