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Impact of pre-harvest fruit bagging on fruit yield and biochemical properties of pomegranate cv. Phule Bhagwa super

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Abstract
Field experiment was carried out to study the effect of pre-harvest fruit bagging on fruit weight, fruit yield and biochemical properties of pomegranate (*Punica granatum* L.) cv. Phule Bhagwa Super during 2019-2020 in Randomized Block Design with six treatments replicated four times. The bagging treatments were Butter paper bag (T_1), Brown paper bag (T_2), Parchment bag (T_3), English newspaper bag (60 gsm) (T_4), Marathi newspaper bag (35 gsm) (T_5) and Control (without bagging) (T_6). Pomegranate fruits were covered with bags 30 days after fruit set. Bagging treatments influenced the yield and biochemical parameter of the pomegranate fruit. The highest fruit weight and fruit yield per plant was recorded by the bagging treatment Parchment bag (T_3) which was 316.44 g and 25.68 kg plant^{-1}, respectively. In general decreasing trend for values of biochemical characters was observed. Maximum TSS, total sugars, non-reducing sugars and reducing sugars whereas lowest acidity was recorded in control (T_6) i.e. unbagged fruits. Among the bagging treatment, the bagging treatment Parchment bag (T_3) recorded maximum values for TSS, total sugars, non-reducing sugars and reducing sugars and lowest for acidity.

Keywords: Pomegranate, bagging, bio-chemical parameters, TSS, sugars

Introduction
Pomegranate is globally recognized as a “Super-food” owing to its nutritious characteristics and therapeutic values. Because if which there is a world-wide rise in demand for pomegranate fruits. Different practices are followed to enhance the fruit quality and yield of pomegranate. Among these approaches, pre-harvest fruit bagging has emerged as an effective tool which is widely followed different fruit crops such apple, banana, grapes etc. However, there is scanty work in pomegranate on this aspect. With this view, the present work was carried out in pomegranate cv. Phule Bhagwa to study the efficacy of different bagging material on yield and biochemical characteristics of fruit.

Materials and Methods
The field experiment was conducted on five years old orchard of the pomegranate cv. Phule Bhagwa Super spaced at 4.5 m x 3 m at Pomegranate Research and Technology Transfer Centre (PRTTC), Lakhmapur Tal. Satana, Dist. Nashik, in year 2019-20. The experiment was conducted on *Hasta bahar*. The experiment was arranged in Randomized Block Design and each treatment was replicated four times. Five types of bags were employed for this study namely (1) Butter paper bag, (2) Brown paper bag, (3) Parchment bag, (4) English newspaper bag (60 gsm) (5) Marathi newspaper bag (35 gsm) at size of 25 x 20 cm. Perforations were made on all bags at the bottom of bag (4 mm) for proper ventilation. Fruits at 30 days after fruit set were selected for bagging. Five fruits were randomly selected per treatment per replication for recording variosus fruit weight and biochemical parameters.

Fruit weight (g)
Five fruits from each observational plant were selected randomly and their weight was recorded on electronic weighing balance and was summed and averaged out.

Biochemical parameters

Titratable acidity (%)

It was estimated as per the method suggested by Ranganna (1986) [15] and was expressed by using following formula. The acidity was expressed in per cent of citric acid.

$$\text{Titratable acidity (\%)} = \frac{\text{Titrate (B.R.) x Normality of NaOH x meq. wt. of acid x 100}}{\text{Volume of the sample used}}$$

Total soluble solids (TSS)

The total soluble solids were recorded with the help of Erma Hand Refractometer (0-32ºBrix) at room temperature and expressed in terms of ^{0}Brix.

