



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2023; 12(8): 554-560

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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 08-05-2023

Accepted: 12-06-2023

## Ravi GK

Ph.D. Scholar, Department of Fruit Science, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot

## Kulapati H

ADRE, Professor and Head, Department of Fruit Science,

## Mastiholi A

Professor of Agronomy, Principal Investigator, ZBNF Project, RHREC, Dharwad

## Shantappa T

ADRE, Professor and Head, RHREC, Dharwad

## Patil S

Assistant Professor and Head, AICRP-Vegetable Crops, RHREC, Dharwad

## Corresponding Author:

### Ravi GK

Ph.D. Scholar, Department of Fruit Science, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot

## Influence of jeevamrutha on growth, yield and quality of mango (*Mangifera indica* L.) var. Alphonso

Ravi GK, Kulapati H, Mastiholi A, Shantappa T and Patil S

### Abstract

Jeevamrutha application in mango var. Alphonso at different concentrations and at different frequent intervals was carried out on 20-year-old mango var. Alphonso at Regional Horticulture Research and Extension Centre, Dharwad (University of Horticultural Sciences, Bagalkot) during 2019-20 and 2020-21. The objective to standardize the dose and frequency of jeevamrutha application in mango. Growth parameters were found to be increased by increasing the jeevamrutha concentration at a very frequent interval. In pooled data, the total chlorophyll content in leaf was found to be maximum due to application of jeevamrutha 1000 litre/ha at an interval of 15 days (D<sub>3</sub>F<sub>1</sub>) (4.12 mg/g) was on par with D<sub>2</sub>F<sub>1</sub> (3.83 mg/g) and D<sub>1</sub>F<sub>2</sub> (3.65 mg/g). Number of fruits per tree and fruit yield varied significantly. The pooled data revealed that RPP recorded the maximum number of fruits (330.00) and fruit yield (78.64 kg/tree and 9.71 t/ha) followed by application of jeevamrutha 1000 litre/ha at an interval of 15 days (D<sub>3</sub>F<sub>1</sub>) (226.50, 56.98 kg/tree and 7.04 t/ha for number of fruits per tree, fruit yield (kg/tree) and fruit yield (t/ha) respectively). Shelf life was found to be maximum in D<sub>3</sub>F<sub>1</sub> (12.91 days).

**Keywords:** Mango, growth, yield, quality, jeevamrutha, dosage and frequency

### Introduction

Mango (*Mangifera indica* L.) is the leading fruit crop of India, belongs to the family Anacardiaceae. Native to Indo-Burma region (Mukharjee, 1958) [14] and is distributed in both in tropical and sub-tropical regions of the world. It is considered to be the 'king of fruits' because of its delicious taste and excellent flavor. The fruit is nutritionally rich and have unique taste and flavour thus, accounts for approximately half of the all tropical fruits produced globally (Anees *et al.*, 2011) [1]. In addition, mango is a rich source of vitamin A, C and they have also contains good amount of minerals, particularly potassium. In India, mango is cultivated in an area of 2.30 million hectare with an annual production of 20.53 million MT and productivity of 8.93 MT/ha. Mango has a share of 38 per cent of area and 21.7 per cent of production of total fruit production in India. Using conventional techniques in agriculture lead to deteriorate the soil health slowly and become uncultivable. It does not only makes the soil barren but eventually, the farmer goes under debt (Bishnoi and Bhatia, 2017) [3]. Natural farming practices helping farmers to get rid of debt, improve soil fertility, yield and quality product obtained.

Jeevamrutha is a low-cost improvised preparation that enriches the soil with indigenous microorganisms required for mineralization of the soil. Jeevamrutha, is a microbial culture, mainly prepared from cow dung and cow urine generally used in organic farming to meet the nutritional requirement of crops. It is a plant growth promoting substance containing beneficial microorganisms that provides all the necessary nutritional requirement for growth and yield of a crop. In this perspective, there is a need to standardize the jeevamrutha for mango crop, which is not yet standardized. Keeping these points in view, the present investigation was undertaken to study the "influence of jeevamrutha on growth, yield and quality of mango (*Mangifera indica* L.) var. Alphonso".

### Materials and Methods

The experiment was undertaken to study the influence of jeevamrutha on growth, yield and quality of mango (*Mangifera indica* L.) var. Alphonso was carried out in Regional Horticulture Research and Extension Centre, Dharwad (University of Horticultural Sciences, Bagalkot) during 2019-20 and 2020-21. The experiment was conducted on 20 years old trees of mango var. Alphonso planted at 9 m x 9 m spacing. The experiment was laid out in two Factorial Randomized Block Design with ten treatments (3 x 3 +1) and three replications.

