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Effect of impregnated bags on physical qualities and suitability of chemical with relation to incidence of pests and diseases of mango. (*Mangifera indica* L.) cv. Mallika

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Abstract

An field experiment was conducted to investigate the “Studies on effect of impregnated bags on quality of mango (*Mangifera indica* L.) cv. Mallika taken up at the AICRP on irrigation water management, VNMKV Parbhani in the year 2016-17 from February to June which constituted seven treatments T₁-Methoxam treated bag, T₂-decis bag, T₃-Potassium metabisulphite treated bag, T₄-Methoxam + Decis treated, T₅-Potassium metabisulphite + Decis treated bag, T₆-Untreated bag, T₇-Control (no bagging), undertaken in Randomized Block Design. Mango fruits were subjected to seven treatments with tree replication at 30 days after fruit set. Result showed that the physical parameters such as were affected significantly due to bagging. The T₂ decis bag showed best performance length of fruit T₂ (12.69 cm), diameter of fruit (7.86 cm) than control. Maximum pulp weight found (237.83), pulp to stone ratio (5.8:1), pulp percent (42.22%) and weight of fruit T₁ (367.39 g). Infestation of pests and diseases found were non-significantly varied due to bagging. The result showed that the minimum incidence of pest (fruit fly, stone weevil, mealy bug, spotted fruit) was noticed nil in T₁, T₂, T₃, T₄, and T₅ and where as T₆ and T₇ highest percentage of incidence of pest was recorded and also spotted fruits. The minimum fruit drop was recorded at harvest in T₃ (1.94%). Bagging of mango fruits prior to harvest controlled mechanical damage caused by various factors, improved colour and physico-chemical properties of fruit. Thus, it was concluded impregnated bags influenced growth and development of mango fruit and it is one of the best alternative to avoid adverse effect of recent changes in climate on fruit.

Keywords: Mango, Mallika, bagging, fruit weight and fruit fly

1. Introduction

Mango (*Mangifera indica* L.) is the oldest and choicest fruit of the world. It is considered as ‘National fruit of India’ and rightly known as ‘King of fruits’ owing to its nutritional richness, unique taste, pleasant aroma and its religious and medicinal importance. Mango is believed to be originated to South East Asia, Indo Burma region, in the foot hills of the Himalayas (Mukherjee, 1951) [15]. Due to its good qualities and high medicinal values, it is enjoyed by masses and classes from each corner of the World. It has an intimate association with cultural, religious, aesthetic and economical life of Indians since time immemorial (Chattopadhyay, 1976) [9]. At present, mango is grown in 111 countries spread over five continents with an area of 5.37Mha with total annual production of 48.98 m MT and average productivity is 8.7 tonnes/ha (FAO, 2013) [10]. India is the largest producer of mango in the world, and ranks first in area and production. The total production of mango in India is 20.29 mMT from about 2.27 mha area with the productivity of 8.94 MT/ha, which is having 40.48% average share in total world production (Anon. 2017) [4]. The other countries which follow India in mango production (mMT) are China (4.51), Thailand (3.27), Indonesia (2.13), Pakistan (1.88) and Mexico (1.82) (Anon. 2014) [3].

The leading state of mango production in India are Uttar Pradesh where highest production (45.40 MT) and productivity (17.14 tonnes/ha). In Maharashtra, mango is occupying an area of 157.07 M ha with annual production of 314.87 m MT with productivity of 3.28 t/ha (Anon 2016-17) [4]. Most of the people love mangoes for their luscious tropical flavour, they also deliver a host of nutrients and make healthy eating a delightful sensory experience. It is rich source of vitamin A. The ripe mango is reported to have 83.46 - 86.70% moisture, 0.82 g

protein, 0.38 g fat, 14.98 g carbohydrate, 11 mg calcium, 14 mg phosphorus, 0.16 mg iron, 0.135 - 1.872 Vitamin A (mg/100g β -Carotene), 0.038g/100 g Riboflavin and 36.4 mg/100g Ascorbic acid, 12.0-23.0 TSS ($^{\circ}$ B) and 0.12-0.38% acidity (Anon. 2010b) [2].

