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Vipnesh Singh
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

RS Verma
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

Sanjay Kumar
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

Rubee Lata
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

Shatrunjay Yadav
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

Dharmraj Meena
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

Corresponding Author:
RS Verma
Department of Horticulture, School of Agricultural Sciences and Technology Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareli Road, Lucknow, Uttar Pradesh, India

Efficacy of foliar spray of micronutrients and fruit bagging on physiochemical attributes of guava (*Psidium guajava* L) cv. Allahabad Safeda

Vipnesh Singh, RS Verma, Sanjay Kumar, Rubee Lata, Shatrunjay Yadav and Dharmraj Meena

Abstract
The present investigation entitled "Impact of foliar spray of nutrients and fruit bagging on growth yield and quality of guava (*Psidium guajava* L.) cv. Allahabad safeda was conducted at guava orchard of Horticulture Research Farm-I, Babasaheb Bhimrao Ambedkar University Lucknow (U.P.), during rainy season of 2020-21 and 2021-22. Among the 51 guava trees with even size and vigour were selected and were sprayed with various concentrations of different nutrients (Borax @ 0.1% and 0.2%), ($ZnSO_4$ @ 0.2% and 0.4%) with and without borax (1.0%). The study was conducted in RBD (Randomised Block Design) with 17 treatments which replicated thrice. Fruits were analysed for their physical and chemical characteristics in the laboratory of Department of Horticulture. The results of present study revealed that the fruit's physical characters i.e. fruit weight 128.96 g., total soluble solids 11.30 Brix. vitamin C 200.67 100 mg g^{-1}, and pectin percentage 1.256 5 were improved significantly with the use of Borax 0.2% + Zn 0.4% (T_9) and fruit were bagged/covered with Foam bag + Brown paper + Blue polythene. While maximum acidity percentage were recorded 0.453% under controlled (T_1)

Keywords: Allahabad safeda, foliar spray, and fruit bagging

Introduction
Guava (*Psidium guajava* L.) "Apple of the tropics" is one of the most encouraging fruit crops of India and is viewed as one of the impeccable healthfully important remunerative crops (Singh *et al.*, 2000) [16]. It is wider edapho-climatic adaptability, resistance to biotic and abiotic stresses, precocious and prolific bearing habit, quality fruit with high nutritive value, medicinal attribute, use both as fresh fruit and after processing in various values added products. (Suman *et al.*, 2016) [7]. Guava belongs to the family 'Myrtaceae'. Guava flowers twice a year in the agro-climate of north India: once in April or May for crops grown during the rainy season and once in September or October for crops grown during the winter season. In general, rainy season crops produce more fruit than winter crops. (Rathore and Singh, 1974; Singh *et al.*, 2000a) [14, 19], but the quality and taste of the fruits are lower (Maji, 2015) [10] and there is more pest and disease infestation during the rainy season than during the winter (Rawal and Ullasa, 1988) [15]. Fruits are of higher quality and fetch high prices throughout the country during the winter (Singh *et al.*, 2000b) [18]. But fruits collected during the rainy season are the lowest quality, most watery, and disease and pest-prone of the crop's three fruiting seasons. Ambe Bahar guava fruits have very low storage Excellency. As a result, crop management or bahar treatment techniques frequently reduce or eliminate fruit yield throughout this season. It is a significant barrier to the guava crop's yearly yield. Therefore, good crop management should be used to reduce all of these issues.

In order to assure worker safety, consumer health, and reduced environmental effect, researchers have recently worked to create consumer-friendly methods for controlling pests and illnesses of fruits with a focus on reduced pesticide use (R.R. Sharma *et al.*, 2020) [16]. In recent years, on-the-tree fruit bagging has shown to be a successful strategy (Sharma *et al.*, 2014b). This method involves placing a bag over each fruit or fruit cluster on the tree for a set amount of time. It alters the microenvironment inside a bag, which has positive effects on fruit size and internal fruit quality (Amarante *et al.*, 2002a,b; Joyce *et al.*, 1997; Kitagawa *et al.*, 1992; Li *et al.*, 2008; Sharma *et al.*, 2014b) [1-2,, 21, 8]; it also improves the visual appeal of fruits by promoting peel colour and reducing the incidence of pests, diseases, and physiological disorders (Xu *et al.* (2010) [20], Zhang *et al.* (2015) [22], Sharma *et al.* (2016), and

