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Studies on the comparative performance of organic manures on Physico-chemical attributes of winter season guava (*Psidium guajava* L.) in cv. l-49

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Abstract
The present investigation entitled "Studies on the comparative performance of organic manures on yield, quality and Physico-chemical characteristics of winter season guava *(Psidium guajava L.*) in cv. L-49" was conducted during 2019-20 at the experimental field, Govind Nagar Farm- Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) to analyze the effect of organic matter on Physico-chemical attributes of guava fruit cv. L-49 Seven treatments of different organic manures *viz.* T_1 (control), T_2 (FYM), T_3 (vermicompost), T_4 (poultry manure), T_5 (FYM + vermicompost), T_6 (vermicompost + poultry manure) and T_7 (FYM + poultry manure) were incorporated in Guava fruit plant cv. L-49 in Random Block Design with three replications. The different levels of organic manures were applied in the soil at a distance of 1-2 ft. away from the tree trunk. Fruit weight, fruit size (length and width), fruit volume, total soluble solids, reducing sugars, non-reducing sugars, and total sugars, acidity, and ascorbic acid were all investigated in guava fruits.

The observations revealed that plants fed with vermicompost + poultry manure produced the largest fruit (length and width 6.56 cm and 6.19 cm respectively), maximum weighted fruit (147.37 g), and fruit Volume (144.47 cc). Among the different manures, the application of vermicompost + poultry manure was found superior in the chemical parameter. Maximum TSS (13.90 ^{0}Brix), Sugars (reducing sugars, non-reducing sugar, and total sugars 7.58%, 3.94%, and 11.45% respectively) Ascorbic acid (145.03 mg/100g pulp), and lowest acidity (0.356) were reported in fruit produced from plants treated with vermicompost + poultry manure. The above observation indicates that among the different organic manures evaluated in the present study, vermicompost + poultry manure combination emerged as the best choice of organic manures, closely followed by FYM + poultry manure in improving the quality of guava fruits.

Keywords: FYM, Vermi-compost, poultry manure, randomized block design

Introduction
Guava (*Psidium guajava* L.), is one of the most important tropical and sub-tropical fruit crops of India, which belongs to the family Myrtaceae. It is native to tropical America, stretching from Mexico to Peru, and gradually becoming a commercial significance level of fruit crop in several countries.

Guava is the fourth most important fruit in the area and production after mango, banana, and citrus. It is cultivated throughout the tropical and subtropical regions. The major producing countries are South Asian countries of the world. In India, it has been introduced in the early 17^{th} century and gradually become a commercial crop all over the country, particularly in Maharashtra, Uttar Pradesh, Karnataka, Bihar, Orissa, Punjab, Uttarakhand, Gujarat, Madhya Pradesh, and West Bengal. Guava produced in the Allahabad region of Uttar Pradesh is the best in the world (Chaddha, 2007) [5]. It covers around 3.7% (2,70,000 ha) of total area under fruit crops and contributes 3.3% (41,07,000 MT) of total fruit production (Anon. 2017-18) [2].

Guava is one of the cheapest sources of vitamin C (95.75 to 239.00mg/100g) and pectin (0.78%). The ripe fruits contain moisture, dry matter, ash content, crude fat, crude protein, and crude fiber but their composition varies widely with cultivar, stage of maturity, and season. Besides, this also contains an appreciable amount of vitamins, minerals, protein, and sugars too. Therefore, it has been considered a "poor man's apple". Its cultivation is getting popularity due to increasing international trade, better nutritional contents, and processing of its value-added products.

The soil quality determines the sustainability and productivity of any agroecosystem (Dwivedi & Dwivedi 2007) [7]. An increase in productivity of fruit remove large amounts of essential nutrients from the soil and land began to be intensively exhausted which led to a declining trend in soil fertility and production of less quality fruit. Continuous use of inorganic fertilizers as a source of plant nutrients in a disproportionate manner results in serious damage to the environment and certain situations harms the plants themselves and also the consumers (Shanker *et al*., 2002) [20]. Large-scale use of chemical fertilizers causes the problem of groundwater through leaching, volatilization, denitrification, and wastage of nutrients through costly fertilizers.

