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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON QUALITY ATTRIBUTES OF GUAVA (*PSIDIUM GUAJAVA* L.)

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ABSTRACT

Integrated Nutrient Management (INM) is recognized as a pivotal approach to improving nutrient accessibility for plants, which consequently influences crop quality. Hence, a study was conducted at the Horticulture Research Farm, Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, during the 2021-2022 agricultural season and the primary, objective was to standardize nutrient management practices impacting the quality attributes of guava. The investigation, titled "Effect of Integrated Nutrient Management (INM) on Quality Attributes of Guava," evaluated thirteen treatments, each replicated three times. Among the treatments, T_{11}, which comprised 100% Recommended Dose of Fertilizers (RDF: 600:300:300 g NPK), supplemented with 10 kg of Vermicompost (VC), 10 kg of Farm Yard Manure (FYM), and microbial inoculants including 10 g of Phosphate Solubilizing Bacteria (PSB), 10 g of Arbuscular Mycorrhizal Fungi (VAM), and 10 g of Azospirillum, exhibited superior results. This treatment significantly enhanced fruit quality attributes, yielding a Total Soluble Solids (TSS) of 11.39(° Brix), ascorbic acid content of 205.20 (mg/100g pulp), acidity of 0.18(%), total sugars of 7.7(%), reducing sugars of 4.30(%), and non-reducing sugars of 3.43(%). The findings underscore that the application of INM strategies can greatly improve the quality of guava fruits.
***Keywords*:** Integrated Nutrient Management, Guava, V.A.M., Vermicompost, Carboxylation.

Introduction

Guava (*Psidium guajava* L.) is a tropical fruit prized for its distinct flavor, abundance of nutrients, and various applications. Belonging to the Myrtaceae family, guava is native to Central America but is now cultivated in tropical and subtropical regions worldwide. The fruit is characterized by its round or pear-shaped appearance, with a thin green or yellowish skin that may be rough or smooth, depending on the variety. It is a very valuable source of vitamin C, that surpasses even oranges, coming in third place among fruits after Aonla and Barbados cherry. When compared to other fruits, guavas are a good source of iron, calcium, and phosphorus. Guavas can be consumed fresh, juiced, or used in various culinary applications such as jams, jellies, desserts, and beverages the fruit's versatility adds to its popularity in different cuisines. Beyond its culinary uses, guava is recognized for its potential health benefits. It contains bioactive compounds with antimicrobial, anti-inflammatory, and antioxidant properties, contributing to its role in traditional medicine. Quality attributes in guava are crucial for consumer satisfaction, market competitiveness, and the overall economic value of this tropical fruit. Nutrient management in agriculture is critical to sustainable and productive farming practices. It involves the careful and strategic application of essential nutrients to crops, aiming to optimize plant growth, yield, and overall crop quality. Numerous vital nutrients are needed by plants, such as nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, and various micronutrients, for their growth and development, providing these nutrients in the correct ratios and quantities ensures that plants have what they need for healthy growth and reproduction. The integrated nutrient management is an important agricultural practice by which all the nutrients are provided to plants in proper quantity and improve soil fertility, ensuring that the soil has the right balance of nutrients for sustained productivity. INM, Practices such as incorporating organic matter, cover cropping, and crop rotation are part of nutrient management strategies to enhance soil structure and nutrient-holding capacity. By providing the necessary nutrients, farmers can maximize the potential of their crops, leading to increased productivity and economic returns. Nutrient availability influences the quality attributes of crops, including taste, aroma, texture, and nutritional content. Proper nutrient management can enhance the market value of guava fruit and its products. Thus, the goal of the study was to ascertain the ideal nutrient availability using various nutrient sources to ensure the healthy growth of plants and high-quality fruits.

Materials and Methods

The experiment was conducted in the academic year 2021-22 at the Horticulture Research Farm of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, located in Lucknow, Uttar Pradesh, India (26^o 46' North latitude and 80^o 55' East longitude). This experiment employs a complete Randomized Block Design (CRBD) with three replications and 13 different treatment combinations. All the treatment combinations were applied on a nine-year-old guava orchard of the 'Sardar' variety, planted with a spacing of 6*6 meters. The experimental treatments included applications of the Recommended Dose of Fertilizers (RDF), vermicompost, farmyard manure (FYM), phosphate-solubilizing bacteria (PSB), Vesicular Arbuscular Mycorrhiza (VAM), and Azospirillum.