Factor A includes D<sub>1</sub>: 500 litre/ha (4 litre/tree), D<sub>2</sub>:750 litre/ha (6 litre/tree) and D<sub>3</sub>:1000 litre/ha (8 litre/tree), Factor-B includes F<sub>1</sub>: Once in two weeks (15 days), F<sub>2</sub>: Once in three weeks (21 days) and F<sub>3</sub>: Once in four weeks (30 days) and RPP. ghanajeevamrutha was applied in july month at 1000 kg/ha. Organic mulching with sugarcane thrash (1<sup>st</sup> year) and cow pea (2<sup>nd</sup> year) was common to all the treatments except T<sub>10</sub>. Observations during the course of this study on growth parameters viz., plant height (m) and canopy volume (m<sup>3</sup>) were recorded as per standard methods. The tree canopy volume was calculated by using Castle's formula (Kumar *et al.*, 2008)<sup>[12]</sup>.

$$\text{Canopy volume} = \frac{(\text{NS} + \text{EW})^2}{2} \times \text{Canopy height (m)} \times \text{CF}$$

Where,

NS = Plant spread in North to South direction (m),

EW = Plant spread in East to West direction (m),

CF = Correction factor for mango (0.5238).

Reproductive and yield parameters in terms of number of panicles/tree, fruits harvested per tree, fruit yield (kg/plant) and fruit yield (t/ha) were recorded during fruiting period. Benefit: cost ratio was calculated by using formula, gross returns (Rs. ha<sup>-1</sup>)/total cost of cultivation (Rs. ha<sup>-1</sup>). The quality parameters like shelf life, total sugars and carotenoids (mg/100 g pulp) were worked out by following procedure suggested by Ranganna (1986)<sup>[15]</sup>. Statistical analysis was carried out according to the standard procedures.

## Results and Discussion

### Growth and biochemical parameters of leaf

Growth parameters like tree height and canopy volume was not influenced significantly either by dosage or by frequency

and their interactions and its comparison with RPP during both the years and in pooled data (Table 1). But per cent increase in tree height was observed due to higher dosage of liquid jeevamrutha application and frequency interval of once in 15 days. Total chlorophyll varied non-significantly by the dosage of liquid jeevamrutha during 2019-20 and 2020-21 but a significant difference was found in pooled. The pooled data revealed that the maximum total chlorophyll content was recorded in D<sub>3</sub> (dosage of jeevamrutha 1000 litre/ha.) (3.70 mg/g) and it was on par with D<sub>2</sub> (3.43 mg/g). Frequency of jeevamrutha influenced non-significantly on total chlorophyll content of leaf during 2019-20 but significantly influenced during 2020-21 and in pooled data. The maximum total chlorophyll was recorded in F<sub>1</sub> (3.52 mg/g and 3.68 mg/g) (application of jeevamrutha at 15 days interval) and which was on par with F<sub>2</sub> (3.38 mg/g and 3.53 mg/g) during 2020-21 and in pooled data respectively. Interaction effect between dosage and frequency of liquid jeevamrutha and the treatment of interactions compared with RPP (Recommended package of practice) was found significant for total chlorophyll content during 2019-20, 2020-21 and pooled. In pooled data, the maximum total chlorophyll content was recorded by the application of jeevamrutha 1000 lit/ha at 15 days intervals (D<sub>3</sub>F<sub>1</sub>) (4.12 mg/g) and it was on par with D<sub>2</sub>F<sub>1</sub> (3.83 mg/g) and D<sub>1</sub>F<sub>2</sub> (3.65 mg/g). Higher dosage of liquid jeevamrutha at frequent intervals helped to increase the chlorophyll content in leaves and these biochemical attributes are closely related to yield and quality parameters. Similar research findings were reported by Chaithra (2018)<sup>[5]</sup> in sunflower that increased dosage of jeevamrutha @ 1500 litre/ha had increased leaf chlorophyll content at 60 days after sowing and also the combined application of vermicompost + jeevamruth at 500 ml pot<sup>-1</sup> + beejamruth helps to increase the total chlorophyll in strawberry compared to without jeevamrutha (Sahana *et al.*, 2020)<sup>[16]</sup>.

**Table 1:** Growth and total chlorophyll content (mg/g) in leaf of mango var. Alphonso as influenced by dosage and frequency of liquid jeevamrutha