Agrochemical-based horticultural crop production is not sustainable and safe because of loss in soil health, surface and groundwater pollution, and low income from high production costs (Pimentel *et al*. 2005). Many countries are now looking at ways and means to minimize the use of harmful agrochemicals in the production system, focusing on safe and sustainable food production and soil health. Increasing awareness about conservation of the environment as well as health concerns caused by harmful agrochemicals has resulted in paradigm shifts in consumers' preference towards safe foods globally with niche markets promoting organic foods (FAO 2010) [9]. Crop production can't be sustained with the application of N, P, and K only (Singh 2008) as it creates nutrients imbalance in the soil. Emphasis should be given to protecting the environment from pollution with the overuse of agrochemicals (Ayala and Rao 2003) [4]. Adoption of organic farming practices may be a suitable option for the cost-effective and sustainable production of guava (Ram and Verma 2017) [19]. The horticultural crops production strategy should be focused on reduced external inputs used for higher income. Efficient use of energies helps to achieve optimum production and productivity and contributes to more profit per unit area (Singh *et al*. 2002) [23].

Integration of organic substrates with mineral fertilizers can significantly affect the physical, microbiological, and chemical properties of soil, which are indirectly responsible for supporting plant growth (Adak *et al*., 2012) [1]. Therefore, integrated nutrient management is the most appropriate approach for managing nutrient input. This calls for moving away from chemical agriculture and embracing organic matter management, which improves all soil properties and brings nitrogen through organic manures. Organic manures like farmyard manure are bulky organic manure, which is a storehouse of major nutrients apart from containing a considerable amount of macro and micronutrients, Secondly, the use of organic manures increases the organic matter content of the soil by increasing the water holding capacity.

Vermicompost, which is a stabilized organic material produced by interactions between earthworms and microorganisms, in a non-thermophilic process, has been reported to enhance seed germination and growth and plant yields in a greenhouse and to improve growth and plant yield under field conditions. The presence of plant growth influencing substances in vermi composts, such as plant growth hormones and humic acids has also been suggested as a possible factor contributing to increased microbiological processes, plant growth, and yields (Pramanik *et al*., 2010) [18]. Keeping this in view, the present investigation has been carried out entitled "Studies on the comparative performance of organic manures on fruit quality of winter season guava (*Psidium guajava* L.) in cv. L-49". To meet a balanced nutrient supply in guava, integrated nutrient management is an important alternative source, which is not only beneficial to maintaining soil health but also to sustaining fruit production.

Materials and Methods

During the years 2017–19, the current investigation was conducted at the Govind Nagar Farm, Govind Nagar; Acharya Narendra Deva University of Agriculture & Technology-Kumarganj Ayodhya. It is located at 26.47º N latitude, 82.12º E longitude, and 113 meters above mean sea level. In a typical saline-alkaline belt, the site is in the Indo-Gangetic plains of eastern Uttar Pradesh. The experiment was set up in a Randomized Block Design with seven different organic treatments *viz*. T_1 (control), T_2 (FYM), T_3 (vermin-compost), T_4 (poultry manure), T_5 (FYM + vermin compost), T_6 (vermin compost + poultry manure) and T_7 (FYM + poultry manure) having 3 replications of each on the guava fruit cv. L-49. The observations were recorded for total soluble solids, Titrable Acidity, Ascorbic Acid, Reducing Sugars, Non-reducing sugar, and Total sugars.

The total soluble solids of the fruits were determined using an Erma Hand Refractometer (Tokyo, Japan) with a range of 0-32^0 Brix and corrected at 20 ^{0}C. A small piece of fruit was crushed and placed on the prism of the refractometer, with the value read against the light. The ascorbic acid and titrable acidity were calculated using the AOAC method (2000) [3]. The 'Fehling solution method' was used to calculate the sugar percentage, which was expressed as a percentage.