2. Material and Methods

The experiment was conducted randomized block design (RBD). It was conducted in the Mango orchard Cv.Mallika experimental field AICRP on Water Irrigation Management, College of Agriculture, V.N.M.K.V Parbhani (M.S.), India. Fruits of equal size were randomly selected using impregnated bags at 30 days after fruit set. Experiment was taken in 3 replications and 30 fruits were selected randomly per treatment and per replication. T₁-Methoxam treated bag, T₂-decis treated bag, T₃-Potassium metabisulphite treated bag, T₄-Methoxam + Decis treated, T₅-Potassium metabisulphite + Decis treated bag, T₆-Untreated bag, T₇- Control (no bagging), There were perforated of bags made up of from "filter paper" it require proper ventilation for fruit development. Fruit at 30 days after fruit set were selected for bagging. The size of bags was 25x20 cm, while bagging the filter paper bags impregnation with different insecticide, pesticide and chemical solutions. The impregnated bags were stapled properly, so that it will not fall down as well as there will not be open space for entry of any insects or rain etc. five fruit randomly selected per treatment per replication to record various physical and chemical parameters.

3.1. Observations recorded

The length and diameter was measured with the help of Vernier caliper and expressed in centimetres (cm). The weight of fruits and pulp was recorded by using monopan electronic balance and expressed in grams (g), fruit firmness were determined with the help of penetrometer (kg/cm²). Mango fruit pulp and stone of ripe fruit were separated and their weight was recorded in grams (g) and ratio of pulp weight to stone weight was calculated. Calculate the juice of fresh fruit and the weight of juice was recorded by using monopan electronic balance and expressed in grams (g) and it expressed in percentage, Observe fruit drops per plant at pea stage, egg stage, harvest stage and final stage counted out of 30 bagged fruit.

3.2. Pests and disease incidence

The fruits were harvested at 85 percent maturity and were ripened under uniform conditions at room temperature and 95% R.H. Each fruit was thoroughly examined on alternate days for any visible symptoms of spoilage, pests and disease incidence during storage at ambient temperature conditions.

3.3 Benefit: cost ratio (B: C ratio)

Economics of mango fruit crop was calculated on the basis of cost of cultivation under corresponding treatments. The gross monetary returns were divided by corresponding cost of cultivation by using the following formula.

$$\text{B: C ratio} = \frac{\text{Gross monetary returns (Rs.)}}{\text{Total cost of cultivation (Rs.)}}$$

3.4. Statistical analysis

The data obtained was analyzed statistically as per the method suggested by Panse and Sukhatme (1985). The standard error of mean (S.E.m.) was worked out and the critical difference

(C.D.) at 5 per cent was calculated whenever the results were found significant. The important results have been supported through graphs and plates.

4. Results and Discussion

From this research study examination of data (Table1) revealed that fruit length of mango was found significantly increased at all stages in all treatments, as compared to control. However, treatment T₂ i.e. decis treated bag recorded significantly superior length i.e.2.69, 9.78, and 12.69 (cm) respectively at bagging, at 60 days and at harvest, except the 30 days after bagging. It was at par with T₄ (Thiamethoxam + decis). fruit diameter was recorded in treatment T₂ - (decis treatment bag) at all stages i.e. 0.98, 3.65, 6.40 and 7.86 cm. at bagging, at 30 days, at 60 days and at harvest respectively. The improvement observed in the fruit diameter This could be due to microclimate surrounding the bagged fruit and accumulated heat might induce higher respiration rates and CO₂ accumulation within bags might lead to more acetaldehyde production and removal of astringency (Amarante *et al.*, 2002; Awad 2007; Awad *et al.*, 2012; Yang *et al.*, 2009, Muchui *et al.*, 2010 [1, 5, 6, 14] also reported that fruit pre-harvest bagging could effectively improve fruit quality. Fruit weight was increased at harvest significantly, superior increased the weight. Thiamethoxam treated fruit as compared to control (T₇). Fruits treated with thiamethoxam impregnated bags recorded maximum fruit weight i.e. at harvest T₁ (367.39) was recorded maximum fruit weight, While minimum recorded in T₇ (295.38). Maximum pulp weight was found in treatment T₂ (decis treated bag) 237.83 followed by T₁ (233.11 and was at par with as compare to treatment T₇. the pulp per cent or juice per cent was difference significantly in all the treatments. Treatment T₂ gives highest pulp percentage (42.22) followed by T₅ (40.38) and T₄ (40.19) also they were at par. The maximum pulp to stone ratio was noticed in T₂ (5.8:1), which was at par with the T₄ (5.7:1), T₃ (5.6:1), T₅ (5.5:1) and T₁ (5.4:1). The minimum pulp to stone ratio was observed in T₇ (4.8:1) and T₆ (5.0:1).Whereas this study found highest pulp to stone ratio might be due to over all increasing of weight of fruit, weight of pulp, pulp per cent and weight of stone. It could be attributed due to deltaethrine treated bag stimulated the functioning of enzymes in physiological process which probably caused an increase in weight of fruit. Increasing pulp weight, peel weight and stone weight is directly effect on fruit weight or fruit size. Burondkar *et al.*, (2009) [8] reported that treated fruit remain physiologically more active to build up sufficient food stock for developing fruit ultimately leading the higher fruit production. Vejjendla *et al.*, (2008) [17]. decis (T₂) recorded significantly maximum weight of stone (40.68) followed by as treatments and were at par with each other as compare to control. It could be attributed to ultimately there may be large shape, size & weight of fruit to increase stone weight. by wahdan *et al.*, (2011) [18]. The fruit firmness recorded in treatment T₂ (Decis treated bag) at days of storage. i.e 7.35, 4.60 and 2.38 at 3rd, 9th and 12th respectively except at 6th days of storage, firmness of mango gradually decreased during the entire period of storage because during there is disintegration of carbohydrate and starch. Softening of fruits is caused either by breakdown of insoluble protopectine into soluble pectin or cellular disintegration leading to membrane permeability maintain the structure and function of cell wall. Motto *et al.*, (1975) [13] Karemera and Habimana (2014) [11]. In case of incidence of and pests and diseases (disordered.), application treatments involving wrapping material as well as

