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IMPACT OF PRE-HARVEST FRUIT BAGGING ON QUALITY, PEST AND DISEASE INCIDENCE IN MANGO CV. CHINNRASAM

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ABSTRACT

Mango is an important tropical and subtropical fruit crop in India. However, due to climate change and non-adoption of good management practices in mango leads to increased pest and disease incidence. Hence, farmers are using pesticides indiscriminately to control these pests leads to pesticide residues on fruits which is a major hurdle for exports of mango fruits from India. Preharvest fruit bagging possess prospectus in mango to avoid pest and disease incidence thereby increasing the quality of fruit. Hence, the field experiment was conducted at Mango Research Station Nuzvid, Dr. YSR Horticultural University during 2021 to 2024 for four years to study the effect of pre-harvest fruit bagging on quality and pest and disease incidence in mango cultivar chinnarasam which is a popular commercial variety of Andhra Pradesh. The experiment was laid out in Randomized Block Design (RBD) with 3 replications and 7 treatments consisted three colours of bags and two variants in each colour and control as no bagging. The findings clearly indicated that among the treatments, T₄ (Yellow colour with flip) recorded significantly maximum content of ascorbic acid (54.25 mg/100g), which was on par with T₂ (Reddish brown with flip) while minimum content (27.42 mg/100g) was found in T₇ (Control). Both reddish brown and yellow colour were superior for non-reducing sugars total sugars followed by white bags. Thrips and sooty mould damage was recorded minimum (10.19% and 10.96%, respectively) in reddish brown bags, which was followed by yellow and white bags. Fruit fly damage was not found in bagged fruits while control recorded highest incidence of 42.33%. Based on these results, it can be concluded that pre-harvest bagging of fruits with reddish brown or yellow colour found to be best for improving the fruit quality and to avoid pests and disease incidence thereby pesticide residues in mango.

Key words : Bagging, Quality, Pest, Diseases, Mango.

Introduction

Mango (*Mangifera indica* L.), the King of fruits is an important tropical and subtropical fruit crop. It has delicious taste, excellent flavour, attractive colour, huge variability and varied end usage. It is rich in nutrients particularly vitamin A and C. Raw fruits are used for making chutney, pickles, raw mango dried flakes and dried powder (amchur). The ripe fruits besides being used for table purpose are also utilised for preparing several value-added products like jam, jellies, squash, cordial, syrup, nectar etc.

India is the leading country for mango production in the world which occupies 24 million hectares with

production of 21.79 million tonnes (Anonymous, 2024). In India, Andhra Pradesh and Uttar Pradesh are having the largest area under mango cultivation each with around 25% of the total area followed by Bihar, Karnataka, Kerala and Tamil Nadu. In Andhra Pradesh, mango is grown in 1.31 lakh hectare and producing 43.5 lakh metric tonnes (Anonymous, 2024). The major mango growing districts in Andhra Pradesh are Krishna, Vijayanagaram, Ananthapur, Kadapa, Srikakulam, West Godavari and Chittore.

Bagging refers to the covering of fruits with bags to protect them from various biotic and abiotic factors. It is a technique, which provides physical protection to the

fruits, that helps in improving their physical and internal quality as well as changes the microclimate inside the bag for proper growth and development (Fan and Mattheis, 1998; Nagaharshitha *et al.*, 2016). In mango, bagging also helps to prevent fruit fly attack and fungal disease incidence, which is a major concern for exports. Further, in recent years the climate change spoil the external appearance of fruit. Thus, bagging can be helpful under such conditions. Hence, the present study was conducted to study the effect of bagging on fruit quality and pest and disease incidence in Chinnarasam cultivar of mango. Chinnarasam also called Nuzvid Chinnarasalu is an important commercial variety grown across South India. It has thin skin and juicy fibrous pulp with a sweet and tangy taste. It is a good source of vitamin C and dietary fiber making it a healthy and delicious fruit. The unique combination of size, shape and colour of this variety contributes the distinctiveness and popularity among the mango varieties. Studies on pre-harvest fruit bagging of mango in general and Chinnarasam variety in specific are very meagre. Hence, this study was conducted to assess the impact of pre-harvest fruit bagging on quality and pests and disease incidence in mango.

