The Bioscan 10(3): 1371-1374, 2015 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

ORGANIC FRUIT PRODUCTION OF GUAVA CV. L-49 IN GANGETIC ALLUVIAL PLAIN OF WEST BENGAL

KAUSHIK DAS*, D. ROY, D. SENGUPTA AND P. DATTA
Department of Fruits and Orchard Management, Faculty of Horticulture,
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur - 741 252, Nadia, West Bengal, INDIA
e-mail: kaushikdas.bckv@gmail.com

KEYWORDS
Guava
Organic manure
Yield
West Bengal

Received on :
15.062015

Accepted on :
26.09.2015

***Corresponding author**

ABSTRACT
Ten treatments of Vermicompost and FYM alone and in combinations were applied on 6 years old guava plant at farmer's field, Gayeshpur, Nadia, West Bengal during 2012-13. Combined application of Vermicompost @ 5 kg/ plant + FYM @ 20 kg/plant (T_6) was found best as compared to other treatments which significantly increased the physico-chemical attributes of guava where highest fruit length (8.42cm), diameter (7.10cm), fruit weight (140.42g) and pulp weight (96.38g) was recorded, whereas regarding chemical attributes viz. maximum TSS (10.40 °Brix), total sugar (7.39%), reducing sugar (4.11%), Vitamin C (163.41 mg/100g of pulp) and least acidity (0.21%) was obtained in this treatment while chemical fertilizer (T_9) recorded maximum acidity (0.39%). Leaf minerals (N, P and K) were also affected by application of different organic nutrients with maximum nitrogen (1.48%) and potassium (1.11%) obtained from Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant while Vermicompost @ 10 kg/plant + FYM @ 20 kg/plant recorded maximum leaf P (0.40%) content. Thus among the different treatments Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant (T_6) application was found to be best which significantly improve the soil health, fruit quality, leaf mineral content and an increased yield by 14.12%.

INTRODUCTION

Organic farming can be defined as an approach where the aim is to create integrated, human environmentally and economically sustainable agricultural production systems (Ram *et al.,* 2007b). Guava (*Psidium guajava* L.) is one of the leading fruit crops in India due to its wide adaptability to varying soil and climatic conditions. In the Indo-Gangetic alluvial soils of West Bengal, the crop has immense potential in increasing productivity and yield sustainability (Sharma *et al.,* 2013b). It is rich source of minerals, vitamin-C and pectin. Guava is such a horticultural crop, where fruits are usually consumed fresh after harvest along with skin and pulp; hence, there is feasibility of organic farming in its cultivation. Ram *et al.* (2007a) reported that integrated application of different fertilizers, organic manures and bio-fertilizers in guava cv. Sardar improved the vegetative growth parameters, yield and fruit quality. Indiscriminate use of chemical fertilizers, weedicides and pesticides has resulted in various environmental and health hazards along with socio-economic problems (Audus, 1970; Kakkar, 1981; Gupta, 1991; Joshi *et al.*, 1995, Shanker *et al.*, 2002). The entire agricultural community is trying to find out an alternative sustainable farming system which is ecologically sound, economically and socially acceptable (Pathak and Ram, 2004). There is a great need to standardize eco-friendly technologies for the production of safe and residue free organic guava for getting high economic return. Though systematic work on manuring of guava was started since 1960 in India, limited systematic work on organic fruit production of guava has been reported. Thus, the present investigation was undertaken with the objective to find out the effect of different organic manures on yield, fruit quality and leaf mineral composition of guava cv. L-49.

MATERIALS AND METHODS

The experiment was conducted at the farmer's field, Gayeshpur, Nadia, West Bengal during 2012-13 on 6 years old plant spaced at 6m x 6m.The plants were uniform in growth and vigour. The orchard soil was clay loam having pH 6.9, 0.63% organic carbon, available nitrogen 271.00 kg ha^{-1}, phosphorus 28.21 kg ha^{-1} and potassium 210.00 kg ha^{-1}. The different combination of treatments were T_1- Vermicompost (5 kg $plant^{-1}$ $year^{-1}$), T_2- Vermicompost (10 kg $plant^{-1}$ $year^{-1}$), T_3- FYM (10 kg $plant^{-1}$ $year^{-1}$), T_4- FYM (20 kg $plant^{-1}$ $year^{-1}$), T_5- Vermicompost (5 kg $plant^{-1}$ $year^{-1}$) + FYM (10 kg $plant^{-1}$ $year^{-1}$), T_6- Vermicompost (5 kg $plant^{-1}$ $year^{-1}$) + FYM (20 kg $plant^{-1}$ $year^{-1}$), T_7- Vermicompost (10 kg $plant^{-1}$ $year^{-1}$) + FYM (10 kg $plant^{-1}$ $year^{-1}$), T_8- Vermicompost (10 kg $plant^{-1}$ $year^{-1}$) + FYM (20 kg $plant^{-1}$ $year^{-1}$), T_9- N: P: K (260:320:260 g $plant^{-1}$ $year^{-1}$), T_{10}- (Control). The organic manures were applied around the trunk of the tree in two splits once in January and again during August as per treatment schedule. The experiment was laid out in completely randomized design (Goon *et al.,* 2001) with three replications. Uniformly healthy plants were selected for this study. The mature ripe fruits were harvested and physico- chemical analysis was done following all standard methods as described by Ranganna (2003). The soil properties, leaf mineral content (N, P and K) were estimated using standard procedure as described by Jackson (1973). The plant protection measures were taken through organic

means.