impregnated bag with chemicals effectively reduced mealy bug infestation. However, the minimum or no infestation was noticed in T₁, T₂, T₄, and T₅ and was significantly superior over other treatment. Followed by T₃ (5.33%) and T₆ (5.67%). Whereas, maximum infestation was noticed in T₇ (9.67%). The non-significant result treatments involving wrapping material as well as impregnated with chemical, effectively reduced the fruit fly infestation. The minimum or no infestation was noticed in T₁, T₂, T₃, T₄, and T₅ treatment. Maximum infestation was noted in T₆ (0.13). T₇ (0.40). Kehat *et al.*, (1969) ^[12] where date bunches were well covered by dense-mesh netting as soon as the fruit begins to ripen, which satisfactory protected the fruit from raisin moth. Stone weevil infestation was difference significantly the minimum or no infestation was noticed in T₁, T₂, T₃, T₄ and T₅ and was significantly superior over other treatment. Were as, maximum infestation was noticed in T₆ (1.00) and T₇ (0.80). Thus it was observed that bagging had significant effect on controlling fruit stone weevil infestation. It might due to pre-

harvest bagging impregnated bag with different chemical that control the infestation. Bayogan *et al.*, (2006) ^[7]. Less no. of spotted in fruit observed T₁, T₂, T₃, T₄ and T₅. That impregnated bags significantly reduced incidence of spotted fruits. Black spotting in storage period due to the infection of anthracnose caused by (*coletotrichum gloeosporioides*) and stem end rot caused by *Diplodolia netalensis* (yadav *et al.*, 2013) ^[19]. Observed in guava bagging decreased insect damage and spotted fruit of guava during both years respectively. Fruit drop was found to be non-significant at 30, 60, and at harvest this could be due to the reduction of abscission and the influence in the maintaining of middle lamella cells. Yang *et al.*, (2009) ^[20] noticed bagging tender to promote early fruit drop but reduced late fruit drop. Highest B: C ratio (2.74) was observed in the treatment T₃ (Potassium metabisulphite treated bags. The lowest B: C ratio T₇ (1.72) was observed. As a whole, these results are important for economic and horticultural point of view.

Table 1: Studies on effect of impregnated bags on physical parameter of mango. Cv. Mallika