The treatment combinations applied are given as under:

Treatment representation	Treatment content
T_0	Control
T_1	100 % RDF(600:300:300 gm NPK) + 10 kg Vermicompost
T_2	50 % RDF + 10 kg Vermicompost
T_3	100 % RDF + 10 kg FYM
T_4	50 % RDF + 10 kg FYM
T_5	100 % RDF +10 gm PSB
T_6	50 % RDF + 10 gm PSB
T_7	100 % RDF + 10 gm VAM
T8	50 % RDF + 10 gm VAM
T_9	100 % RDF + 10 gm Azosprillum
T_{10}	50 % RDF + 10 gm Azosprillum
T_{11}	100 % RDF + 10 kg VC+ 10 kg FYM+ 10 gm PSB+ 10 gm VAM+ 10 gm Azosprillum
T_{12}	50 % RDF + 10 kg VC+ 10 kg FYM+ 10 gm PSB+ 10 gm VAM + 10 gm Azosprillum

*RDF-recommended dose of fertilizer, VC- vermicompost, FYM- farm yard manure, PSB- phosphate solubilizing bacteria, VAM-vesicular arbuscular mycorrhiza.

In August, all treatments were applied, and observations were recorded for the following parameters, Total soluble solids (°Brix) were measured using an Erma hand refractometer and corrected based on a standard reference table, with results expressed in °Brix at 20°C. Ascorbic acid content (mg/100g) was determined by diluting a known volume of juice with 3% meta-phosphoric acid and titrating with 2,6-dichlorophenol-indophenol solution. Reducing sugars (%), non-reducing sugars (%), and total sugars (%) were measured by titrating the sample against Fehling's solution, using methylene blue as an indicator (A.O.A.C. 1990). The data were then analyzed following the analysis of variance method outlined by Panse and Sukhatme (1961).

Results and Discussion

The results in Table-1 indicate that fruit quality parameters, such as TSS (11.39) °Brix, ascorbic acid (205.20) mg/100g pulp, acidity (0.18%), total sugars (7.7%), reducing sugar (4.30%), and nonreducing sugar (3.43%), exhibited significant results in the T_{11} treatment (100% RDF + 10 kg VC + 10 kg FYM + 10 gm PSB + 10 gm VAM + 10 gm Azosprillum) followed by T_{12} (50 % RDF + 10 kg VC+ 10 kg FYM+ 10 gm PSB+ 10 gm VAM + 10 gm Azosprillum). The enhanced fruit quality observed in

T_{11} is likely due to integrated nutrition management's synergistic and complementary effects, facilitating the adequate supply of mobilized macro and micronutrients. This promotes vegetative growth and the carboxylation process, resulting in an increased accumulation of carbohydrates, starch, and metabolites. As a result, there is improved translocation of assimilates towards the fruits, enhancing the source-sink ratio. Similar observations were reported by Rubee *et al.* (2011) in guava, Bohane and Tiwari (2014) in Ber, and Shukla *et al.* (2014) in guava.

Likewise, the increased TSS, reduced acidity, and increased total sugars in guava under the T_{11} treatment are associated with positive effects on total leaf area, leading to enhanced carbohydrate production through accelerated photosynthesis. Enhanced quality results from healthier plant growth and more porous soils, which promote greater sugar accumulation, lower acidity, and higher ascorbic acid levels. These quality improvements are often related to better soil physical properties, such as increased porosity, improved water retention, and reduced bulk density. These factors collectively boost the microbial biomass in the soil rhizosphere. The application of bio-fertilizers such as Azosprillum, VAM, and PSB contributes to an overall improvement in guava fruit quality and reduces reliance on inorganic fertilizers. The flavor and aroma of fruits are influenced by adequate nutrient supply; for instance, the proper balance of nitrogen can impact the synthesis of compounds responsible for taste and aroma. The enhanced physiological characteristics of guava fruit achieved through the combined use of bio-organic sources can be attributed to increasing beneficial effects, including bacteria proliferation, biological nitrogen preparation, increased nutrient uptake (P, Zn, Cu, Mn, Fe), and Azosprillum growth regulation in the root zone. The current findings align with those of Ram *et al.* (2004) in guava, Bhobia *et al.* (2005) in guava, Maity *et al*. (2006) in guava, Athani *et al.* (2007) in guava, Ram *et al.* (2007) in guava, and Mahendra *et al.* (2009) in ber. Parihar and Paikra (2020) observed similar trends in guava, along with Dheware *et al.* (2020) and Gupta and Kumar (2021) in guava.