Treatment	Tree height (m)			Canopy volume (m <sup>3</sup> )			Total chlorophyll (mg/g)		
	2019-20	2020-21	Mean	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
<b>Dosage</b>									
D <sub>1</sub>	4.53	4.87	4.70	90.33	107.51	98.92	3.52	3.23	3.38
D <sub>2</sub>	4.00	4.40	4.20	54.44	67.38	60.91	3.56	3.29	3.43
D <sub>3</sub>	4.79	5.23	5.01	89.53	112.04	100.79	3.91	3.50	3.70
S. Em±	0.27	0.27	0.27	14.93	16.99	15.94	0.15	0.08	0.09
C. D. @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	0.27
<b>Frequency</b>									
F <sub>1</sub>	4.57	4.99	4.78	70.20	89.17	79.68	3.85	3.52	3.68
F <sub>2</sub>	4.21	4.60	4.41	79.35	97.55	88.45	3.68	3.38	3.53
F <sub>3</sub>	4.54	4.90	4.72	84.75	100.22	92.49	3.46	3.12	3.29
S. Em±	0.27	0.27	0.27	14.93	16.99	15.94	0.15	0.08	0.09
C. D. @ 5%	NS	NS	NS	NS	NS	NS	NS	0.25	0.27
<b>Interaction</b>									
D <sub>1</sub> F <sub>1</sub>	5.01	5.38	5.20	88.88	109.85	99.36	3.06	3.16	3.11
D <sub>1</sub> F <sub>2</sub>	4.43	4.79	4.61	106.69	125.15	115.92	3.97	3.33	3.65
D <sub>1</sub> F <sub>3</sub>	4.14	4.43	4.29	75.43	87.52	81.48	3.52	3.21	3.37
D <sub>2</sub> F <sub>1</sub>	4.31	4.75	4.53	75.88	93.35	84.61	4.27	3.38	3.83
D <sub>2</sub> F <sub>2</sub>	3.44	3.84	3.64	35.99	45.90	40.95	3.15	3.71	3.43
D <sub>2</sub> F <sub>3</sub>	4.23	4.61	4.42	51.44	62.91	57.17	3.27	2.78	3.02
D <sub>3</sub> F <sub>1</sub>	4.37	4.84	4.61	45.84	64.31	55.08	4.22	4.02	4.12
D <sub>3</sub> F <sub>2</sub>	4.74	5.19	4.96	95.36	121.60	108.48	3.91	3.10	3.51
D <sub>3</sub> F <sub>3</sub>	5.25	5.65	5.45	127.39	150.22	138.81	3.59	3.37	3.48
S. Em±	0.47	0.47	0.47	25.86	29.43	27.61	0.26	0.14	0.16
C. D. @ 5%	NS	NS	NS	NS	NS	NS	0.78	0.43	0.48

RPP	4.63	5.06	4.85	107.48	132.47	119.98	3.66	2.85	3.26
S. Em±	0.49	0.50	0.49	26.97	30.78	28.84	0.25	0.14	0.15
C. D. @ 5%	NS	NS	NS	NS	NS	NS	0.74	0.41	0.45

D <sub>1</sub> - Jeevamrutha 500 litre/ha (4.0 litre/tree)	F <sub>1</sub> - Once in 15 days	F <sub>3</sub> - Once in 30 days
D <sub>2</sub> - Jeevamrutha 750 litre/ha (6.0 litre/tree)	F <sub>2</sub> - Once in 21 days	RPP- Recommended package of practice
D <sub>3</sub> - Jeevamrutha 1000 litre/ha (8.0 litre/tree)		

**Yield parameters**

The data on number of panicles per tree, number of fruits/tree, fruit yield (kg/tree and t/ha) were presented in Table 2 and Fig. 1. The data on number of panicles per tree varied non-significantly by the dosage of liquid jeevamrutha, frequency and their interaction during both the years (2019-20 and 2020-21) and in pooled data except due to dosage during 2020-21. The maximum number of panicles were recorded by the application of jeevamrutha at 1000 litre/ha (D<sub>3</sub>) (390.56) which was on par with D<sub>2</sub> (373.00). Data on the number of panicles per tree resulted in non-significant differences for treatments of interaction compared with RPP (Recommended package of practice) during 2019-20 and 2020-21 and in pooled data. Number of fruits per tree was found significant difference as influenced by the dosage of liquid jeevamrutha during both the years and in pooled. In pooled data significantly, the maximum number of fruits were recorded in D<sub>3</sub> (207.61) followed by D<sub>2</sub> (169.67). The interpretation of data revealed significant difference for the number of fruits per tree among the different frequency levels of liquid jeevamrutha during 2020-21 and pooled. The maximum

number of fruits recorded in F<sub>1</sub> (182.67 and 200.17) during 2020-21 and pooled respectively, but in pooled it was on parity with F<sub>2</sub> (173.89). Non-significant interaction was recorded between dosage and frequency of jeevamrutha application for a number of fruits per tree during 2019-20 and in pooled data but there was a significant interaction was observed during 2020-21. The mean maximum number of fruits was recorded by the application of jeevamrutha 1000 litre/ha at an interval of 15 days (D<sub>3</sub>F<sub>1</sub>) (201.00) and it was on par with D<sub>1</sub>F<sub>1</sub> (188.33), D<sub>3</sub>F<sub>3</sub> (180.00), D<sub>3</sub>F<sub>2</sub> (164.33) D<sub>2</sub>F<sub>1</sub> (158.67) and D<sub>1</sub>F<sub>2</sub> (158.00). Recommended package of practice (RPP) differs significantly over the interaction treatments during both the years and in pooled data. Pooled data pointed out that the maximum number of fruits was recorded in RPP (330.00) followed by D<sub>3</sub>F<sub>1</sub> (226.50). Fruit yield (kg/tree) differed significantly by dosage of liquid jeevamrutha during both the years (2019-20 and 2020-21) and in pooled data. Pooled data revealed that, significantly maximum fruit yield was recorded by application of jeevamrutha 1000 litre/ha (D<sub>3</sub>) (51.63 kg/tree and 6.37 t/ha).

