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Chavan MTAssistant Professor, College of
Agriculture, Umarkhed,
Yavatmal, Maharashtra, India**Thutte AS**Assistant Professor, Shriram
College of Horticulture, Paniv,
Malshiras, Solapur,
Maharashtra, India**Kakade AR**Department of Fruit Science,
Faculty of Horticulture, Dr.
Panjabrao Deshmukh Krishi
Vidyapeeth, Akola,
Maharashtra, India**Solanke AA**Ph.D. Scholar, College of
Horticulture, Dapoli Dr.
BSKVV, Dapoli, Maharashtra,
India

Effect of levels of N, P, K on yield and quality of guava (*Psidium guajava* L.) under high density planting

Chavan MT, Thutte AS, Kakade AR and Solanke AA

Abstract

The present investigation entitled "Effect of levels of N, P, K on yield and quality of guava (*Psidium guajava* L.) under high density planting" was undertaken at the Instructional-cum-Research Farm, college of Agril. business management, Chakur, dist. Latur. The experiment framed was intended to study the effects of levels of N, P, K on yield, quality and to find out optimum economic dose of NPK for guava trees under high density planting. The experiment was conducted on three years old Sardar guava trees. There were eight treatments of different level of NPK replicated thrice in randomized block design. 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 of monsoon as per the treatments as basal dose and remaining half dose of N as per treatments was applied at fruit stage. The N, P, K, was applied in the form of urea, single super phosphate and muriate of potash respectively.

The results of the present investigation indicated that, different levels of NPK had shown varied response to yield and quality of guava. The yield and yield contributing characters were also significantly superior with the application of 300:150:150 g NPK/tree and at par results are seen with the application of NPK@ 350:175:175 g/tree. The maximum values of physical quality characters like, fruit length (5.45 cm), fruit diameter (5.71 cm), volume of fruit (159.54 ml), weight of pulp (187.12 g), pulp: seed ratio (28.83) and chemical quality attributes like TSS (10.42 °Brix), reducing sugars (3.65%), total sugars (6.55%), organoleptic taste (20.53 out of 25) and shelf life (6.87 days) and minimum physiological weight loss (7.07%) were recorded with the application of 300:150:150 g NPK/tree (T6). The fruits obtained with the application of 350:175:175 g NPK/tree (T7), 400:200:200 g NPK/tree (T8) and 250:125:125 g NPK/tree (T5) has shown at par results. Hence, it can be concluded that, for the guava trees grown under high density planting dose of application of NPK @ 300:150:150 g/tree was found to be optimum for getting higher yield and superior quality of guava fruits by maintaining the soil fertility.

Keywords: *Psidium guajava* L., planting, respectively, minimum

Introduction

Guava (*Psidium guajava* L.) is an important fruit crop of the subtropical and tropical regions in the world. Guava also known as "apple of the tropics" and one of the most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India. The fruit belongs to the family Myrtaceae, which has 140 genera and 3000 species widely distributed throughout the tropical and subtropical regions of the world. It is a good source of ascorbic acid, pectin, sugars and certain minerals. The ascorbic acid content ranges from 75 to 260 mg/100g pulp which varies with cultivar, season, location and stage of maturity. The total soluble solid content in fruits varies from 8.2 to 10.5 °Brix. The total sugars ranges between 4.9 to 10.1 per cent, out of which fructose (59%), glucose (36%) and sucrose (5%) are predominant sugar in ripe guava fruit. Fructose is the principle sugar in green ripe fruit while sucrose is the main one in fully ripe fruits. Fruits are fair source of vitamin A (about 250 IU/100 g) and contain appreciable quantities of thiamine, niacin and riboflavin. The pectin content in guava ranges between 0.5 to 1.8 per cent.

At present, the fertilizer recommendation for guava crop is 800:400:400g NPK/ tree/year at the spacing of 6 X 6m which accommodates 277 plants per ha (Anon., 2018). But in recent days, many farmers are adopting the concept of "high density planting" for guava crop, which allows more number of plants ranging from 1111 to 3333 per hectare depending upon the plant spacing varied from 3X3 m to 2X1.5m respectively. This practice is becoming popular among the farmers. The fertilizer recommendations on scientific basis are not available for high density planted guava trees. The farmers are in need of the nutrient management technology for such meadow guava orchards. There was also a feedback of extension officers regarding the exact nutrient requirement of guava trees grown under high density planting.

Corresponding Author:**Chavan MT**Assistant Professor, College of
Agriculture, Umarkhed,
Yavatmal, Maharashtra, India

Hence, it was felt necessary to find out the solution for the problem faced by the farmers through experimentation.

