



Effects of Levels of N: P: K on Yield and Quality of Guava (*Psidium guajava* L.) under Meadow Orchard System

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A field experiment was carried out at central research field, Department of horticulture, Naini Agricultural Institute (NAI) SHUATS, Prayagraj, U.P. India during 2022 session. The experiment was conducted to study the different levels of N: P: K on yield and fruit quality of guava to find out the optimum dose of N: P: K for guava trees under meadow orchard system. The experiment was conducted on eight years old Allahabad safeda guava trees planted at 2x1 m spacing. There were eight treatments of different levels of NPK viz. (T₀) control, (T₁) 100:50:50 g NPK/tree, (T₂) 150:75:75 g NPK/tree, (T₃) 200:100:100 g NPK/tree, (T₄) 250:125:125 g NPK/tree, (T₅) 300:150:150 g NPK/tree (T₆) 350:175:175 g NPK/tree, (T₇) 400:200:200 g NPK/tree. The experiment was arranged in a randomized complete block design with three replicates and each replicate was represented by one tree. All the cultural operation were carried out as per recommendations. The observation on yield and fruit quality aspects of guava cultivation under different treatments were recorded, analyzed and presented.

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The results of this experiment indicated that, different levels of N: P: K has shown different response to yield and fruit quality. The application of N: P: K @400:200:200 g NPK/tree (T_7) produced superior yield of guava in terms of fruit volume (165.56cm^3), fruit weight (61.53g), fruit diameter (6.72cm), number of fruits per branch (21.26), number of fruits per plants (322.15) and fruit yield per plant (55.30kg). The fruit quality with application of N: P: K @400:200:200 g NPK/tree (T_7) was also superior in terms of TSS (12.17°brix), Total sugar (8.84%), ascorbic acid (167.86 mg) and minimum acidity (0.205%). Hence it can be concluded that, for guava trees grown under meadow orchard system at 2x1 m spacing the dose of application of N: P: K @ 400:200:200 g/tree was found optimum for getting higher yield and superior fruit quality of guava. Further the treatment of application of N: P: K @ (T_6) 300:175:175 g/tree produced at par result for most of the parameters under the study of this experiment indicate the scope of increasing the fertilizer dose as per the age of the trees.

Keywords: Meadow orcharding; N, P, K; fruit quality; yield; guava.

1. INTRODUCTION

Guava (*Psidium guajava* L.), the apple of the tropics, is one of the most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India. The fruit are quite hardy and prolific bearer belongs to the family Myrtaceae [1-3]. "It is the fifth most important fruit in area after mango, citrus, banana, and apple and fifth most important fruit in production after banana, mango, citrus and papaya" [4].

"This fruit originated in tropical America and seems to have been growing from Mexico to Peru. The trees were domesticated more than 2000 years ago. It was spreaded rapidly through the worlds' tropics by Spanish and Portuguese soon after the discovery of the new world" [5-8]. Now it is cultivated in tropical and subtropical parts of several countries like India, Hawaii, Brazil, Mexico, Thailand, New Zealand, Philippines, Indonesia, China, Malaysia, Cuba, Sri Lanka, Venezuela, Australia, Burma, Myanmar, Israel, Pakistan and Bangladesh. India is the leading producer of guava in the world [4].

"Guava claims superiority over several other fruits because of its commercial and nutritional values. It is a rich and cheap source of vitamin C and pectin" [4].

"Maximum values for TSS, total sugars, non-reducing sugars and TSS: acid ratio in guava" Kher et al. [2].

"Meadow orchard system is a new concept of planting which has been developed for the first time in India at Central institute for Subtropical Horticulture, Lucknow. The planting is done at 2.0 m (row to row) X 1.0 m (plant to plant), which gives a density of 5000 plants per hectare.

Meadow orcharding gives higher yield as well as quality fruit production" Singh, [8].

"High density planting is one of the advanced techniques that have proven significantly good in increasing not only the productivity per unit area but also in improving the fruit quality" Singh, [8].