Total sugars (%)

The total sugars were estimated by titration against standard Fehling's mixture (Fehling A and B) using methylene blue as an indicator to brick red end point. (Ranganna, 1986) [15] and was worked out with the following formula. It was expressed in per cent total sugars.

$$\text{Total sugar (\%)} = \frac{\text{Fehling Factor x volume made}}{\text{Burette reading x weight of sample}} \text{ X } 100$$

Reducing sugars (%)

The reducing sugars were estimated by the procedure suggested by Ranganna (1986) [15] and were worked out with following formula. It was expressed in per cent reducing sugars.

$$\text{Reducing sugars (\%)} = \frac{\text{100 x 0.05 (glucose value) x 250}}{\text{Burette reading x Weight of sample}}$$

Non-reducing sugars (%)

Non-reducing sugar content was determined by subtracting the reducing sugar content from total sugar content. Non-reducing sugar content was determined by using the following formula and was expressed in per cent total sugars-

% Non-reducing sugar = (% Total sugar - % Reducing sugar) x 0.95

The data generated for each parameter was subjected to statistical analysis as per the standard procedures suggested by Panse and Sukhatme (1995) [14].

3. Results and Discussion

Fruit weight (g)

All the bagging treatments improved fruit weight, however significantly highest fruit was observed in the treatment Parchment bag (T_3) recording 316.44 g fruit weight. Similar results were reported by Abd El-Rhman (2010) [2] and Samra and Shalan (2013) [18] in pomegranate. Salama *et al.* (2018) [16] also reported highest values for fruit weight of pomegranate trees treated with 780 g potassium sulphate tree^{-1} and fruit bagged with butter paper bag as compared to unbagged pomegranate fruits cv. Wonderful. Sakineh *et al.* (2015) [17] also reported increased size and weight of fruits in pomegranate due to single layer white paper bag. Islam *et al.* (2017a) [11] observed maximum fruit weight of 329.2 g in mango bagged 35 days after fruit set with brown paper bags. Debnath and Mithra (2008) [5] in litchi reported that Brown Paper and Newspaper bags showed an increase fruit weight than control. Increased relative humidity and reduced fruit water loss would have increased fruit weight in bagging treatments.

Marketable Yield (kg plant^{-1})

It is revealed from the data presented in Table 1 and Figure 2 the treatment T_3 (Parchment bag) recorded the highest yield of 25.68 kg plant^{-1}. However, the treatments T_1 (Butter paper bag), T_4 (English newspaper bag), T_2 (Brown paper bag) and T_5 (Marathi newspaper bag) were on par with each other. Results are in accordance with Samra and Shalan (2013) [18] who reported increase in fruit yield (kg/ tree) in pomegranate due to different bagging treatment. Hegazi *et al.* (2014) [8] recorded improvement yield in Manfaloty and Wonderfull cultivars of pomegranate due to bagging and spraying with 50 ppm GA_3, 2 or 4% $CaCl_2$ and 5% kaolin. Similar results were also obtained by Salama *et al.* (2018) [16] who reported highest values for yield of pomegranate trees treated with 780 g potassium sulphate tree^{-1} and fruit bagged with butter paper bag as compared to unbagged pomegranate fruits cv. Wonderful. Increase in yield of pomegranate might be due to increase in the fruit weight.

Table 1: Effect of types of bag on fruit weight (g) and Yield (kg plant^{-1}) in pomegranate cv. Phule Bhagwa Super at harvest

Treatment	Treatment detail	Fruit weight (g)	Yield (Kg plant^{-1})
T_1	Butter paper bag	307.47	24.30
T_2	Brown paper bag	292.25	23.39
T_3	Parchment bag	316.44	25.68
T_4	English newspaper bag	305.42	23.96
T_5	Marathi newspaper bag	266.45	23.13
T_6	Control (without bag)	260.68	18.65
	S. E. ±	2.02	0.92
	C. D. 0.5%	6.10	2.77

