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Yield, Economics and Quality of Guava as Influenced by Varied Levels and Frequency of Application of Jeevamrutha

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ABSTRACT

Background: Sustainable production of fruit crops with the use of locally available natural resources to reduce dependence on external inputs needs to be addressed with suitable alternatives. Standardization of optimum dose of inputs used in natural farming helps the farmers for profitable cultivation of crops under ecological farming systems.

Methods: The field study in 15 year old guava(*Psidium guajava* L.) orchard was conducted consecutively for three years to optimize the dosage and frequency of jeevamrutha applied at Regional Horticultural Research and Extension Centre, Dharwad, Karnataka. There were nine treatment combinations which were compared with three controls and replicated thrice. The experiment was laid out under factorial randomized block design.

Result: Higher dosage of jeevamrutha (1000 l/ha) applied at shorter interval (once in 15 days) (D_3F_1) recorded higher yield, yield parameters, net returns and B: C ratio. However, recommended package of practices (RPP) recorded higher yield, returns and B: C ratio than all other treatments under study. The quality parameters such as TSS, TSS: Acid ratio, reducing sugars, non-reducing sugars and total sugars content were found higher in RPP. However, the values of the quality parameters recorded in D_3F_1 were found on par with RPP.

Key Words: Economics, Guava, Jeevamrutha, Quality, Yield.

INTRODUCTION

There is a renewed interest by some farmers towards ecofriendly farming practices such as natural farming owing to the negative impacts of use of chemicals in agriculture. Indiscriminate and irrational use of fertilizers and pesticides caused environmental pollution and destruction of micro and macro flora and fauna in soil. Most of the fruits and vegetables are consumed a fresh. The chemical residues in these produce has put the health of people at risk. The cost of production is also increasing enormously as a result of increased input costs in modern crop production in post-green revolution period. All these problems compel the farmers to look for an alternate production system to overcome the constraints.

Growing fruit crops in natural ways by adopting natural farming principles is one of the recent approaches being followed by some farmers. As per Palekar (2006) use of beejamrutha, jeevamrutha, besides application of organic mulch and maintenance of 'waphasa' in crop production are the core practices in natural farming. However, these practices need to be standardized for sustainable fruit production. The natural farming practices provide favorable environment to the microorganisms present in soil (Bishnoi and Bhatia, 2017) besides preventing development of fungal and bacterial plant disease causing organisms (Keerthi *et al.,* 2018). The productivity of tropical orchards is declining due to deterioration of soil health. Improvement of orchard soil is a must for enhancement of productivity and fruit yield along with quality.

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Guava (*Psidium guajava* L.) also known as 'apple of tropics' or 'poor man's apple' is highly productive, delicious and nutritious fruit grown commercially throughout the tropical and sub-tropical regions of India. It is the fourth most important fruit crop in area and production after mango, banana and citrus (Bose and Mithra, 2001). In India, guava is cultivated in an area of 265 thousand hectare with an annual production of 4054 thousand tons and productivity of 15.3 MT per hectare. In Karnataka, guava is cultivated in an area of 7.18 thousand hectares with an annual production

of 140.23 thousand MT with a productivity of 19.52 MT per hectare (Anon., 2018).

Though some growers are practicing natural farming but, the inputs used in natural farming such as beejamrutha, jeevamrutha and astras (neemastra, agniastra, brahmastra *etc*.) used in plant protection are not standardized for crops to optimize the yield and maximize the profit. In this backdrop, an experiment to study the influence of different dosage and frequency of application of liquid jeevamrutha on yield, economics and quality of guava cultivation was undertaken.

MATERIALS AND METHODS

Field experiment was conducted on 15 years old guava trees of cv. L-49 at the Regional Horticultural Research and Extension Centre, Dharwad, Karnataka, India.The experimental site comes under the Northern Transitional Zone (Zone 8) of Karnataka which lies between the western heavy rainfall areas of Hilly Zone (Zone 9) and low rainfall areas of Northern Dry Zone (Zone 3) of Karnataka. The area receives average annual rainfall of 802.1 mm. Trees planted at a spacing of 7.5 m × 7.5 m with uniform growth were selected in guava orchard for the experiment. The soil of the experimental plot was sandy loam, reddish brown in colour, well drained having moderate water holding capacity with good aeration.