Table 1: Effect of integrated nutrient management on fruit quality attributes

Treatments	**Treatment contents**	**Fruit TSS** (°Brix)	**Ascorbic acid** (mg/ 100g)	**Acidity** (%)	**Non-reducing sugar** (%)	**Reducing sugar** (%)	**Total sugars** (%)
T_0	Control	6.89	151.38	0.44	2.22	3.37	5.59
T_1	100 % RDF + 10 kg Vermicompost	7.19	157.56	0.41	2.38	3.44	5.82
T_2	50 % RDF + 10 kg Vermicompost	7.24	161.24	0.37	2.40	3.56	5.56
T_3	100 % RDF + 10 kg FYM	7.87	168.97	0.35	2.53	3.66	6.19
T_4	50% RDF + 10kg FYM	7.92	172.16	0.33	2.56	3.77	6.33
T_5	100 % RDF +10 gm PSB	8.09	175.97	0.32	2.67	3.86	6.53
T_6	50 % RDF + 10gm PSB	8.13	182.54	0.31	2.77	3.92	6.69
T_7	100% RDF + 10 gm VAM	9.11	182.69	0.29	3.12	3.97	7.10
T_8	50 % RDF + 10gm VAM	9.19	188.78	0.27	3.22	4.04	7.26
T_9	100 % RDF + 10gm Azosprillum	9.95	192.19	0.27	3.36	4.12	7.48
T_{10}	50% RDF + 10gm Azosprillum	10.38	199.36	0.25	3.43	4.30	7.73
T_{11}	100 % RDF + 10kg VC+ 10kg FYM+ 10 gm PSB+ 10 gmVAM+10gm Azosprillum	11.39	205.20	0.18	3.73	4.50	8.23
T_{12}	50 % RDF + 10kg VC+ 10kg FYM+ 10gm PSB+ 10gm VAM + 10gm Azosprillum	11.29	202.90	0.22	3.49	4.41	7.90
SE(m)±		0.17	1.16	0.01	0.01	0.009	0.015
CD at 5 % ($P_{=0.05}$)		0.51	3.42	0.03	0.04	0.026	0.045

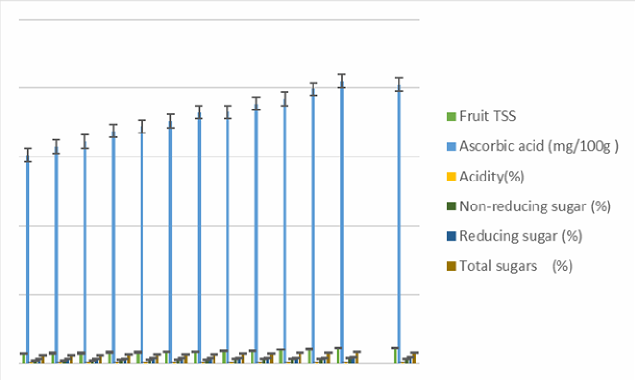

Fig. 1: Graphical representation of the impact of INM on quality parameters of Guava cv. Sardar.

Conclusion

The results of the experimental investigation indicated substantial variations in fruit quality parameters attributable to differing treatment regimes. Notably, the treatment designated as T_{11}, which employed a 100% Recommended Dose of Fertilizers (RDF) complemented by amendments including 10 kg of Vermicompost, 10 kg of Farmyard Manure (FYM), alongside microbial inoculants such as 10 gm of Phosphate-Solubilizing Bacteria (PSB), 10 gm of Vesicular Arbuscular Mycorrhiza (VAM), and 10 gm of Azospirillum, demonstrated a remarkable enhancement in fruit quality metrics. The amalgamation of organic amendments, bio-fertilizers, and balanced inorganic fertilizers ensured the provision of both macro and micro-nutrient requirements, thereby facilitating optimal vegetative growth and enhancing carboxylation processes. This holistic nutrient management approach fostered an improved translocation of assimilates towards the fruit, thereby bolstering the source-sink dynamics. The implications of these findings are profound, positing that a comprehensive strategy encompassing both organic and inorganic nutrient sources, supplemented by microbial inoculants, can significantly augment the economic viability and market competitiveness of guava cultivation. This study imparts critical insights for farmers and agricultural professionals aiming to implement sustainable and productive methodologies in the cultivation of guava.

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