Time of pruning is in May-June. After pruning, shoots emerges and flowering takes place, which yields fruits during December-February [4,6-11]. These shoots are further pruned for the third time in September- October. It is done primarily for better canopy architecture. As a result of pruning in October, fruiting is obtained in March- April. This is the technique for maintaining a meadow orchard for optimum production and dwarf tree size [12,13].

The height of plants is restricted to 1.0 m, while an average production of 10-12 kg fruits/ plant is obtained every year. As harvesting is easy in a meadow orchard, no damage occurs to the fruits.

2. MATERIALS AND METHODS

The present investigation entitled "Effect of different levels of N, P, K on yield and quality of guava (*Psidium guajava* L.) under meadow orchard system" was conducted at the central research farm of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj during 2021-23.

The methods employed during the course of investigation and materials utilized had great significance in research program. "The experiment was carried out in randomized block

design with 8 treatment and 3 replications. The experimental trees were applied with 20 kg FYM along with full dose of P₂O₅ and K₂O and half dose of N at the beginning as per the treatment as basal dose and remaining half dose of N as per treatment at fruit set" [14-17].

The N, P, K was applied in the form of urea, single super phosphate and muriate of potash respectively.

2.1 Climatic and Weather Condition

Allahabad has a humid subtropical climate common to cities in the plains of North India, designated *Cwa* in the *koppen* climate classification. The annual mean temperature is 26.1°C (79.0°F); monthly mean temperatures are 18–29°C (64–84°F). Allahabad has three seasons: a hot, dry summer, a cool, dry winter and a hot, humid monsoon. Summer lasts from March to September with daily highs reaching up to 48 °C in the dry summer (from March to May) and up to 40 °C in the hot and extremely humid monsoon season (from June to September). The monsoon begins in June, and lasts till August; high humidity levels prevail well into September. Allahabad never receives snow, but experiences dense winter fog due to numerous wood fires, coal fires, and open burning of rubbish—resulting in substantial traffic and travel delays, but the city does not receive snow Its highest recorded temperature is 48°C (118.4 °F), and its lowest is -2°C (28°F).

2.2 Treatment Details

Table 1. Treatment Combination [14]

Notation	Treatments
T ₀	Control
T ₁	100:50:50 g NPK/tree
T ₂	150:75:75 g NPK/tree
T ₃	200:100:100 g NPK/tree
T ₄	250:125:125 g NPK/tree
T ₅	300:150:150 g NPK/tree
T ₆	350:175:175 g NPK/tree
T ₇	400:200:200 g NPK/tree

3. RESULTS AND DISCUSSION

3.1 Yield Parameters

The data regarding effects of different levels of NPK on yield parameters showed that, there is significant differences with regards to fruit

volume (cm³), fruit weight(g), fruit diameter (cm), number of fruits per branch, number of fruits per plant, fruit yield per plant (kg). The data shown in Table 2.

3.2 Fruit Volume (cm³)

The maximum fruit volume was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (61.53) cm³, followed by treatment T₆ (350:175:175 g NPK/tree) with (60.88) cm³ which were significantly superior over control T₀ (control) with (56.24) cm³.

3.3 Fruit Weight (g)

The maximum fruit weight was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (61.53) g, followed by treatment T₆ (350:175:175 g NPK/tree) with (60.88) g which were significantly superior over control T₀ (control) with (56.24) g.

3.4 Fruit Diameter (cm)

The maximum fruit diameter was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (6.72) cm, followed by treatment T₆ (350:175:175 g NPK/tree) with (6.30) cm which were significantly superior over control T₀ (control) with (3.13) cm.

3.5 Number of Fruits per Branch

The maximum number of fruits per branch was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (21.67), followed by treatment T₆ (350:175:175 g NPK/tree) with (19.67) which were significantly superior over control T₀ (control) with (13.67).

3.6 Number of Fruits per Plant

The maximum number of fruits per plant was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (322.15), followed by treatment T₆ (350:175:175 g NPK/tree) with (274.28) which were significantly superior over control T₀ (control) with (149.01).

3.7 Fruit Yield per Plant (kg)

The maximum fruit yield per plant was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (55.30) kg, followed by treatment T₆ (350:175:175 g NPK/tree) with (46.25) kg which were significantly superior over control T₀ (control) with (21.69) kg.