**Table 2:** Yield parameters of mango var. Alphonso as influenced by dosage and frequency of liquid jeevamrutha

Treatment	Number of panicles/ tree			Number of fruits per tree			Fruit yield (kg/tree)			Fruit yield (t/ha)			B:C ratio		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
<b>Dosage</b>															
D <sub>1</sub>	412.78	320.89	366.83	174.22	148.33	161.28	43.24	38.06	40.65	5.34	4.70	5.02	2.44	2.42	2.43
D <sub>2</sub>	439.56	373.00	406.28	184.44	154.89	169.67	44.71	39.16	41.94	5.52	4.83	5.18	2.38	2.41	2.39
D <sub>3</sub>	472.78	390.56	431.67	233.44	181.78	207.61	56.82	46.43	51.63	7.02	5.73	6.37	2.91	2.72	2.82
S. Em±	44.23	18.78	21.96	16.00	8.46	8.78	2.82	1.49	1.58	0.35	0.18	0.20	0.15	0.09	0.09
C.D. @ 5%	NS	56.29	NS	47.95	25.37	26.33	8.45	4.48	4.74	1.04	0.55	0.59	0.44	0.27	0.26
<b>Frequency</b>															
F <sub>1</sub>	445.67	396.44	421.06	217.67	182.67	200.17	53.28	46.37	49.82	6.58	5.72	6.15	2.66	2.65	2.66
F <sub>2</sub>	437.78	339.00	388.39	190.11	157.67	173.89	46.95	40.77	43.86	5.80	5.03	5.41	2.53	2.51	2.52
F <sub>3</sub>	441.67	349.00	395.33	184.33	144.67	164.50	44.56	36.52	40.54	5.50	4.51	5.00	2.53	2.39	2.46
S. Em±	44.23	18.78	21.96	16.00	8.46	8.78	2.82	1.49	1.58	0.35	0.18	0.20	0.15	0.09	0.09
C.D. @ 5%	NS	NS	NS	NS	25.37	26.33	NS	4.48	4.74	NS	0.55	0.59	NS	NS	NS
<b>Interaction</b>															
D <sub>1</sub> F <sub>1</sub>	439.33	378.67	409.00	194.67	188.33	191.50	48.21	46.76	47.49	5.95	5.77	5.86	2.56	2.81	2.69
D <sub>1</sub> F <sub>2</sub>	437.33	303.33	370.33	173.67	158.00	165.83	42.36	40.02	41.19	5.23	4.94	5.09	2.40	2.57	2.49
D <sub>1</sub> F <sub>3</sub>	361.67	280.67	321.17	154.33	98.67	126.50	39.17	27.41	33.29	4.84	3.38	4.11	2.34	1.88	2.11
D <sub>2</sub> F <sub>1</sub>	452.00	394.67	423.33	206.33	158.67	182.50	49.75	40.24	44.99	6.14	4.97	5.55	2.50	2.31	2.41
D <sub>2</sub> F <sub>2</sub>	397.67	353.67	375.67	168.00	150.67	159.33	42.42	39.50	40.96	5.24	4.88	5.06	2.30	2.43	2.36
D <sub>2</sub> F <sub>3</sub>	469.00	370.67	419.83	179.00	155.33	167.17	41.98	37.74	39.86	5.18	4.66	4.92	2.34	2.48	2.41
D <sub>3</sub> F <sub>1</sub>	445.67	416.00	430.83	252.00	201.00	226.50	61.87	52.10	56.98	7.64	6.43	7.04	2.92	2.82	2.87
D <sub>3</sub> F <sub>2</sub>	478.33	360.00	419.17	228.67	164.33	196.50	56.06	42.79	49.43	6.92	5.28	6.10	2.89	2.53	2.71
D <sub>3</sub> F <sub>3</sub>	494.33	395.67	445.00	219.67	180.00	199.83	52.54	44.41	48.47	6.49	5.48	5.98	2.92	2.82	2.87
S. Em±	76.60	32.52	38.03	27.70	14.66	15.21	4.88	2.59	2.74	0.60	0.32	0.34	0.25	0.16	0.15
C.D. @ 5%	NS	NS	NS	NS	43.94	NS	NS	7.76	NS	NS	0.96	NS	NS	NS	0.47
RPP	519.00	414.67	466.83	356.67	303.33	330.00	84.72	72.57	78.64	10.46	8.96	9.71	3.85	3.72	3.79
S. Em±	74.14	31.09	36.32	30.22	18.26	16.59	4.95	3.25	2.89	0.61	0.40	0.36	0.25	0.18	0.15
C.D. @ 5%	NS	NS	NS	89.80	54.24	49.29	14.72	9.67	8.60	1.82	1.19	1.06	0.74	0.52	0.46