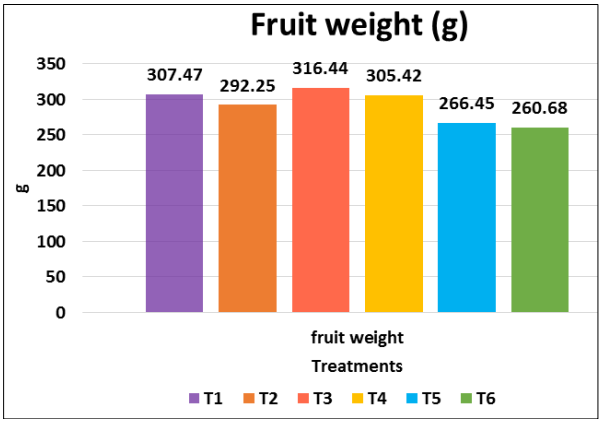

Fig 1: Effect of types of bag on fruit Weight (g)

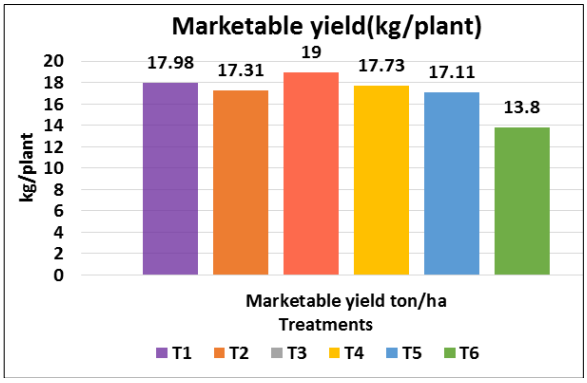

Fig 2: Effect of types of bag on Marketable yield (kg/plant)

Biochemical parameters

1. Total Soluble Solids (TSS) (^{O}B)

Results (Table 2 and Figure-3) indicated that although bagging influenced the TSS, there was decrease in TSS as compared to control (T6) which recorded maximum TSS and was 15.76 ˚B. Among the bagging treatments, T_3 (Parchment bag) recorded maximum TSS of 15.48 ˚B followed by T_1 (Butter paper bag) and T_4 (English newspaper bag) which recorded, 15.35 and 15.12 ˚B TSS were on par with control (T6). The bagging treatment T5 (Marathi newspaper bag) recorded the lowest TSS (14.05˚ B). (Table 02) Decrease in TSS was in all the bagging treatments except prgmen bag as compared to control. Similar findings were reported by Asrey *et al*. (2020) [4] stating that TSS was maximum in control (unbagged) in pomegranate fruits. Reduction in TSS in bagging treatments compared to control might be due direct exposure fruits to sunlight as suggested by Zha *et al*. (2019) [20] in grapes.

2. Titratable Acidity (%)

In general, there was increase in titratable acidity, except the treatment T_3 when compared with the control (T_6) recording 0.32 5 acidity (Table 2 and figure 4). The treatments T_3 (0.32%), T_1 (0.33%) and T_4 (0.34%) were on par with T_6. The highest percentage of acidity was recorded in T_5 (Marathi newspaper) which recorded 0.38% acidity. Abou El-Wafa (2014) [3] also observed lowest acidity in control (1.23 and 1.26%) as compared to bagging treatments during both the years of study. The guava fruit which developed in newspaper bags and harvested during mature green and green yellow stage had significantly higher values of acidity in comparison to un-bagged control fruits as reported by Abbasi *et al*., 2014) [1]. Devalla, *et al*. (2016) [6] recorded highest percentage of acidity at harvest in mango fruits bagged with Marathi newspaper and lowest in the control.

3. Total sugar (%)

As evident from Table 2 and Figure 5 reduction in total sugars as compared to control (T_6) was observed. The control treatment (T_6) recorded the highest total sugars of 14.07%. However, the treatments T_3 (Parchment bag) (13.91%) and T_1 (Butter paper bag) (13.69%) were at par with T_6 (control). Lowest total sugar content was recorded in the treatment T_5 (Marathi newspaper bag) and it was 13.19% (Table 02). Similar results were recorded by Haldankar *et al*. (2015) [7] in mango cv. Alphonso and Hossain *et al*. (2020) [9] in mango cv. Amrapalli who reported decrease in total sugar content as compared to non-bagged control fruits.