The Data obtained from the experiment was calculated and statistically analyzed as per the method given by Panse and Shukhatme (1985) and the results were evaluated at a 5% level of significance.

Results and Discussion

Data presented in table -1 indicate that the application of different organic manures has significantly influenced the fruit size. The fruit length (6.20 cm) in the case of vermicompost (T_3), was superior to FYM (T_2) and control (T_1) treatments; and fruit width (6.19) was recorded with fruits from vermicompost + poultry manure (T_6). Fruits from poultry manure (5.96 cm) measured much similar width as that of fruits treated with FYM + vermicompost (5.98 cm). The increase in fruit size (length and breadth) might be due to the optimum supply of plant nutrients right amount during the entire crop growth period causing vigorous development of the plants, leading to the production of more photosynthates which ultimately improves the size of fruits. The results are very close to the findings of Katiyar *et al.* (2008) [12], Dhomane *et al*. (2012) [6], Sharma *et al.* (2013) [21], and Tyagi *et al.* (2018) [24] in guava.

The average fruit weight was significantly influenced by different treatments (Table 1). Maximum average fruit weight was recorded under vermicompost + poultry manure treatment (147.37 g) and minimum average fruit weight was recorded under control (111.80 g). Among the organic manures combination treatment of vermicompost + poultry manure manifested a greater synergetic influence on fruit weight. Poultry manure ranked third in influencing fruit weight. vermicompost also influenced significantly the fruit weight and recorded a weight of 128.80 g per fruit. Maximum fruit volume (144.47 cm3) was measured in the treatment vermicompost + poultry manure treatment (T_6) and minimum fruit volume (107.43 cm3) was recorded with control (T_1) and both were statistically different from each other. The fruit volume was 133.67 cm3 in the case of poultry manure (T_4), which was superior to vermicompost (T_3), FYM (T_2), and control (T_1) treatments. The increase in fruit weight and volume through the application of different manures may be due to the proper supply of nutrients which are essential for the pollination as well as the development of fruits. Similar findings were also reported by Dwivedi *et al.* (2012) [8], Kumrawat *et al.* (2018) [14], and Sharma *et al.* (2013) [21]

The application of different organic manures significantly improved the quality of fruits data presented in (Table 2) which indicates that guava plants showed a significant positive response to the different organic manure. Total soluble solids of fruit pulp responded significantly to the various treatments. The highest content of TSS (13.90%) was recorded in the fruits obtained from plants treated with vermi-compost+ poultry manure (T_6) whereas, the minimum TSS was found with control. The earlier findings of Ismail, (1997) [11], Tyagi *et al.* (2018) [24], Goswami *et al.* (2015) [10], and Kumrawat *et al.* (2018) [14] in guava and Sarkar *et al.* (2009) in litchi are also in consonance with the present results.

Sugar content in guava fruits was significantly influenced by the different organic manures. Maximum reducing sugars (7.58%), Non-reducing sugar (3.94%), and Total sugar (11.45%) were found in treatments (T_6) vermi-compost+ poultry manure, whereas minimum reducing sugar (5.16%), non-reducing sugar (3.37%), and total sugar (8.46%) was recorded in control. increase in total sugar, reducing and non-reducing sugars of fruits pulp due to application of nutrients alone and in combination with growth substances. Kumar *et al*. (1998) [13], Shukla *et al.* (2014) [22], and Sharma *et al.* (2013) [21] in guava also confirmed the present findings.