RESULTS

Effect of different organic manures on fruit retention and yield of guava

Number of fruits/plant, yield are significantly varied due to different treatments which is evident from Table 1. It is observed that, highest number of fruits/plant (289), highest yield/plant in kg (40.82 kg/plant) and highest yield/ha in tonnes (11.34 tonnes/ha were recorded from T_6 (Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant) followed by 280 number of fruits/plant recorded from T_5 (Vermicompost @ 5 kg/plant + FYM @ 10 kg/plant) and 38.77 kg yield/plant and 10.77 tonnes yield/ plant were recorded from T_8 (Vermicompost @ 10 kg/plant + FYM @ 20 kg/plant). Minimum number of fruits/plant (215), yield/plant (26.70 kg/plant) and yield/ha (7.42 tonnes/ha) were obtained from control.

Effect of different organic manures on physical characters of guava fruit

It is evident from Table 2, that fruit weight of guava significantly increased due to different combinations of organic manures. Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant (T_6) proved as the most effective treatment by showing highest fruit weight (140.42 g) followed by 138.47 g which was obtained from T_2 (Vermicompost @ 10 kg/plant application). Fruit length, fruit diameter, core wt. and pulp wt. are also significantly varied due to different combinations of organic manures treatments. Highest fruit length (8.42 cm) was obtained by applying Vermicompost @ 5 kg/plant along with FYM @ 20 kg/plant followed by T_5 (Vermicompost @ 5 kg/plant + FYM @ 10 kg/ plant) as recorded 8.12 cm. T_6 (Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant) recorded the highest fruit diameter (7.10 cm) followed by T_8 which recorded fruit diameter as 6.99 cm. Highest core weight (44.35 g) was obtained from T_2 (Vermicompost @ 10 kg/plant) followed by 44.26 g which was obtained from T_7 (Vermicompost @ 10 kg/plant + FYM @ 10 kg/plant).

Again vermicompost @ 5 kg/plant + FYM @ 20 kg/plant recorded highest pulp weight (96.38 g) followed by 94.75 g, which was recorded from T_8. In all cases control plant recorded minimum value.

Table 1: Effect of different organic manures on fruit retention and yield of guava cv. L-49

Treatments	Number of fruits plant $^{-1}$	Yield plant $^{-1}$(kg)	Yield ha^{-1} (tonnes)
T_1	245.20	34.75	9.60
T_2	270.00	35.12	9.76
T_3	250.00	36.72	10.2
T_4	252.50	33.44	9.29
T_5	280.00	37.42	10.40
T_6	289.00	40.82	11.34
T_7	265.25	38.12	10.59
T_8	270.20	38.77	10.77
T_9	240.50	32.90	9.14
T_{10}	215.00	26.70	7.42
SEm ±	0.41	0.032	0.032
CD (p = 0.05)	1.218	0.094	0.095

Effect of different organic manures on biochemical composition of guava fruit

Perusal of data in Table 3 indicated that different treatments of organic manures significantly increased the total soluble solids, total sugar, reducing sugar, non-reducing sugars and ascorbic acid content of fruit. T_6 (Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant) showed maximum TSS (10.40 ^{0}brix), total sugar (7.39%), reducing sugar (4.11%), non-reducing sugar (3.28%) and ascorbic acid (163.41 mg/100g) with minimum 0.21% acidity of fruits followed by T_5 (Vermicompost @ 5 kg/plant + FYM @ 10 kg/plant) while fruits treated with chemical fertiliser or without any application showed minimum fruit qualities with maximum acidity.

Effect of different organic manures on leaf mineral (N, P and K) content of guava

The data presented in Table 4 revealed that, leaf P content and leaf K content were significantly varied due to different organic manures. But leaf N content was not significantly varied. Highest leaf N content (1.48%) and leaf K content (1.11%) were recorded from T_6 (Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant) followed by T_8 (Vermicompost @ 10 kg/plant + FYM @ 20 kg/plant) in both the cases (1.41% and 1.04% respectively). Highest leaf P content (0.40%) was recorded from T_8 followed by T_7 (Vermicompost @ 10 kg/ plant + FYM @ 10 kg/plant) as recorded 0.39%. In all the cases control recorded the minimum (leaf N, P and K content as 1.27%, 0.29% and 0.89% respectively).