4. Reducing sugar (%)

Data depicted in Table 2 and Figure 6, the highest reducing sugar content was registered in the treatment T_6 (control) which was 11.89% and there was reduction in bagging treatments. Among the bagging treatments, T_3 (Parchment bag) recorded maximum reducing sugar (11.72%) which was at par with the treatment T_3 (Parchment bag). Lin *et al*. (2008) [12] in pear and Yang *et al*. (2009) [19] in logon showed that total as well as reducing sugar content was reduced in bagged fruit because of microenvironment and also due to exposure of fruit to direct sunlight and high temperature. Liu *et al*. (2013) [13] is of that opinion that bagging inhibit synthesis of sugars and organic acids which quickly increased during 0–4 days after bag removal in apple cv. Grany Smith.

5. Non-reducing sugar (%)

Non-reducing content was also highest in the control (T_6) and was 2.07 per cent as observed the Table 2 and Figure 7. Among the bagging treatments, maximum non-reducing sugar content was observed in Parchment bag (T_3) which was 2.06 per cent. The treatments Parchment bag (T_3), Butter paper bag (T_1) and English newspaper bag (T_4) were at par with treatment T_3 (Parchment bag). Hossain *et al*. (2018) [10] also reported reduction in non-reducing sugar content in guava cv. Swarupkathi. Devalla *et al*. (2016) [6] in mango cv. Alphonso also reported reduction in non-reducing sugar content at harvest in the fruit bagged with brown paper bag, news paper bag, butter paper bag and plastic bag.

Table 2: Effect of types of bag on chemical composition of pomegranate cv. Phule Bhagwa Super at harvest

Treatment	Treatment detail	TSS (˚B)	Titratable acidity (%)	Total Sugars (%)	Reducing Sugars (%)	Non-reducing Sugars (%)
T_1	Butter paper bag	15.35	0.33	13.69	11.57	2.01
T_2	Brown paper bag	15.05	0.35	13.33	11.36	1.87
T_3	Parchment bag	15.48	0.32	13.91	11.72	2.06
T_4	English newspaper bag	15.12	0.34	13.56	11.47	1.98
T_5	Marathi newspaper bag	14.05	0.38	13.19	11.25	1.84
T_6	Control (without bag)	15.76	0.32	14.07	11.89	2.07
	S. E. ±	0.2268	0.014	0.160	0.101	0.055
	C. D. 0.5%	0.6838	0.042	0.482	0.305	0.166

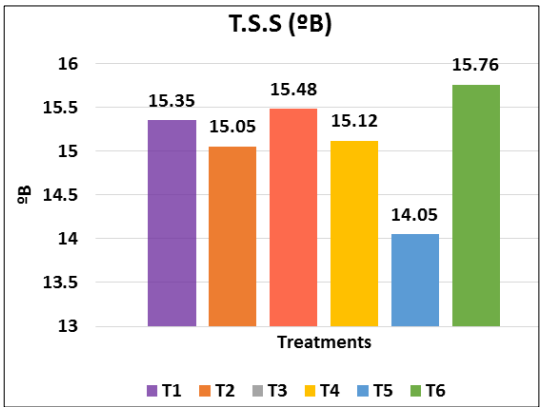

Fig 3: Effect of types of bag on Total soluble solids (T.S.S) (%)

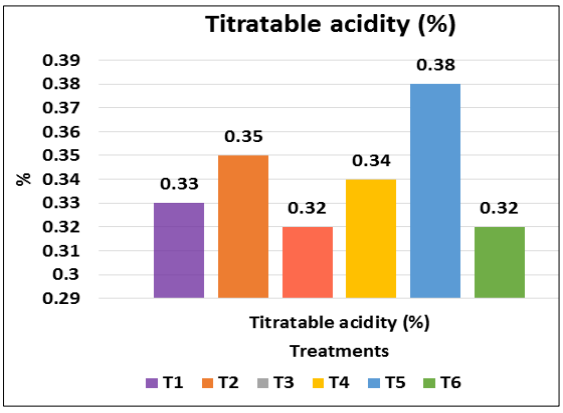

Fig 4: Effect of types of bag on Titratable acidity (%)

