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ASSESSMENT OF PRE HARVEST FRUIT BAGGING TO MANAGE PESTS OF MANGO (*MANGIFERA INDICA* L.) CV. BENISHAN

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Abstract– Mango commonly known as king of fruits in India is reported to be affected by 188 species of insects in India. Pest and disease incidence in mango mainly starts from flowering stage and continues till harvesting. Farmers generally rely upon pesticides to control pests and diseases of mango but over a period of time, due to poor management practices and changing climatic conditions, pest incidence in mango increased rapidly which in turn increased pesticide sprayings. This resulted in increased production cost and pesticide residues on fruit which is a major hurdle for mango export and also few pests like fruit fly cannot be controlled by insecticides alone. Hence, on farm trial was conducted during summer, 2022 to assess the performance of fruit bags in reducing pests and diseases of mango against farmers practice i.e., spraying of pesticides. Fruit bagging method effectively controlled fruit fly, thrips and bacterial black spot diseases whereas in farmers practice 11.28%, 2.17% and 23.22% were recorded respectively despite of regular sprayings. There is a significant difference between fruit bagging and farmers practice and fruit bagging method found to be best in reducing pest and disease incidence. Higher yield was recorded in fruit bagging, i.e. 9 t/ha whereas in farmers practice it was 7.5t/ha. Even though cost of production is high in fruit bagging i.e., Rs 104000/- hectare due to good market price to bagged fruits, farmers got more net returns i.e., Rs 3,42,300/- hectare. Reduced sweetness in the fruit and difficulty in bagging of all the fruits in older trees are the cons in fruit bagging method. Overall, pre harvest fruit bagging found to be one of the best management practice in mango which not only reduces pest and disease incidence but also to get higher yield and quality fruits.

INTRODUCTION

Mango belonging to Anacardiaceae family is commonly known as king of fruits in India. Andhra Pradesh occupies second position in mango area in India with an area of 4.31 lakh hectares and production of 4.35 lakh ton. In Chittoor district of Andhra Pradesh, mango is grown in an area of 1.3lakh hectares and the area is in increasing state. Even though area of mango is increasing every year in the district but quality mango production is not increased. Attack of insect pests and diseases reduce not only fruit yield but also quality fruits. Mango is reported to be affected by 492 species of insects worldwide of which 188 species were reported from India (Kumar *et al.,* 1985). Mango hoppers, fruit fly, fruit borer, sootymold, bacterial black spot and anthracnose are the major biotic constraints in mango production. To manage these problems farmers majorly rely upon pesticides but over a period of time, due to indiscriminate use of pesticides, changing climatic conditions and poor management practices resulted in rapid increase of pests and diseases in mango. Despite of regular sprayings, farmers are unable to control pests and diseases of mango which resulted in poor quality mango fruits and they are fetching low market price to the mango growers. In a crop like mango, where pesticide spraying is a cumbersome process, more emphasis should be given to cost effective management methods which not only reduces pesticide usage but also protects environment and

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consumer health.

Among such alternatives, the pre harvest fruit bagging methodis effective against insect pests and diseases and it also improves fruit color and quality. It reduces mechanical damages, sunburn,pesticide residueson the fruits. An attractive, spotless and pest free fruits fetch premium rate to the growers. Knowing the importance of fruit bags few countries like Argentina and Mexico do not accept/ import fruits unless they were pre harvest bagging is done (Sharma *et al*., 2014).

Hence, On Farm Trial was conducted at Krishi Vigyan Kendra, Kalikiri, Chittoor district to assess impact of fruit covers in reducing pests and diseases of Mango during Summer 2022. Fruit bagging was done when the fruit is at lemon size and it was compared against farmers practice, *i.e.,* spraying of pesticides.

MATERIALS AND METHODS

Mango orchards of 8-10 years old were selected to conduct the trial. Fruit bags were tested in Mango variety Benishan in all the locations. Commercially available fruit bags were tied when the fruit is at lemon size and removed one week before harvesting. Healthy fruits were wrapped with fruit bags properly covering 3cm of stalk. In farmers practice, farmers sprayed chemicals to control pests and diseases from flowering stage onwards.

T1: Fruit bagging with brown paper double layered bag

T2: Farmers practice (Spraying of pesticides)

The percent damage by pests was recorded from a randomly selected sample of 50 fruits at the time of harvest in fruit bagging method and farmers practice separately. Mango fruit yield was also recorded after harvesting of the crop.

$$\text{Pest/disease incidence (\%)} = \frac{\text{Number of infested/infected fruits}}{\text{Total no. of fruits (n=50)}} \times 100$$

Economics of both fruit bagging method and farmers practice was calculated by comparing cost per hectare derived from farmers practice with the costs derived from fruit bagging method. For this, cost of pesticides, number of sprayings and labour wages were considered. For fruit bagging method, cost of fruit bags and labour wages were taken into consideration. Collected data analyzed statistically and results are concluded accordingly.

RESULTS AND DISCUSSION

Results from Table 1 depicts that there is a significant difference between fruit bagging and farmers practice with respect to pest incidence. Fruit bagging significantlyreduced the major pests/ diseases that occur during fruit development stage in benishan cultivar *i.e.,* thrips, fruit fly and bacterial black spot diseases. Bacterial black spot disease was the major problem during the season. In fruit bagging method, the disease was not observed whereas in farmers practice 23.25% was observed. Chonhenchob *et al.* (2011)and Chiangsin (2016) reported low incidence of anthracnose disease in bagged mangoes than un bagged fruits. Sangchote (1997) reported that bagging reduced anthracnose disease incidence and disease severity by 95% and 34% respectively.