Cost of raw mango fruits - RPP- 40 Rs. and 46 Rs.per kg during 2019-20 and 2020-21 respectively B:C ratio : Gross income/ total cost of cultivation. Natural farming treatments- 50 Rs. and 60 Rs. per kg during 2019-20 and 2020-21 respectively

D <sub>1</sub> - Jeevamrutha 500 litre/ha (4.0 litre/tree)	D <sub>3</sub> - Jeevamrutha 1000 litre/ha (8.0 litre/tree)	F <sub>2</sub> - Once in 21 days	F <sub>3</sub> - Once in 30 days
D <sub>2</sub> - Jeevamrutha 750 litre/ha (6.0 litre/tree)	F <sub>1</sub> - Once in 15 days	RPP- Recommended package of practice	

The fruit yield (kg per tree) demonstrated non-significant variation among different frequency levels during 2019-20 but significant variation was recorded during 2020-21 and in pooled. In pooled data, the maximum fruit yield was recorded in F<sub>1</sub> (application of jeevamrutha at 15 days intervals) (49.82 kg/tree and 6.15 t/ha). Interaction of dosage and frequency levels had varied non-significantly for fruit yield (kg/tree) during 2019-21 and in pooled data.

But the significant difference was noted in 2020-21, the maximum fruit yield (kg/tree) was recorded due to the application of jeevamrutha 1000 litre/ha at an interval of 15 days (D<sub>3</sub>F<sub>1</sub>) (52.10 kg/tree and 6.43 t/ha) and it was on par with D<sub>1</sub>F<sub>1</sub> (46.76 kg/tree and 5.77 t/ha) and D<sub>3</sub>F<sub>3</sub> (44.41 kg/tree and 5.48 t/ha). The higher yield was recorded in D<sub>3</sub> (Jeevamrutha @ 1000 litre/ha) and F<sub>1</sub> (15 days once) might be due to favorable effects of macro and micronutrients, which helps in better availability of nutrients throughout the crop growth which might be the result of improved microbial activity in the soil. These findings are in accordance with Kasbe *et al.* (2009) [10] where in, it is reported that higher nutrient status of jeevamrutha formulation (2500 l ha<sup>-1</sup>) resulted in profused growth in the form of higher drymatter accumulation and yield parameters and Sutar *et al.* (2019) [20] reported that jeevamrutha at 1000 litre/ha was recorded maximum number of pods per plant, grain yield and Haulm yield in cow pea compared to 500 litre/ha of jeevamrutha and control. Whenever liquid manures like jeevamrutha was applied at regular intervals (15 days once), they acted as a stimulus in the plant system and in turn increase the production of growth regulators in the cell system and growth hormones which in turn might have enhanced the soil

biomass, there by sustaining the availability and uptake of applied as well as native soil nutrients which ultimately have resulted in better growth and yield of crops (Sutar *et al.*, 2019) [20].

Interaction treatments compared with RPP (recommended package of practice) significantly influenced fruit yield during individual years and pooled data. The pooled data revealed that the maximum fruit yield was recorded in RPP (78.64 kg/tree and 9.71 t/ha) followed by D<sub>3</sub>F<sub>1</sub> (56.98 kg/tree and 7.04 t/ha) and the minimum fruit yield was recorded in D<sub>1</sub>F<sub>3</sub> (33.29 kg/tree and 4.11 t/ha). The increased yield in RPP (recommended package of practice) due to application of nutrients through FYM and chemical fertilizers might be attributed to the quick release and availability of nutrients in required quantity with the application of fertilizers. Further, FYM acts as store house for various micro and macro nutrients that are released during the process of mineralization. Which intern increase the fruit bud differentiation, number of panicles and retained maximum number of fruits was due to protection from major pest (leaf hoppers) and disease (powdery mildew) by the use of chemical pesticides and fungicides. The results are supported with the findings of Gorabal (2020) [7] where in, it is reported that application of FYM and fertilizers resulted in higher yield and its components were recorded in groundnut compared to jeevamrutha and ghana jeevamrutha and their interactions and Anusha *et al.* (2018) [2] reported that application of 100 per cent RDF improved the yield attributes compare to organic sources of nutrients. The results are in agreement with the findings of Gore and Sreenivasa, 2011; Mahapatra *et al.*, 2017. [8, 13]