Sharma *et al.* (2017). In order to produce apples, pears, peaches, grapes, and loquats with better colour and quality, on-the-tree fruit bagging is commercially used in Australia, Japan, and China (Sharma *et al*., 2014b). But there have also been reports of detrimental impacts on fruit size, colour, and quality (Abdel Gawad-Nehad *et al.*, 2017; Hofman *et al.*, 1997;) [3, 4]. Therefore, we conducted a study to determine the impact of on-the-tree fruit bagging on the 'Allahabad Safeda' guava crop during the rainy season.

The improvement in the fruit quality may be due to the environment created inside by the bagging material that plays a significant role in growth and development of fruits (Sharma *et al*., 2014). High density plantations of mango are being introduced; the technique could be very effective for the production of quality fruits in such plantations where insect pests are the main problem due to conducive environment for their reproduction.

Materials and Methods

The experiments were conducted during rainy season of 2020-21 and 2021-22 at Horticulture Research Farm-I, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.) India. The experimental site is situated at 80° 92´'East longitude and 26° 76´' North latitude and 123 meter above MSL (Mean Sea Level). The climate of Lucknow is characterized by sub-tropical with hot, dry summer and cool winters. The soil of experimental orchard is sandy loam and slightly alkaline in nature with soil pH 8.2, 85.46 kg ha-^{1}available nitrogen, 16.62 kg ha^{-1} and 142.07 kg ha-^{1} available potash. For this study, 51 eighteen-year-old uniform guava plants were taken at a distance of 6 X 6 metres apart. The suggested package of methods for guava nutrient application and other orchard management measures were followed. In the month of February 2019, the fruit were bagged with different bagging materials (foam bags, polyethylene bags and paper bags). Fruit bagging was done after twenty days after fruit setting when the fruits attained ber like size. The bags have small cut at lower corner for proper aeration, gaseous and exchange. The experiment was set up in a Randomized Block Design (RBD) with three replications. Per plot, one plant was used as a unit. Seventeen treatments in to *viz*., T_1 (Control), T_2(Borax 0.1% + Foam bag + white Paper + White Polythene bag), T_3 (Borax 0.2% + Foam bag + white Paper + White Polythene bag), T_4 (Zinc 0.2% + Foam bag + white Paper + White Polythene bag), T_5 (Zinc 0.4% + Foam bag + white Paper + White Polythene bag), T_6 (Borax 0.1 + Zinc 0.2% + Foam bag + Brown Paper + yellow Polyethylene bag), T_7 (Borax 0.1 + Zinc 0.4% + Foam bag + Brown Paper + yellow Polyethylene bag), T_8 (Borax 0.2 + Zinc 0.2% + Foam bag + Brown Paper + yellow Polyethylene bag), T_9 (Borax 0.2 + Zinc 0.4% + Foam bag + Brown Paper + yellow Polyethylene bag), T_{10} (Borax 0.1 + Zinc 0.2% + Foam bag + News Paper + Blue Polyethylene bag), T_{11} (Borax 0.1 + Zinc 0.4% + Foam bag + News Paper + Blue Polyethylene bag), T_{12} (Borax 0.2 + Zinc 0.2% + Foam bag + News Paper + Blue Polyethylene bag), T_{13} (Borax 0.2 + Zinc 0.4% + Foam bag + News Paper + Blue Polyethylene bag), T_{14} (Borax 0.1 + Zinc 0.2% + Foam bag + Butter Paper +Green Polyethylene bag), T_{15} (Borax 0.1 + Zinc 0.4% + Foam bag + Butter Paper +Green Polyethylene bag), T_{16} (Borax 0.2 + Zinc 0.2% + Foam bag + Butter Paper +Green Polyethylene bag), T_{16} (Borax 0.2 + Zinc 0.4% + Foam bag + Butter Paper +Green Polyethylene bag).