Materials and Methods

This experiment was conducted to study the effect of preharvest bagging on quality parameters, pest and disease incidence in mango cv. Chinnarasam at Mango Research Station, Nuzvid, Dr.YSR Horticultural University, Andhra Pradesh from 2021 to 2024 for 4 consecutive years. The experimental site was geographically situated at 16° 46' 48" N latitude and 80° 50' 59" E longitude. The experiment was laid out in Randomized Block Design (RBD) with three replications consisting of 7 treatments viz., T₁: Reddish brown cover without flip, T₂: Reddish brown cover with transparent flip, T₃: yellow cover without flip, T₄: yellow colour with flip, T₅: White colour without flip, T₆: white colour with flip and T₇: Control (no bagging). Twenty fruits were selected for bagging per replication per treatment. Bagging was done when fruits weighed approximately 100g and the transparent flip with polythene sheet was made on fruit cover before bagging of fruits in the respective treatments. The bags were secured to the fruit stalk with the help of binding wire attached to the fruit cover in such a way that it will not fall down as well as there will not be open space for entry of insects or rain. Fruit weight was determined by average weight of randomly selected five fruits per replication per treatment. Total soluble solids (° Brix) were measured by using the

'Erma' hand refractometer. The titratable acidity was calculated on the basis of one ml N/10 NaOH equivalent to 0.0064 g of anhydrous citric acid or per cent citric acid in juice. The total sugars were estimated by titrating the boiling mixture of 5 ml, each of Fehling A and Fehling B solution against the hydrolyzed aliquot by using methylene blue as an indicator. Non-reducing sugars were calculated by subtracting reducing sugars from the total sugars and multiplying the difference by standard factor (0.95). Reducing sugars and ascorbic acid were estimated by method suggested by Ranganna (1986). The shelf life was determined by recording the number of days the fruits remained in good condition without spoilage.

The percent damage by pests was recorded at the time of harvest and calculated with the following formula.

Pest or diseases incidence percentage =

$$\frac{\text{Number of infested /infected fruits}}{\text{Total number of fruits}} \times 100$$

The data obtained from the study was statistically analysed according to the procedure given by Panse and Sukhatme (1985).

Results and Discussion

The results of the pooled data from 2021 to 2024 presented in Table 1 (quality parameters) and in Table 2 (pest and disease incidence).

The results indicating that average fruit weight, Total Soluble Sugars (TSS) and reducing sugars were not influenced by bagging with different coloured fruit bags. Nagaharshitha *et al.* (2016) also reported that TSS was not varied significantly due to bagging. However, acidity was found significantly highest (1.062%) in T₇ (control) while lowest was recorded in reddish brown colour bags i.e T₁ and T₂ (0.697% and 0.646%, respectively). Among the treatments T₄ (Yellow colour with flip) recorded significantly maximum content of ascorbic acid (54.25 mg/100g) which was on par with T₂ (Reddish brown with flip) while minimum content (27.42 mg/100g) was found in T₇ (Control). Similar findings were reported by Hongxia *et al.* (2009) and Haldankar *et al.* (2015) in mango. Similarly, Islam *et al.* (2017) have also reported high ascorbic acid content with bagging. Non reducing sugars and total sugars were highest in T₁, T₂, T₄ and T₆ whereas lowest in T₃. This is due to the congenial microclimate around the fruit with bagging and conversion of starch into simple sugars resulting in increased non-reducing sugars and total sugars during subsequent growth and development stages of fruit. A similar increase in non-reducing sugars of fruits due to bagging was reported

Table 1 : Effect of different fruit covers on quality parameters of mango cv Cinnarasam.

Treatments	Fruit weight (g)	TSS (%)	Acidity (%)	Ascorbic Acid (mg/100g)	Reducing sugars (%)	Non-reducing sugars (%)	Total Sugars (%)	Shelf life (days)
T ₁	283.2	17.2	0.697	35.79	5.9	11.7	17.6	7.2
T ₂	272.9	16.5	0.646	45.90	5.4	12.7	18.1	7.4
T ₃	289.6	16.9	0.827	36.86	5.6	8.3	13.9	6.7
T ₄	265.6	17.4	0.992	54.25	5.6	12.6	18.2	6.9
T ₅	269.7	17.8	0.841	29.82	5.0	10.2	15.2	7.3
T ₆	259.2	17.8	0.881	39.02	4.9	11.8	16.7	7.0
T ₇	253.1	17.2	1.062	27.42	5.3	8.8	14.1	5.4
CD (0.05p)	NS	NS	0.24	9.96	NS	1.81	2.3	1.1
SEM ±	11.1	0.45	0.08	3.20	0.4	0.6	0.7	0.4
CV%	8.2	5.2	15.7	14.4	12.8	9.3	7.8	9.1

Table 2 : Effect of different types of covers on pest and disease incidence in mango cv. Chinnarasam.