The treatments consisted of three levels of dosage of liquid jeevamrutha such as D_1: 500 l/ha (2.8 l/tree), D_2: 750 l/ha (4.2 litre/tree) and D_3: 1000 l/ha (5.6 litre/tree) and three levels of frequency of application such as F_1: Once in two weeks (15 days), F_2: Once in three weeks (21 days) and F_3: Once in four weeks (30 days). There were nine treatment combinations which were compared with three check treatments such as application of only liquid jeevamrutha @500 l/ha once in three weeks (21 days) (J), application of only ghanajeevamrutha @1000 kg/ha at the beginning of the season (GJ) and recommended package of practice (NPK @300: 120: 150 g/tree+FYM @25 kg/tree) (RPP). The tree basin was covered with organic residue @5 tons per hectare (28 kg/tree basin or 4" thick) as organic mulch in all the treatments, except RPP. There were totally 12 treatments which were replicated thrice and the experiment was laid out in factorial randomized block design (FRBD). The experiment was conducted consecutively for three years (2019-20, 2020-21 and 2021-22).

The number of fruits harvested was determined by counting the number of fruits harvested per tree. Fruits harvested from the treatment plots were converted into fruit yield expressed in ton per hectare. TSS was recorded by using hand refractometer and expressed in °Brix. Titrable acidity was estimated as per the procedure given by Srivastava and Kumar (1994) and TSS: Acid ratio was calculated by dividing TSS with respective acidity values. Reducing, non-reducing and total sugars (Ranganna, 1986) and ascorbic acid content (AOAC, 1990) of fruits was estimated as per the procedures. The shelf life of fruits was determined by counting the number of days from harvesting till they remained in a good edible condition without spoilage under ambient condition which was judged through visual appearance. The economics was worked by taking into account the costs of all the operations, prevailing costs of inputs and price of the produce. The data collected was analysed statistically as per the procedure outlined by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Yield

Application of jeevamrutha @1000 litreper hectare at an interval of 15 days (D_3F_1) recorded significantly maximum

Table 1: Yield parameters in guava cv. L-49 as influenced by different dosage and frequency of liquid jeevamrutha.

Treatment	Fruit yield (kg/tree)				Fruit yield (t/ha)			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
D_1F_1	81.08^{bcd}	85.32^{bcde}	87.61^{bcd}	84.66^{cde}	14.43^{bcd}	15.19^{cde}	15.59^{bcd}	15.07^{cde}
D_1F_2	73.84^{de}	79.18^{de}	82.60^{de}	78.52^{def}	13.14^{de}	14.09^{de}	14.70^{dc}	13.98^{def}
D_1F_3	69.76e	76.78e	78.30e	74.92f	12.42^{e}	13.67^{e}	13.94^{e}	13.34^{f}
D_2F_1	89.66^{ab}	93.39^{ab}	95.17^{ab}	92.76^{ab}	15.96^{ab}	16.62^{ab}	16.94^{ab}	16.51^{ab}
D_2F_2	80.47^{bcd}	87.14^{bcd}	90.61^{abcd}	86.05^{bcd}	14.32^{bcd}	15.51^{bcd}	16.13a^{bcd}	15.32^{bcd}
D_2F_3	69.24^{e}	79.22^{de}	83.42^{de}	77.31^{ef}	12.32^{e}	14.10^{de}	14.85^{de}	13.76^{ef}
D_3F_1	95.72^{a}	97.47^{a}	98.45^{a}	97.20^{a}	17.04^{a}	17.35^{a}	17.52^{a}	17.30^{a}
D_3F_2	85.64^{abc}	89.68^{abc}	92.59^{abc}	89.28^{abc}	15.24^{abc}	15.96^{abc}	16.48^{abc}	15.89^{abc}
D_3F_3	78.24^{cde}	83.78^{cde}	84.92^{cde}	82.29^{cdef}	13.93^{cde}	14.91^{cde}	15.12^{cde}	14.65^{cdef}
S.Em±	3.37	3.01	2.94	2.65	0.60	0.54	0.52	0.47
C.D. (0.05)	10.10	9.03	8.81	7.95	1.80	1.64	1.57	1.41
J	68.68	70.07	74.08	70.92	12.22	12.47	13.19	12.62
GJ	57.23	59.67	62.59	59.81	10.19	10.62	11.14	10.65
RPP	103.55	104.70	110.02	106.04	18.43	18.64	19.58	18.88
S.Em±	3.36	3.93	3.21	2.91	0.60	0.70	0.57	0.52
C.D. (0.05)	9.87	11.53	9.42	8.53	1.76	2.05	1.68	1.52