The fruits were collected at mature stage from all treatments as well as control for determination of physical and biochemical parameters. Five fruits were taken randomly from each treatment as sample and similar number of un-bagged fruits taken as control and harvested to record data on different parameters. There are following observations were recorded on the basis various parameters i.e. Fruit weight total soluble solids, acidity percentage, vitamin C, and pectin percentage were taken under consideration for weighing and quality characters of guava fruits. The observations were statistically analysed OPSTAT website by using simple RBD.

Result and Discussion

When compared to other covered and uncovered fruits (96.57 g), the fruits wrapped in brown paper bags had a heavier fruit weight (128.96 g). Similarly, effect of yellow polyethylene was found improving weight of fruits. (Meena K. R. *et al.* 2015). Fruit bagging has been proven to significantly increase the fruit's quality in terms of total soluble solids. The highest total soluble solids were found in the fruits wrapped in brown paper bags (11.30 °Brix), followed by those wrapped in news paper bags (11.18 °Brix). The total soluble solids content of unbagged fruits (the control) was lower (8.79 °Brix); nevertheless, the bagging treatments had little to no impact on the data titratable acidity of fruit juice. Fruits covered in polyethylene and various coloured paper bags had different acidities on a point-by-point basis (0.415% and 4.53%, respectively), compared to uncovered control fruits. Titratable acidity of fruit juice was not substantially different across any of the treatments.

Under treatment number nine (T9), the maximum amounts of vitamin C (100 mg g-1) and pectin were discovered. These values were 200.67 for vitamin C and 1.256% for pectin, respectively. Better than the other treatment that covered and uncovered (control), treatment nine. According to a closely connected study on fruit packaging, an improvement in fruit quality may be attributable to the environment established inside the bags, which is crucial for the development and growth of fruits (Sharma *et al.*, 2014). Bagging primarily alters the temperature, humidity, and light levels around the contained fruit, which causes a variety of phytochemical changes in the final product (Liu, B., Wang, L., Wang, S., Li, W., Liu, D., Guo, X., & Qu, B. (2019) [8].

Conclusion

The findings of this study definitely show that preharvest fruit bagging has become a cutting-edge, user-friendly, and grower-friendly technique that has various positive benefits on the visual appearance and biochemical quality of tree fruits. On the other hand, fruits in bags. Farmers that grow guavas will benefit from increased market prices thanks to their beautiful colour. Therefore, employing technology for commercial guava growing, it is advised to combine yellow polyethylene with brown paper bags to produce attractive and high-quality fruits throughout the wet season.

Table 1: Effect of foliar spray of micronutrients and fruit bagging on guava fruits.

Treatments	Fruit weight (g)	T.S.S.	Acidity %	Vit. C (100 mg g^{-1})	Pectin%
T_1	96.57	8.79	0.453	176.32	1.018
T_2	105.75	9.29	0.282	179.12	1.024
T_3	107.00	9.98	0.315	180.99	1.033
T_4	107.45	10.14	0.326	181.72	1.045
T_5	108.78	10.16	0.333	182.73	1.060
T_6	114.29	10.68	0.336	184.28	1.086
T_7	117.67	10.72	0.365	187.46	1.131
T_8	123.91	11.00	0.393	191.67	1.160
T_9	128.96	11.30	0.415	200.67	1.256
T_{10}	108.91	10.49	0.341	183.20	1.065
T_{12}	116.03	10.69	0.383	187.21	1.121
T_{12}	123.50	10.85	0.394	189.19	1.150
T_{13}	124.97	11.18	0.423	199.67	1.190
T_{14}	109.95	10.62	0.345	183.98	1.075
T_{15}	115.60	10.69	0.375	185.77	1.095
T_{16}	117.99	10.79	0.393	188.32	1.145
T_{17}	124.10	11.03	0.424	194.93	1.180
SE(m) ±	1.10	0.13	0.005	2.91	0.010
C.D. at 5%	3.18	0.38	0.015	8.41	0.030

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