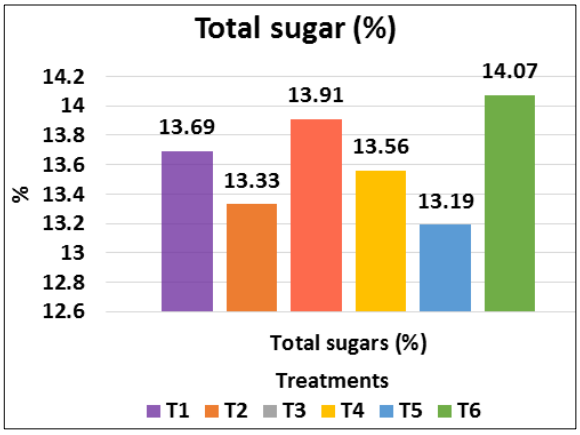

Fig 5: Effect of types of bag on Total Sugars (%)

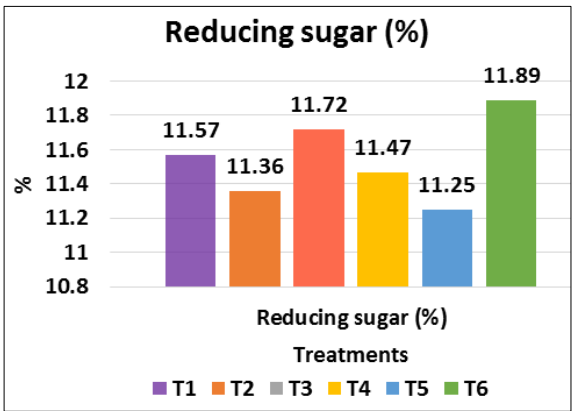

Fig 6: Effect of types of bag on Reducing Sugars (%)

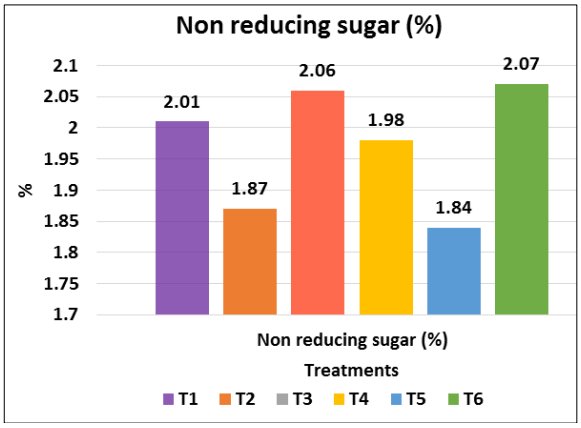

Fig 7: Effect of types of bag on Non-reducing Sugars (%)

Conclusion

The bagging treatment Parchment bag (T_3) recorded the highest fruit weight and fruit yield. In case of fruit biochemical characters the reduction all the biochemical parameters were observed, although the reduction was not drastic. Among the bagging treatment parchment bag (T_3) was observed to be most promising bagging treatment.