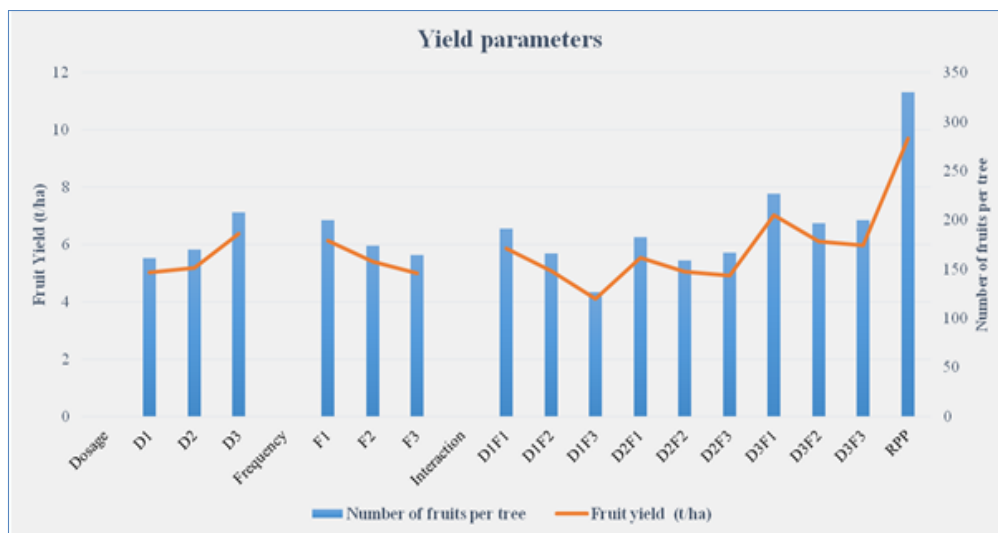


Fig 1: Yield parameters of mango var. Alphonso as influenced by dosage and frequency of liquid jeevamrutha.

D <sub>1</sub> - Jeevamrutha 500 litre/ha (4.0 litre/tree)	F <sub>1</sub> - Once in 15 days	F <sub>3</sub> - Once in 30 days
D <sub>2</sub> - Jeevamrutha 750 litre/ha (6.0 litre/tree)	F <sub>2</sub> - Once in 21 days	RPP- Recommended package of practice
D <sub>3</sub> - Jeevamrutha 1000 litre/ha (8.0 litre/tree)		

The dosage of liquid jeevamrutha vary significantly for B: C ratio during both the years and pooled data. The pooled data revealed that the dosage of liquid jeevamrutha at 1000 litre per ha. (D<sub>3</sub>) registered the highest B: C ratio (2.82: 1). Frequency and the interaction treatments was not found significant difference for B: C ratio during 2019-20, 2020-21 and pooled.

The interactions compared with RPP was significantly influenced for B: C ratio during both the years and pooled data. The pooled data confessed that significantly highest B: C ratio was recorded in RPP (3.79:1) followed by D<sub>3</sub>F<sub>1</sub> (2.87:1). The highest benefit : cost ratio was obtained in RPP (recommended package of practice) even though cost of fertilizers, pesticides and fungicides were more, but maximum



yield was recorded in RPP because by use of chemicals easily managed the pest and diseases upon using this chemical fertilizers and pesticides the soil and human health will be deteriorated, in future soil will become uncultivable hence by natural farming practices like jeevamrutha, ghana jeevamrutha, biopesticides and bio fungicides were used in different treatments at different levels of jeevamrutha. Natural farming treatment fruits fetched 30% more price than RPP, which is based on the current market price for organically grown raw mangoes were calculated. The results are

supported with the findings of Chaithra and Sujith, (2021) [4] where in the highest B: C ratio of 2.23:1 by the application of 150% N equivalent through FYM + Jeevamrutha @ 1500 l ha<sup>-1</sup> compared to lower doses of jeevamrutha. Sutar (2016) [19] reported that highest benefit cost ratio (2.95:1) was recorded with application of jeevamrutha @ 1000 l ha<sup>-1</sup>. These results are supported with the findings of (Siddappa, 2015; Kumar, 2016; Chaithra, 2018; Gorabal, 2020; Sharma et al., 2021) [11, 5, 7, 18].