Treatments	length (cm)	Diameter (cm)	weight (g)	wt. of pulp(g)	wt. of stone (g)	Pulp percent (Juice %)	Pulp to stone ratio
T ₁ (Methoxam treated bag)	12.19	7.82	367.39	233.11	40.11	39.37 (63.44)*	5.4:1
T ₂ (Decis treated bag)	12.69	7.86	354.43	237.83	40.68	42.22 (67.14)	5.8:1
T ₃ (Potassium metabisulphite treated bag)	11.57	7.41	363.10	226.35	38.52	38.56 (62.32)	5.6:1
T ₄ (Methoxam + Decis treated bag)	12.24	7.49	335.43	216.59	39.21	40.19 (64.54)	5.7:1
T ₅ (KMS + Decis treated bag)	11.63	7.32	330.21	213.87	38.40	40.38 (64.79)	5.5:1
T ₆ (Untreated bag)	10.36	7.43	310.23	184.77	36.44	36.55 (59.55)	5.0:1
T ₇ (Control)	9.80	6.82	295.38	171.02	35.30	35.43 (57.95)	4.8:1
Mean	11.49	7.45	336.60	211.93	38.38	38.96	5.5:1
S. Em ±	0.111	0.136	9.37	7.14	0.88	1.00	0.172
C. D. at 5%	0.344	0.419	28.84	21.99	2.73	3.10	0.530

*Note: Figures in parenthesis are arc sin values

Table 2: Studies on effect of impregnated bags on fruit firmness of mango. Cv. Mallika

Treatments	Fruit Firmness in (kg/cm ²)			
	3rd Days	6 th Days	9 th Days	12 th Days
T ₁ (Methoxam treated bag)	7.25	5.40	4.36	2.32
T ₂ (Decis treated bag)	7.35	5.73	4.60	2.38
T ₃ (Potassium metabisulphite treated bag)	7.29	5.75	4.20	2.35
T ₄ (Methoxam + Decis treated bag)	7.10	5.32	4.26	2.25
T ₅ (KMS + Decis treated bag)	7.24	5.31	4.53	2.28
T ₆ (Untreated bag)	7.23	5.30	3.80	1.98
T ₇ (Control)	6.82	5.17	3.35	1.87
Mean	7.18	5.43	4.16	2.20
S. Em ±	0.079	0.058	0.130	0.051
C. D. at 5%	0.244	0.17	0.404	0.159

Table 3: Studies on effect of impregnated bags on Incidence of pests and fruit drop of mango. Cv. Mallika

Treatments	Incidence of pests (%)				Fruit Drop in (%)			
	Mealy bug (%)	Fruit fly (%)	Stone weevil (%)	Spotted Fruit (%)	After 30 days	60 Days	90 Days	At Harvest
T ₁ (Methoxam treated bag)	0.00	0.00	0.00	0.00	0.00	6.83 (3.91)	4.30 (2.46)	2.03 (1.16)
T ₂ (Decis treated bag)	0.00	0.00	0.00	0.00	0.00	7.17 (4.11)	4.37 (2.50)	2.69 (1.54)
T ₃ (Potassium metabisulphite treated bag)	5.33 (13.34) *	0.00	0.00	0.00	0.00	7.68 (4.40)	5.09 (2.91)	1.94 (1.11)
T ₄ (Methoxam + Decis treated bag)	0.00	0.00	0.00	0.00	0.00	7.79 (4.46)	5.29 (3.03)	2.03 (1.16)
T ₅ (KMS + Decis treated bag)	0.00	0.00	0.00	0.00	0.00	8.72 (5.04)	4.31 (2.47)	2.09 (1.19)
T ₆ (Untreated bag)	5.67 (13.76)	0.13 (1.70)	1.0 (4.62)*	0.43	0.00	7.85 (4.50)	5.04 (2.89)	2.03 (1.16)
T ₇ (Control)	9.67 (18.11)	0.40 (2.76)	0.80 (4.41)	0.87	0.00	7.26 (4.16)	5.50 (3.15)	2.08 (1.19)
Mean	5.65	0.63	0.54	0.18	0.00	4.36	2.77	1.22
S. Em ±	0.25	0.747	1.12	0.14	0.00	0.25	0.10	0.062
C. D. at 5%	0.76	NS	0.22	NS	0.00	NS	NS	NS

*Note: Figures in parenthesis are arc sin values

5. Conclusion

The study has shown fruits impregnated bags influenced growth and development of mango fruits. In physical parameters among all treatments, T₂ decis treated bag was found significantly superior over rest of the treatments followed by most of the times T₃ potassium metabisulphite treated bag, T₄ Methoxam + decis treated bag, T₅ potassium metabisulphite + decis treated bag. These were found to be at par with each other. This study concluded also in incidence of pest and disease. This technique of impregnated bags very helpful to gives maximum protection of fruit from heavy attack which may not cause harmful effects on the consumer. viz., fruit fly, stone weevil, mealy bug and spotted fruit, were minimum infestation found in T₁, T₂, T₄ and T₅ where as maximum infection was noticed in treatment T₇ i.e control.

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