Table 2. Effects of levels of N, P, K on yield parameters on guava

Symbol	Treatment	Fruit volume (cm ³)	Fruit weight (g)	Fruit Diameter (cm)	No. of fruits per branch	No. of fruits per plant	Yield/Plant (kg)
T ₀	Control	150.77	56.24	3.13	13.67	149.01	21.69
T ₁	100:50:50 g NPK/tree	153.07	57.32	3.37	14.67	168.41	27.20
T ₂	150:75:75 g NPK/tree	155.93	57.67	3.73	16.67	208.15	34.08
T ₃	200:100:100 g NPK/tree	157.7	58.19	3.97	15.67	202.08	31.92
T ₄	250:125:125 g NPK/tree	158.66	59.65	5.04	17.67	219.01	34.41
T ₅	300:150:150 g NPK/tree	160.59	59.26	5.86	18.67	208.01	34.06
T ₆	350:175:175 g NPK/tree	164.54	60.88	6.30	19.67	274.28	46.25
T ₇	400:200:200 g NPK/tree	165.56	61.53	6.72	21.67	322.15	55.30
	F Test.	S	S	S	S	S	S
	CD	2.521	2.042	0.924	0.782	0.782	5.462
	SE(d)	1.351	1.021	0.461	0.351	0.351	2.651

Table 3. Effects of levels of NPK on quality of Guava fruits,

Symbol	Treatment	TSS °B	Total Sugar	Ascorbic acid (mg/100g)	Acidity %
T ₀	Control	10.55	5.61	154.52	0.266
T ₁	100:50:50 g NPK/tree	11.61	5.87	155.89	0.244
T ₂	150:75:75 g NPK/tree	11.05	6.44	160.52	0.233
T ₃	200:100:100 g NPK/tree	11.31	6.92	162.81	0.253
T ₄	250:125:125 g NPK/tree	11.4	7.14	163.62	0.233
T ₅	300:150:150 g NPK/tree	11.51	7.75	164.79	0.220
T ₆	350:175:175 g NPK/tree	11.81	8.31	166.12	0.231
T ₇	400:200:200 g NPK/tree	12.17	8.84	167.86	0.205
	F Test.	S	S	S	S
	CD	1.314	1.052	2.065	0.026
	SE(d)	0.658	0.524	0.982	0.012

3.8 Quality Parameters

The data regarding effects of different levels of NPK on yield parameters showed that, there is significant differences with regards to TSS (°Brix), total sugars (%), acidity (%), ascorbic acid (mg/100 pulp). The data shown in Table 3.

3.9 TSS (°Brix)

The maximum TSS was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (12.17) °Brix, followed by treatment T₆ (350:175:175 g NPK/tree) with (11.81) °Brix which were significantly superior over control T₀ (control) with (10.55) °Brix.

3.10 Total Sugars (%)

The maximum Total sugar was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (8.84) %, followed by treatment T₆ (350:175:175 g NPK/tree) with (8.31) % which were significantly superior over control T₀ (control) with (5.61) %.

3.11 Acidity (%)

The minimum acidity was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (0.205) %, followed by treatment T₅ (300:150:150 g NPK/tree) with (0.220) % which were significantly superior over control T₀ (control) with (2.66) %.

3.12 Ascorbic Acid (mg/100 pulp)

The maximum Ascorbic acid was recorded in the treatment T₇ (400:200:200 g NPK/tree) with (167.86) mg/100g, followed by treatment T₆ (350:175:175 g NPK/tree) with (166.12) mg/100g

which were significantly superior over control T₀ (control) with (154.52) mg/100.

4. CONCLUSION

Based on our experiment findings it was concluded that the treatment T₇ (400:200:200 g NPK/tree) was found to be best in terms of TSS (°Brix), Ascorbic acid (mg/100pulp), Acidity (%), Total sugars (%). It was significantly best in terms of yield parameters also i.e., Fruit volume (ml), Fruit weight (g), Fruit diameter(cm), No. of fruit per branches, No. of fruit per plant, Fruit yield per plant(kg)).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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