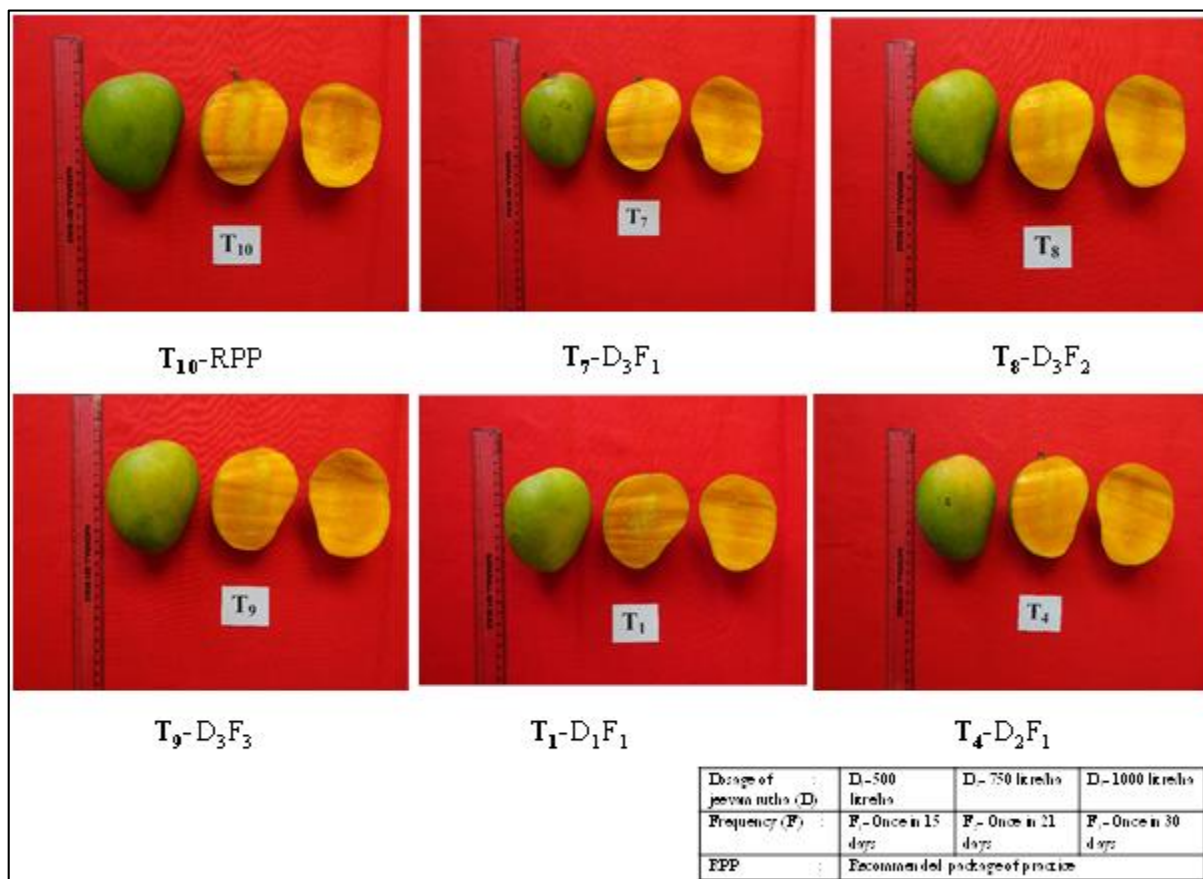


Plate 1: View of fruits from different treatment in experiment - I

Table 3: Quality parameters of mango var. Alphonso as influenced by dosage and frequency of liquid jeevamrutha.

Treatment	Shelf life (number of days)			Total sugars (%)			Carotenoids (mg/100g pulp)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
<b>Dosage</b>									
D <sub>1</sub>	11.71	11.27	11.49	15.47	15.81	15.64	1.71	1.75	1.73
D <sub>2</sub>	12.48	11.96	12.22	15.64	15.80	15.72	1.78	1.94	1.86
D <sub>3</sub>	12.30	13.31	12.80	15.61	15.80	15.71	1.91	1.89	1.90
S. Em±	0.49	0.57	0.34	0.23	0.25	0.16	0.06	0.06	0.05
C. D. @ 5%	NS	NS	1.01	NS	NS	NS	NS	NS	NS
<b>Frequency</b>									
F <sub>1</sub>	12.66	12.28	12.47	15.31	15.08	15.19	1.90	1.88	1.89
F <sub>2</sub>	11.42	11.20	11.31	15.25	16.13	15.69	1.86	1.85	1.85
F <sub>3</sub>	12.41	13.07	12.74	16.16	16.21	16.19	1.64	1.85	1.75
S. Em±	0.49	0.57	0.34	0.23	0.25	0.16	0.06	0.06	0.05
C. D. @ 5%	NS	NS	1.01	0.69	0.75	0.49	0.18	NS	NS
<b>Interaction</b>									
D <sub>1</sub> F <sub>1</sub>	12.03	11.46	11.74	14.67	14.98	14.83	1.84	1.76	1.80
D <sub>1</sub> F <sub>2</sub>	10.93	10.50	10.72	15.41	16.67	16.04	1.69	1.86	1.78
D <sub>1</sub> F <sub>3</sub>	12.15	11.87	12.01	16.33	15.79	16.06	1.58	1.63	1.61
D <sub>2</sub> F <sub>1</sub>	13.23	12.26	12.75	15.69	15.06	15.37	1.96	1.94	1.95
D <sub>2</sub> F <sub>2</sub>	12.27	10.26	11.26	14.98	15.93	15.46	1.86	2.00	1.93
D <sub>2</sub> F <sub>3</sub>	11.95	13.37	12.66	16.26	16.42	16.34	1.52	1.88	1.70