Treatments	Thrips (% damage)	Damage reduction over control	Fruit fly (% damage)	Damage reduction over control	Sooty mould (PDI)	Damage reduction over control
T ₁	10.19a(18.51)	72.8%	0	100 %	10.96a(19.04)	57.5%
T ₂	16.85b(24.22)	54.9%	0	100 %	13.65b(21.65)	47.1%
T ₃	21.02c(27.26)	43.8%	0	100 %	9.68a(17.83)	62.5%
T ₄	22.63c(28.35)	39.5%	0	100 %	14.85b(22.64)	42.4%
T ₅	26.18d(30.65)	30.0%	0	100 %	15.12b(22.89)	41.3%
T ₆	21.67c(27.72)	42.1%	0	100 %	15.82b(23.36)	38.6%
T ₇	37.40e(37.60)		42.33(40.59)		25.78c(30.49)	
C.D (0.05)	3.61		0.98		3.87	
S.E(m) ±	1.16		0.10		1.24	
CV%	7.22		9.51		9.55	

Note: The values in parenthesis are the transformed values of arc sign values.

earlier by Jakhar and Pathak (2016) in mango cv. Amrapali, Akter *et al.* (2020) and Ravikanth *et al.* (2022) in mango. All coloured bags have significantly increased the shelf life upto 7 days compared to control (5 days) at room temperature after ripening. These results are in line with the findings of Islam *et al.* (2019) in mango cv. Langra.

Among the different pest of mango, thrips, hoppers and fruit fly cause huge damage to quality in terms of physical appearance of fruits. Preharvest fruit bagging with different treatments reduces the thrips damage (Table 2) compared to non-bagging treatment (control). Among the different treatments, T₁ (Reddish brown colour without flip) recorded minimum damage (10.19%) followed by T₂ (Reddish brown with flip) *i.e.*; 16.85%. Fruit fly damage was not observed in all bagging treatments. However, control (no bagging) recorded 42.33% damage by fruit flies. Islam *et al.* (2019) also reported that bagged fruits are free from fruit fly attack

in mango cv. Langra. In case of sooty mould disease incidence, T₃ recorded lowest damage (9.68%) which was on par with T₁ (10.96%). However, when compared to control both thrips and sooty mould damage was found lowest in all bagged fruits. These results clearly showed that fruit bags acted as a physical barrier for pests and diseases and hence low pest and disease incidence was recorded. Egg laying by fruit fly was completely restricted by fruit bagging and hence its damage was not recorded in bagged fruits when compared to non-bagged fruits. Tejasree *et al.* (2022) and Prasanna *et al.* (2024) also reported that fruits bagged with brown paper bag not recorded insect pests like thrips, fruit fly and fruit borer in mango cv. Neelum. Ali *et al.* (2021) stated that by altering microenvironment of the fruit, bagging facilitates reduction in pest infestation, sunburn and blemishes *etc.*

Conclusion

The results from the study indicating that fruit quality in terms of acidity, ascorbic acid, non-reducing sugars

and total sugars was improved with bagging of fruits when compared to no bagging. Among the different coloured bags used in this study, reddish brown colour bags were superior followed by yellow and white colour bags for improving the fruit quality. The pest and disease incidence were also found very less and no damage by fruit fly in bagged fruits hence improved the appearance of fruit surface without any blemishes on the fruits. Based on these results, preharvest bagging of fruits with reddish brown or yellow colour covers can be used to improve the fruit quality, to avoid pests and disease incidence and to reduce pesticide usage thereby pesticide residues on fruit in mango. Further, this technique may be included in IPM practices of mango for effective control of pests and diseases. As fruit flies are quarantine pests of mango, fruit bagging will be helpful to produce export quality fruits which in turn increases our country's foreign exchange. Though the cost of production is high in bagging method, with increased yield, attractive fruit colour and quality, farmers will be able to fetch higher returns from Mango by selling at premium price. Preharvest fruit bagging is very much useful particularly in high density and ultra-high density planting orchards where pests and diseases are the major problem due to favourable environment.

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