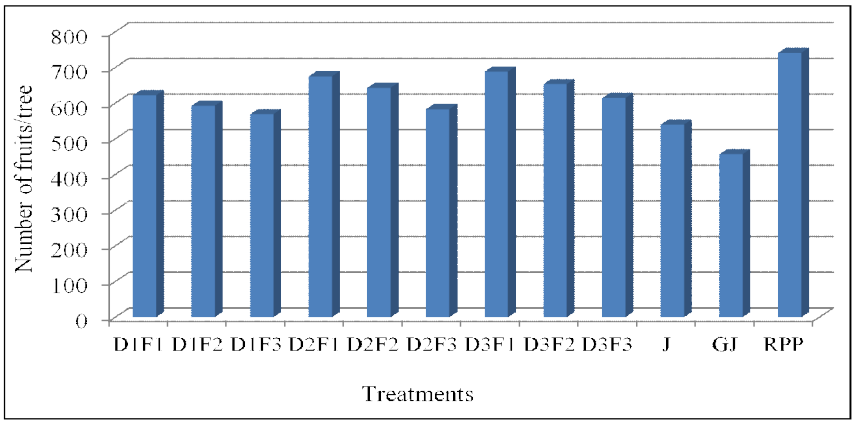

Fig 1: Effect of dosage and frequency of jeevamrutha application on number of fruits per tree in guava (Pooled of 3 years).

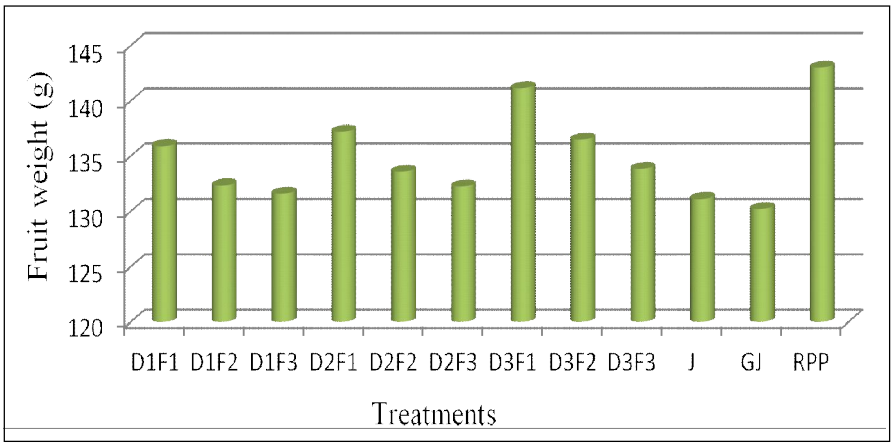

Fig 2: Effect of dosage and frequency of jeevamrutha application on fruit weight (g) in guava (Pooled of 3 years).

Table 2: Economics of guava cultivation as influenced by different dosage and frequency of liquid jeevamrutha (Mean of three years).

Treatment	Fruit yield (t/ha)	Cost of cultivation (Rs.)	Gross return (Rs.)	Net return (Rs.)	B:C ratio
D_1F_1	15.07	156938	301400	144462	1.92
D_1F_2	13.98	143957	279600	135643	1.94
D_1F_3	13.34	133993	266800	132807	1.99
D_2F_1	16.51	170118	330200	160082	1.94
D_2F_2	15.32	164483	306400	141917	1.86
D_2F_3	13.76	141697	275200	133503	1.94
D_3F_1	17.30	166290	346000	179710	2.08
D_3F_2	15.89	161722	317800	156078	1.96
D_3F_3	14.65	147388	293000	145612	1.99
J	12.62	143391	262400	119009	1.83
GJ	10.65	123817	213000	89183	1.72
RPP	18.88	101705	377600	275895	3.71

*Market price of guava fruits Rs. 20/kg

number of fruits (689/tree), av. fruit weight (141.15 g) and fruit yield (97.20 kg/tree and 17.30 t/ha) in pooled data (Table 1 and Fig 1 and 2). Jeevamrutha @1000 litreper hectare applied at longer intervals (once in 21 days) (D_3F_2) also recorded on par yield with D_3F_1. However, the yield obtained in D_3F_1 was 8.37 per cent lower than the yield in recommended package of practice. But, there were 37.08 and 62.44 per cent increase in yield in D_3F_1 when compared to application of only jeevamrutha (J) and only ghanajeevamrutha (GJ), respectively.The highest yield in

Table 3: Fruit quality parameters in guava cv. L-49 as influenced by different dosage and frequency of liquid jeevamrutha (Pooled of 2019-20, 2020-21 and 2021-22).

Treatment	TSS (°Brix)	Acidity (%)	TSS-Acid ratio	Ascorbic acid (mg/100g)
D_1F_1	11.48	0.42	26.81	152.64
D_1F_2	11.33	0.43	26.21	154.54
D_1F_3	11.03	0.45	25.36	151.43
D_2F_1	11.80	0.40	29.0	152.67
D_2F_2	11.38	0.40	28.64	150.38
D_2F_3	11.12	0.42	26.41	154.19
D_3F_1	12.40	0.39	31.44	156.25
D_3F_2	11.82	0.41	29.15	150.77
D_3F_3	11.31	0.42	27.00	152.31
S.Em±	0.29	0.01	3.44	1.32
C.D. (0.05)	NS	NS	NS	NS
J	10.68	0.50	21.38	153.23
GJ	10.23	0.50	20.25	152.46
RPP	12.77	0.42	32.92	157.37
S.Em±	0.26	0.01	1.01	1.61
C.D. (0.05)	0.75	NS	2.97	NS

Table 4: Fruit bio-chemical parameters and shelf life ofin guava cv. L-49 as influenced by different dosage and frequency of liquid jeevamrutha (Pooled of 2019-20, 2020-21 and 2021-22).