After bacterial black spot, fruit fly is the major problem during the season. Fruit fly damage was not observed in bagging method whereas in farmers practice 11.28% of fruit fly damage was recorded. There is a significant difference between the treatments with respect to fruit fly incidence.Thrips incidence of 0.66% was recorded in bagging whereas 2.17% in farmers practice. Significant difference between fruit bagging and farmers practice was observed with respect to thrips incidence.

This indicates that pre harvest fruit bagging effectively controlled fruitfly, thrips and bacterial black spot diseases in mango. Fruit borer incidence

Table 1. Percent damage by pests and diseases in mango

Pests/disease	Treatment	Mean	Variance	t-value	p-value
Bacterial black spot	Fruit bagging	0.0	0.0	4.58**	0.0037
Farmers practice	23.225	102.44			
Fruit fly	Fruit bagging	0.0	0.0	5.824**	0.000394
Farmers practice	11.28	18.77			
Thrips	Fruit bagging	0.66	16.28	5.217**	0.000804
	Farmers practice	2.178	42.627		

** Significant at 1% level

was not recorded both in fruit bagging method and farmers practice. Fruit bags acted as a physical barrier for pests and diseases and hence low pest incidence is recorded. Egg laying by fruit fly was completely restricted by fruit bagging and hence its damage was not recorded. Fruit bags wrapped around diseased fruits enhanced the incidence of bacterial black spot disease hence care must be taken that only healthy fruits are selected for bagging. Tejasree *et al.* (2022) reported that fruits bagged with brown paper bag not recorded insect pests like thrips, fruit fly and fruit borer in Neelum cultivar. Ali *et al.* (2021) reported that by altering microenvironment of the fruit, bagging facilitates reduction in pest infestation, sunburn and blemishes etc. Haider Karar *et al.* (2019) reported that fruit bagging not only reduced pests and diseases but also increased fruit size and weight. Sarker *et al.* (2009) reported that fruit fly incidence was not observed in bagged fruits.

Apart from low pest incidence, fruit bagging resulted in high quality fruits with good colour increased size and shelf life. Sweetness of the fruit is somewhat low in bagged fruit than non-bagged fruit. Removal of fruit bag one week before harvesting and fruit exposure to natural light is essential to increase sweetness of the fruit. Nadeem *et al.* (2022) reported that as the bagged fruits are not exposed to sunlight, it increases xanthophyll content which resulted in preservation of vitamin C in fruits hence sweetness is reduced. Devalla *et al.* (2016) reported that bagging improves pigmentation in fruits which enhances the quality of the fruit at the time of harvest. Watanawan *et al.* (2008) reported that bagging increased fruit colour from green to yellow and two layered bagged fruit has highest weight than non bagged fruit.

Highest yield was recorded in fruit bagging method *i.e.*, 9 ton/ha whereas in farmers practice 7.15ton/ha yield was obtained. there is a significant difference between bagging and farmers practice with respect to yield. This may be accounted for increase in fruit weight due to bagging resulted in increased yield. Cost of cultivation was lowest in farmers practice *i.e.*, Rs. 94400/- per hectare and it was high in fruit bagging method *i.e.*, 104000/- per hectare and there was significant difference between the treatments. It is due to the high market price of the fruit bags and labour wages incurred to tie fruit bags. Even though cost of cultivation is high in fruit bagging method, higher net returns were also recorded in this method *i.e.*, Rs. 342300/- per hectare than farmers practice *i.e.*, Rs. 143150/- per hectare. Mango fruits with good quality and colour fetched high market price for the farmer in fruit bagging method *i.e.*, Rs.50000/- per ton whereas in farmers practice farmers sold their produce at lower market price of Rs. 33000/- per ton. Hence benefit cost ratio is also high in fruit bagging method than farmers practice. Statistically significant difference was observed with respect to gross returns, net returns and B:C ratio. Fruit bagging method found to be superior over farmers practice with respect to pests and diseases and returns to the farmers. Gethe *et al.* (2021) recorded higher yield in bagging method than control in pomegranate. Del Pino *et al.* (2021) recorded high cost of cultivation and high net returns in fruit bagging method than chemical control.

CONCLUSION

Pre harvest fruit bagging effectively controlled major insect pests and diseases of mango cultivar

Table 2. Economics of fruit bagging method and farmers practice method

Treatment	Mean	Variance	t-value	p-value	
Yield (t/ha)	Fruit bagging	9.0	1.312	2.458*	0.0394
	Farmers practice	7.15	1.518		
Cost of cultivation (Rs/ha)	Fruit bagging	104000	67500000	2.46*	0.038
	Farmers practice	94400	8300000		
Gross returns (Rs/ha)	Fruit bagging	449300	3.27	6.796**	0.000138
	Farmers practice	235950	1.65		
Net returns (Rs/ha)	Fruit bagging	342300	2.46	7.102**	0.000102
	Farmers practice	143150	1.47		
B:C ratio	Fruit bagging	4.2:1	0.155	6.938**	0.00012
	Farmers practice	2.52:1	0.137		

* Significant at 5% level
** Significant at 1% level

benishan. It can be added into IPM programme of mango. As fruit flies are quarantine pests of mango, fruit bagging will be helpful to produce export quality fruits which inturn increases our country's foreign exchange. Mango yield was also increased due to this technique because of increase in fruit weight. Even though cost of production is high in bagging method, with increased yield, good fruit colour and quality farmers will be able to fetch higher returns from Mango. But it is not possible to do pre harvest fruit bagging in all the fruits in mango trees of 15 year old or aboveas it is difficult to bag fruits in upper canopy. Hence, farmers should inevitably go for pesticide spraying to control pests and diseases. This technique is very much useful in high density planting orchards where pests and diseases are the major problem due to favourable environment and tree height is also less so that all the fruits in a tree can be bagged.

Conflict of Interest

The authors declare no conflict of interest.

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