Table 2: Effect of different organic manures on physical characters of guava cv. L-49

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Core weight (g)	Pulp weight (g)
T_1	7.42	6.43	137.41	43.97	93.44
T_2	7.99	6.11	138.47	44.35	94.12
T_3	7.88	6.74	134.50	42.05	92.45
T_4	7.94	6.94	136.11	42.63	93.48
T_5	8.12	6.95	137.42	43.3	94.12
T_6	8.42	7.10	140.42	44.04	96.38
T_7	8.10	6.95	138.40	44.26	94.14
T_8	8.11	6.99	137.90	43.15	94.75
T_9	7.11	6.82	134.70	41.92	92.88
T_{10}	6.71	5.92	131.20	40.28	90.92
SEm ±	0.013	0.012	0.412	0.007	0.317
CD (p = 0.05)	0.04	0.037	1.224	0.021	0.94

Table 3: Effect of different organic manures on bio-chemical composition of guava cv. L-49

Treatments	TSS (°Brix)	Total Sugar (% Fresh weight)	Reducing sugar (%Fresh weight)	Non-reducing sugar (%Fresh weight)	Ascorbic acid (mg / 100gof pulp)	Titratable acidity(%)
T_1	9.80	7.00	3.97	3.03	150.10	0.30
T_2	9.90	7.11	3.99	3.12	149.72	0.29
T_3	8.80	6.82	3.81	3.01	140.72	0.29
T_4	8.90	6.90	3.84	3.06	142.76	0.30
T_5	10.20	7.11	3.98	3.13	149.34	0.28
T_6	10.40	7.39	4.11	3.28	163.41	0.21
T_7	9.40	6.94	3.97	2.97	160.11	0.23
T_8	9.60	6.99	3.84	3.15	158.38	0.27
T_9	8.80	6.32	3.81	2.51	139.11	0.39
T_{10}	8.10	6.11	3.71	2.4	130.77	0.34
SEm ±	0.006	0.013	0.113	0.098	1.173	0.023
CD(p = 0.05)	0.017	0.037	NS	0.291	3.483	0.069

Table 4: Effect of different organic manures on leaf mineral (N,P and K) content of guava cv. L-49

Treatments	Nitrogen (%)	Phosphorus (%)	Potassium (%)
T_1	1.39	0.29	0.92
T_2	1.41	0.29	0.98
T_3	1.40	0.31	0.91
T_4	1.38	0.30	0.89
T_5	1.39	0.37	0.99
T_6	1.48	0.38	1.11
T_7	1.40	0.39	1.03
T_8	1.41	0.40	1.04
T_9	1.31	0.30	0.91
T_{10}	1.27	0.29	0.89
SEm ±	0.041	0.019	0.02
CD (p = 0.05)	NS	0.056	0.061

DISCUSSION

Different sources of nutrients significantly increased the physico-chemical qualities and leaf mineral content of guava. Improvement in growth and qualities parameters may be because of better moisture retention capacity and supply of nutrients due to favorable soil condition brought out by vermicompost application (Yadav and Kumari, 2003). Improvement in growth of sapota (Desai *et al.,* 2004) and guava (Naik and Haribabu, 2007) due to exclusive application of organic manures was reported which confirms the result of present study where yield and yield attributes have responded significantly in all treatments. It has been found that increased availability of nutrients improved the growth parameters which might have reflected in increased fruit weight. Similar findings by Sharma *et al.* (2013a) who reported that the increase in average fruit weight in guava cv. Sardar due to the integration of organic sources of nutrients which accelerate mobility of photosynthates from source to sink as influenced by the different growth hormones.

Application of organics not only increased the yield, but also improved the fruit quality. The improvement of fruit quality may be attributed due to improvement in soil physical properties, water holding capacity, bulk density and chemical properties like nutrient status, soil pH and hormone as reported by Chattopadhyay (1994). Further it is likely that the enhanced vegetative growth is the contributing factor for higher yields under organic treatments due to higher quantities of photosynthates (starch, carbohydrate etc.) which is translocated to fruits, thus increasing the contents of various fruit quality parameters. The experimental results are found to be in line with the findings of Ram *et al.* (2007a). Increase in leaf nutrient content was also observed in different treatments of organic manures. The higher nutrient status of the soil due to organics might be due to slow decomposition of organic manures and better uptake of nutrients by the plants which in turn increase the leaf mineral content of guava. The present findings are in close conformity with the earlier finding of Naik and Haribabu (2007). Nutrients applied without organic manure were less effective in improving the guava productivity even at higher doses and more effective when applied with organic manure.

Finally it is concluded that, different sources of organic nutrients single or combined application increased the fruit yield, physico- chemical composition and leaf mineral contents. Among different treatment Vermicompost @ 5 kg/plant + FYM @ 20 kg/plant proved most effective in production of organic and safe guava fruits in Gangetic alluvial plain of West Bengal.

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