Treatment	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Shelf life (Days)
D_1F_1	4.39	2.51	6.89	6.67
D_1F_2	4.28	2.37	6.64	6.50
D_1F_3	4.04	2.28	6.32	6.33
D_2F_1	4.44	2.59	7.03	7.33
D_2F_2	4.25	2.48	6.73	6.83
D_2F_3	4.19	2.34	6.53	6.50
D_3F_1	4.68	2.69	7.37	7.67
D_3F_2	4.54	2.54	7.08	7.00
D_3F_3	4.37	2.48	6.85	6.83
S.Em±	0.19	0.07	0.19	0.43
C.D. (0.05)	NS	NS	NS	NS
J	4.15	2.42	6.58	6.33
GJ	4.10	2.36	6.46	6.17
RPP	4.86	2.83	7.69	6.00
S.Em±	0.19	0.07	0.20	0.43
C.D. (0.05)	0.55	0.20	0.58	NS

(D_3F_1 might be due to favorable effects of macro and micronutrients availability in soil as a result of improved microbial activity in the soil upon application of jeevamrutha. The positive effects of higher dosage of jeevamrutha application in terms of higher dry matter accumulation and yield was also observed by Kasbe *et al.* (2009) in field bean and Sutar *et al.* (2019) in cow pea. Even after three years consecutive study, yields in the best treatment combination (D_3F_1) do not equal the yield obtained in RPP treatments. The higher yield in RPP was due to supply of required nutrients through both FYM and chemical fertilizers. Further, FYM is the store house of both macro and micronutrients that are released during mineralization and thereby making them available to the plants. Higher yield of crops in RPP compared to only organic sources of nutrients were also recorded in groundnut (Gorabal, 2020).

Economics

Among the different combination of dosage and frequency of application of jeevamrutha, higher dosage applied at frequent intervals (D_3F_1) recorded higher net return (Rs. 179710/ha) with higher B: C ratio of 2.08. However, this was found lower than RPP (net return of Rs. 275895/ha and B: C ratio of 3.71). The higher return and B: C ratio in D_3F_1 was due to higher gross return as a result of higher fruit yield. The higher cost of cultivation recorded in all the jeevamrutha treatments than RPP, was due to higher labour cost towards preparation and frequent application of jeevamrutha and plant protection inputs. The higher yield obtained in RPP resulted in higher gross (Rs. 377600/ha) and net return (Rs. 275895/ha) and B: C ratio (3.71) (Table 2). Similar observations were recorded in sunflower (Chaithra and Sujith, 2021) and cowpea (Sutar, 2016) by earlier workers.

Quality parameters

The different levels and frequency of application of jeevamrutha did not influence the guava fruit quality. However, TSS (12.77 °Brix) and TSS: Acid ratio (32.92) was found higher in RPP compared to all other jeevamrutha treatments. The TSS and TSS: Acid ratio recorded in D_3F_1 was also found on par with RPP (Table 3). The fruit biochemical parameters such as reducing, non-reducing and total sugarscontent in guava fruits was not influenced significantly by different dosage and frequency of application of jeevamrutha. But, the highest reducing sugars(4.86%), non-reducing sugars (2.83%) and total sugars (7.69%) were found in RPP. However, reducing sugar content in D_1F_1, D_2F_1, D_3F_1, D_3F_2 and D_3F_3 and non-reducing and total sugar contents in D_3F_1 was found on par with RPP (Table 4). The higher sugar content in the fruits of RPP treatment could be due to higher nutrients availability in soil and higher uptake by plants which lead to increased catalytic activities by which the complex substances (starch) degrade into simple sugars thereby improving the sugar content in fruits.The shelf life of fruits was non-influenced by different treatments. The findings of earlier workers in papaya (Dutta *et al.,* 2009), guava (Binepal *et al.,* 2013) and in banana (Butani and Chovatia, 2013) also supports the present study.

CONCLUSION

Based on the outcome of the study, it is concluded that,Jeevamrutha @1000 litre per hectare (5.6 l/tree) applied once in 15 days in the active root zone with organic mulch

used @5 ton per hectare was found optimum for yield, returns and quality of guava. However, this cannot replace the RPP hence; higher dosage of jeevamrutha may be tried.

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Conflict of interest

All authors declare that they have no conflict of interest.

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