References

1. Abbasi NA, Chaudhary MA, Ali MI, Azhar H, Irfan A. Studies on tree fruit bagging influences quality of guava harvested at different maturity stages during summer. Int. J of Agric. Biol 2014;16:543-549.
2. Abd El-Rhman IE. Physiological studies on cracking phenomena of pomegranates. J Applied Sci. Res 2010;6(6):696-703.
3. Abou El-Wafa M. Effect of Bagging Type on Reducing Pomegranate Fruit Disorders and Quality Improvement. Egypt. J Hort 2014;41(2):263-278.
4. Asrey R, Kumar K, Sharma RR, Meena NK. Fruit bagging and bag colour affects physico-chemical, nutraceutical quality and consumer acceptability of pomegranate (*Punica granatum* L.) arils. J Food Sci. Technol 2020;57(4):1469-1476.
5. Debnath S, Mitra SK. Panicle bagging for maturity regulation quality improvement and fruit borer management in litchi (*Litchi chinenesis*). Acta horticulturae 2008;773:201-209.
6. Devalla N, Haldankar PM, Khopkar RR. Effect of bagging on chemical properties of mango (*Mangifera indica*, L.) International Journal of Horticultural & Crop Science Research 2016;6(1):1-8.
7. Haldankar PM, Parulekar YR, Kireeti A, Kad MS, Shinde SM, Lawande KE. Studies on influence of bagging of fruits at marble stage on quality of mango cv. Alphonso. Journal of Plant Studies 2015;4(2):12-20.
8. Hegazi A, Samra NR, El-Baz EET, Khalil BM, Gawish MS. Improving fruit quality of Manfalouty and Wonderful pomegranate by using bagging and some spray J treatments with gibberellic acid, calcium chloride and kaolin. J Plant Production, Mansoura Univ 2014;5(5):779-792.
9. Hossain MJ, Hossain MM, Rabbani MG, Hafiz MMH, Islam MZ. Effects of preharvest fruit bagging on postharvest quality and shelf life of mango cv. Amrapali. J Bangladesh Agricultural University 2020;18(1):61-67.
10. Hossain MM, Rahman MM, Rahim MA, Rubel MHK, Islam MZ. Effect of pre-harvest fruit bagging on post-harvest quality of guava cv. Swarupkathi. Fundam Appl. Agric 2018;3(1):363-371. doi:10.5455/faa.285146.
11. Islam MT, Rahman MS, Shamsuzzoha M, Chowdhury AKMMB, Alom R. Influence of pre-harvest bagging on fruit quality of Mango (*Mangifera indica* L.) cv. Mishribhog. International Journal of Biosciences 2017a;11(3):59-68.
12. Lin CF. Effects of bagging on quality and nutrient content of Jinfeng pear. J Gansu Agric Univ 2008;2:2-19.
13. Liu Y, Zhang X, Zhao Z. Effects of fruit bagging on anthocyanins, sugars, organic acids, and colour properties of Granny Smith and Golden Delicious during fruit maturation. European Food Research and Technology 2013;236:329-339.
14. Panse VG, Sukhatme PV. Statistical methods for Agricultural Workers. ICAR Rev. Ed. By Sukhatme PV, Amble VN 1995, 97-156.
15. Ranganna S. Manual of Analysis of Fruit and Vegetable Products. Tata Mc. Graw-Hill Publishing Company Ltd, New Delhi 1986, 201-208.
16. Salama MI, El Morsi AA, Omar AK, El Basyoni RI. Improving yield and fruit quality of Wonderful pomegranates using bagging and potassium treatments under kafr El- Sheikh Conditions. *Acta Horticulturae* 2018;1216:105-114.
17. Ehteshami Sakineh, Hassan Sarikhani, Ahmad Ershadi, Jafar Amiri Parian. Effect of Bagging on Fruit Quality and Reducing of Sunburn in Pomegranate cv. Rabab Neiriz. Iranian Journal of Horticultural Sciences 2015;45:353-360.
18. Samra BN, Shalan AM. Studies on thinning, bagging and aluminium silicate spraying on yield and quality of

Wonderful pomegranate. J Plant Production, Mansoura Univ 2013;4(2):219-227.
19. Yang WH, Zhu XC, Bu JH, Hu GB, Wang HC, Huang XM. Effects of bagging on fruit development and quality in cross-winter off-season longan. Scientia Horticulturae 2009;120:194-200.
20. Zha Qian, Xi Xiao Jun, He Yani, Jiang Ai Li. Bagging affecting sugar and anthocyanin metabolism in the ripening period of grape berries. Not Bot Horti Agrobo 2019;47(4):1194-1205.