The ascorbic acid content (Table 2) was recorded maximum under treatment vermicompost + poultry manure treatment T_6 (145.03 mg/100 g pulp) followed by FYM + poultry manure treatment T_7 (139.83 mg/100 g pulp). The minimum in control treatment T_1 (110.43 mg/ 100 g pulp) and statically significant over combination treatments. The increase in ascorbic acid content due to various organic treatments may be due to proper nutrition to treated plants which ultimately improves the vitamins and minerals in fruits. The results are very close to the findings of Shukla *et al.* (2014) [22] and Goswami *et al.* (2015) [10]

The acidity of the fruit pulp of guava was significantly influenced by the treatments (Table 2). It was highest in the case of the control treatment (0.423%) and lowest in plants receiving FYM + poultry manure (0.356%). Contrary to Kumar *et al.* (1998) [13] reports, the acidity of guava fruit increased in the present study due to the application of recommended dose in the control treatment. Reduction in the acidity through the application of organic manures also reported by Mitra *et al.* (2010) [15], and Dhomane *et al.* (2012) [6] in guava fruits

From the above results; it is clear that the various chemical parameters of fruits quality in guava were influenced by the application of different organic manures, and all the treatments increased the content of TSS, acidity, ascorbic acid, total and reducing sugars. Such results may be attributed to better vegetative growth of the treated plants, by which they produced higher quantities of photosynthates (starch, carbohydrates, etc.) and translocated them to the fruits; thus, increasing the content and fruit quality.

Table 1: Effect of different organic manures on physical attributes of guava fruits cv. L-49

Treatments	Fruit length (cm)	Fruit width (cm)	Fruit Weight (g)	Fruit volume (cm^3)
T_1 (Control)	5.91	5.42	111.80	107.43
T_2 (FYM)	6.13	5.62	120.83	117.87
T_3 (Vermicompost)	6.20	5.79	128.80	125.67
T_4 (Poultry Manure)	6.32	5.96	137.27	133.67
T_5 (FYM + Vermicompost)	6.31	5.98	135.13	132.33
T_6 (Vermicompost + Poultry)	6.56	6.19	147.37	144.47
T_7 (FYM + Poultry Manure)	6.43	6.09	140.37	137.67
S.Em±	0.09	0.10	1.60	1.42
CD at 5%	0.28	0.29	4.93	4.37

Table 2: Effect of different organic manures on chemical attributes of guava fruits cv. L-49

Treatments	TSS (^{0}Brix)	Reducing Sugars (%)	Non-Reducing Sugars (%)	Total Sugars (%)	Acidity (%)	Ascorbic Acid (mg/100g of pulp)
T_1 (Control)	11.53	5.16	3.37	8.46	0.423	110.43
T_2 (FYM)	12.13	5.33	3.46	8.79	0.405	118.63
T_3 (Vermicompost)	12.63	5.89	3.58	9.35	0.392	125.50
T_4 (Poultry Manure)	13.20	6.70	3.66	10.27	0.377	135.43
T_5 (FYM + Vermicompost)	12.93	6.54	3.65	10.09	0.382	130.40
T_6 (Vermicompost + Poultry)	13.90	7.58	3.94	11.45	0.356	145.03
T_7 (FYM + Poultry Manure)	13.40	7.20	3.86	10.79	0.368	139.83
S.Em±	0.16	0.17	0.09	0.23	0.004	2.01
CD at 5%	0.50	0.52	0.27	0.69	0.52	0.69