D <sub>3</sub> F <sub>1</sub>	12.70	13.12	12.91	15.56	15.21	15.38	1.90	1.94	1.92
D <sub>3</sub> F <sub>2</sub>	11.06	12.83	11.95	15.36	15.78	15.57	2.02	1.69	1.85
D <sub>3</sub> F <sub>3</sub>	13.14	13.97	13.55	15.90	16.43	16.16	1.81	2.04	1.93
S. Em±	0.86	0.98	0.58	0.40	0.43	0.28	0.10	0.11	0.08
C. D. @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
RPP	11.53	11.10	11.32	15.99	16.53	16.26	1.92	1.88	1.90
S. Em±	0.82	0.97	0.56	0.38	0.41	0.27	0.10	0.10	0.08
C. D. @ 5%	NS	NS	1.65	NS	NS	0.82	0.29	NS	NS

D <sub>1</sub> - Jeevamrutha 500 litre/ha (4.0 litre/tree)	F <sub>1</sub> - Once in 15 days	F <sub>3</sub> - Once in 30 days
D <sub>2</sub> - Jeevamrutha 750 litre/ha (6.0 litre/tree)	F <sub>2</sub> - Once in 21 days	RPP- Recommended package of practice
D <sub>3</sub> - Jeevamrutha 1000 litre/ha (8.0 litre/tree)		

### Quality parameters

The fruit quality parameters like shelf life, total sugars and carotenoids were presented in Table 3. The shelf life was non-significantly influenced due to dosage of liquid jeevamrutha during 2019-20 and 2020-21 but significantly influenced during pooled. Significantly, the maximum shelf life was recorded by the application of jeevamrutha 1000 litre/ha (D<sub>3</sub>) (12.80 days) and it was on par with D<sub>2</sub> (12.22 days) in pooled data. The frequency levels and interaction between dosage and frequency was not differed significantly. When the interactions compared with RPP influenced significantly in pooled data. The pooled data revealed that the highest shelf life was recorded in D<sub>3</sub>F<sub>3</sub> (13.55 days) and this was on par with other treatment interactions except D<sub>1</sub>F<sub>1</sub>, RPP, D<sub>2</sub>F<sub>2</sub> and D<sub>1</sub>F<sub>2</sub>.

The increase in shelf life might be due to reduced respiration of fruits as influenced by the presence of a higher amount of calcium and potassium resulting in increase in the membrane integrity of fruits, so that the fruits could retain more water against the force of evaporation and possibly they might have also altered some of the proteinaceous constituents (Gangadhar *et al.* 2020; Sahana *et al.* 2020) [16, 6].

Total sugars influenced significantly by frequency and interactions compared with RPP. The maximum total sugars was recorded in F<sub>3</sub> (16.19%) and in case of interactions compared with RPP, the maximum total sugar was recorded by the application of jeevamrutha 750 litre/ha at an interval of 30 days (D<sub>2</sub>F<sub>3</sub>) (16.34%) which was on par with other treatment interactions and RPP except D<sub>2</sub>F<sub>2</sub>, D<sub>3</sub>F<sub>1</sub>, D<sub>2</sub>F<sub>1</sub> and D<sub>1</sub>F<sub>1</sub>. The carotenoids varied non-significantly due to dosage, frequency of liquid jeevamrutha and their interactions and its comparison with RPP during both the years and pooled data. Except due to dosage and interactions compared with RPP during 2019-20. The increase in total sugars could be attributed to the conversion of reserved starch and other insoluble carbohydrates into soluble sugars. The results are supported with the findings of Jhade *et al.* (2020) and Sahana *et al.* (2020) [16, 9].

### Conclusions

RPP (recommended package of practice) registered significant improvement in fruit yield of 9.71 t/ha with good management of pest and diseases. However, in interaction treatments, application of jeevamrutha @ 1000 litre/ha at an interval of 15 days registered the highest fruit yield of 7.04 t/ha with good maintenance of soil nutrient status by increasing the microbial and enzyme activity in the soil. RPP obtained the highest B: C ratio (3.79:1) which was followed by dosage of jeevamrutha @ 1000 litre/ha at an interval of 15 days (D<sub>3</sub>F<sub>1</sub>).

### Acknowledgement

Authors are thankful to Director of research, University of Horticultural Sciences, Bagalkot for providing financial assistance to conduct the research work under zero budget natural farming scheme at Regional Horticultural Research and Extension Centre, Kumbapur, Dharwad.

### Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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