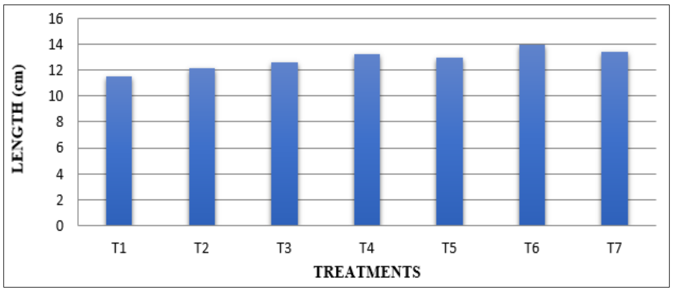

Fig 1: Fruit length

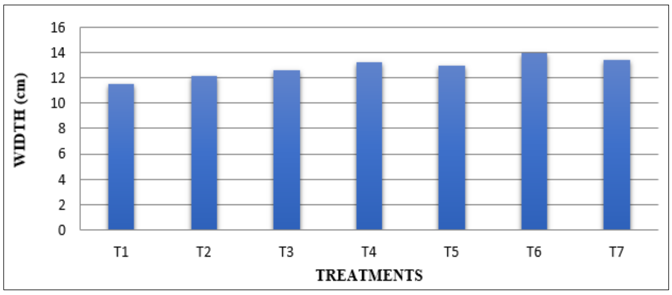

Fig 2: Fruit width

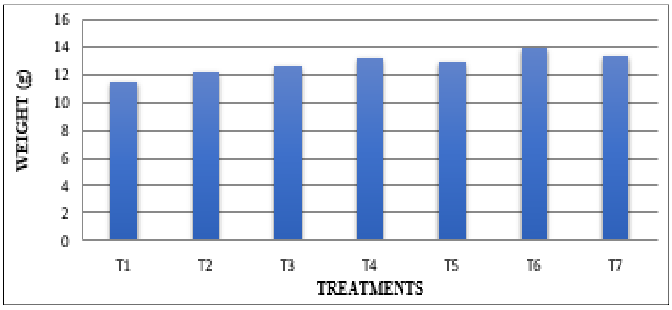

Fig 3: Fruit width

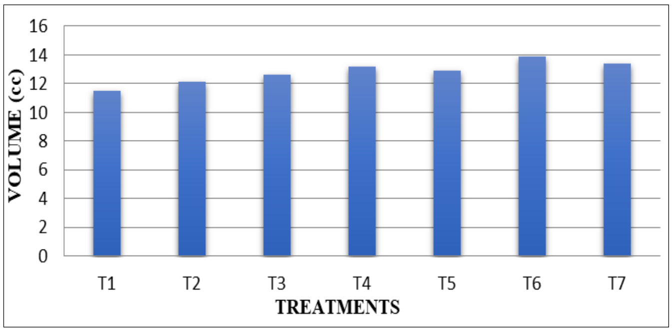

Fig 4: Fruit Volume

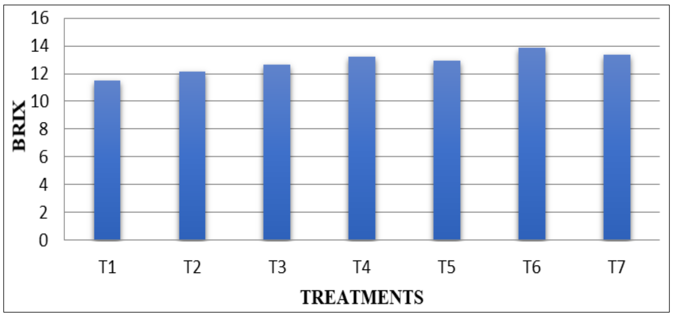

Fig 5: Total soluble solids

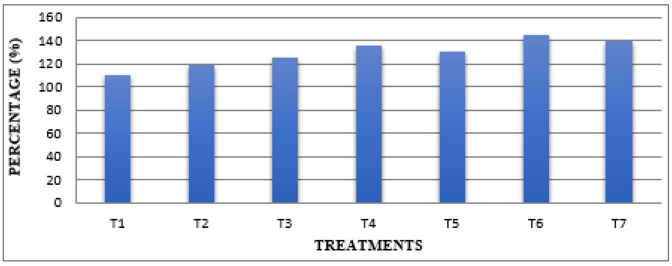

Fig 6: Reducing Sugars

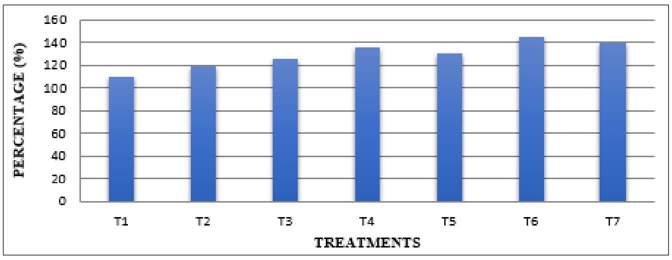

Fig 7: Non- reducing sugar

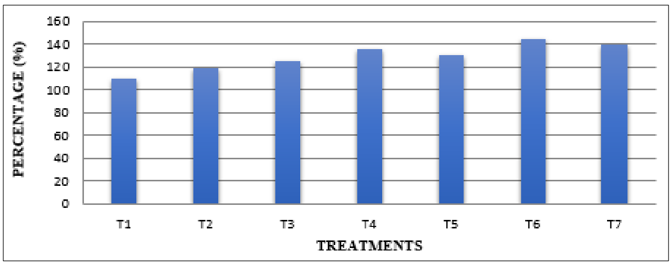

Fig 8: Total Sugars

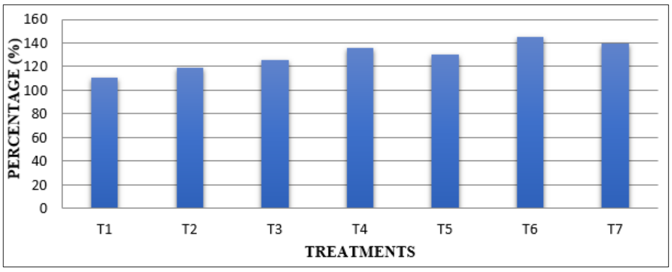

Fig 9: Acidity

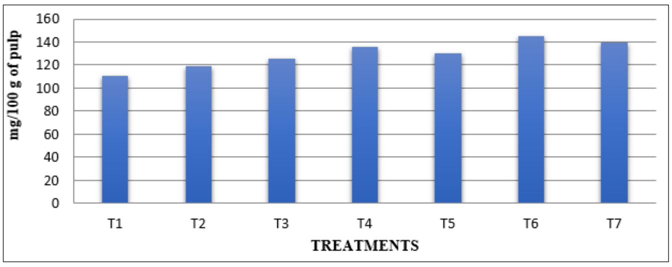

Fig 10: Ascorbic Acid

Conclusion

From the foregoing results and discussion, it is observed that guava responds well to the application of organic manures. As a matter of custom, recommendations were made to include organic manure (particularly FYM, vermicompost, and poultry manure). The work on the effect of different organic manures was done in respect of guava. Among the different organics evaluated in the present study, poultry manure combination emerged as the best choice of organics, closely followed by vermicompost + poultry manure in improving the flowering while in the rest of all the observations, vermicompost + poultry manure resulted as the best in fruiting, and fruit quality. The fruit grower in India is financially poor and has poor purchasing power, hence, he can go for the incorporation of FYM for enhancing yields without incurring extra expenditure. The other organics are not only expensive but also unavailable sometimes. The application of vermicompost is boosted nowadays and many voluntary organizations are producing it, so it may not be difficult to procure vermicompost. There is a strongly organized poultry industry in the country, which can supply required quantities of poultry manure at affordable prices. So finally, it appears the choice of FYM, vermicompost, and poultry manure for organic manuring in guava. Among the various sources of available organic manures, vermicompost is a potential source due to the presence of readily available plant nutrients, growth-enhancing substances, and several beneficial microorganisms like N-fixing, P-solubilising, and cellulose decomposition organisms.

In the present study, the beneficial effects of poultry manure may be due to several reasons. Apart from the presence of macro and micronutrients, the production of certain metabolites and their presence in poultry manure might have contributed to the flowering behavior. Further, it has been proved that poultry manure promotes more flowering of the guava plants. Thus, the application of poultry manure helped in the better performance of the flowering behavior of the plants. The observations from the current investigation revealed that the application of organic manures improved the fruit quality in the guava plant. Among the different organic manures evaluated in the present study, vermicompost + poultry manure combination emerged as the best choice of organic manures, closely followed by FYM + poultry manure in improving the Physico-chemical quality of guava fruits.

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