Materials and Methods

General location

The present investigation was conducted at the Instructional-cum-Research Farm, college of Agril business management, chakur dist-Latur. Geographically, it is situated at an altitude of 633.85 m above Mean Sea Level (MSL), 18°30'47" North latitude and 76°52'31" East longitude on the Balaghat plates.

Climate

The area falls under the semi-arid tropics. The average annual precipitation (worked on the basis of last 33 years) of the district is 840 mm, mostly concentrated during the monsoon months from June to October. The meteorological data were collected from Meteorological Observatory, chakur. The minimum and maximum temperatures recorded were 23 °C and 31.36 °C respectively. The average relative humidity ranged from 53.11 to 67.94%. Meteorological data reveals that 659.5 mm rainfall was received within 36 rainy days during the course of investigation.

Materials

Experimental site

The experimental site was fairly uniform with gentle slope. The soil was medium black slightly alkaline with uniform texture, colour and having good drainage. The experiment was conducted in a well-established orchard of three years age Sardar guava trees planted at 3.0 X 3.0 m spacing. The experiment was carried out in Randomized Block Design with 8 treatment and 3 replication.

Table 1: Treatments details

Sr. No.	Treatment No.	Treatment details
1.	T ₁	Control
2.	T ₂	100:50:50 g NPK/tree
3.	T ₃	150:75:75 g NPK/tree
4.	T ₄	200:100:100 g NPK/tree
5.	T ₅	250:125:125 g NPK/tree
6.	T ₆	300:150:150 g NPK/tree
7.	T ₇	350:175:175 g NPK/tree
8.	T ₈	400:200:200 g NPK/tree

Methodology

Cultural practices

Bahar treatment

The Sardar guava trees grown on medium type soil planted at 3x3m spacing of three years age having uniform growth and vigor were subjected to bahar treatment by withholding irrigation. The various operations like land preparation, removal and disposal of diseased fruits of previous bahar, preparation of basins, weeding, inter-cultivation, plant protection were carried out as per need of the crop.

Application of treatments

The experiment was conducted in a Sardar guava orchard of three years age during Mrig bahar on trees having uniform

growth and vigour. All the cultural and horticultural practices were followed as per the recommendation. The pruning of criss-cross branches, diseased branches was done in month of May. 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 of monsoon as per the treatments as basal dose and remaining half dose of N as per treatments was applied at fruit stage.

Table 2: Chemical composition of fertilizers

Organic manures/Fertilizers	Nutrient contents		
	N (%)	P ₂ O ₅ (%)	K ₂ O (%)
FYM	0.5	0.2	0.5-
Urea	46	-	-
Single Super Phosphate	-	16	
Muriate of Potash			60

Results and Discussion

Yield parameters

The data regarding effect of different levels of NPK on yield parameters of guava are presented in Table 3. The data showed that, there were significant differences with regards to number of fruits per tree, yield kg/ tree, yield per hectare due to the application of different levels of N, P, K.

Number of fruits per tree

The maximum number of fruits per tree (126.19) was recorded with the application of 300:150:150g NPK/tree (T₆), which was statistically at par with the application of 350:175:175g NPK/tree (T₇) and 400:200:200g NPK/tree (T₈). While, minimum number of fruits per tree (85.10) were recorded in control (T₁) treatment.

Average weight of fruit (g)

The maximum average weight of fruit (193.61g) was recorded with the application of 300:150:150g NPK/tree (T₆), which was statistically at par with the application of 350:175:175g NPK/tree (T₇) and 400:200:200g NPK/tree (T₈). While, the minimum average weight of fruit (167.98 g) was observed in control (T₁) treatment.

Yield per tree (kg)

The highest yield (24.43 kg per tree) was recorded in the treatment of application of 300:150:150g NPK/tree (T₆), which was statistically at par with the application of 350:175:175g NPK/tree (T₇). While, the lowest yield per tree (14.29 kg) was observed control (T₁) treatment.

Yield per hectare (t)

The highest yield per hectare (27.14 t) was recorded with the application of 300:150:150g NPK/tree (T₆) and it was followed by 350:175:175 g NPK /tree (T₇). While, the lowest yield per hectare (15.87 t) was observed in control (T₁) treatment.

These results are in accordance with the findings of Kumar *et al.*, (1996)^[3, 5, 9] and Ram *et al.*, (2007) which supports the results of present investigation.

Table 3: Effect of levels of N, P, K on yield parameters of guava

Tr. No.	N, P, K Levels	No. of fruits/tree	Average weight of fruit(g)	Yield kg/tree	Yield t/ha	Percent increase over control
T ₁	Control	85.10	167.98	14.29	15.87	
T ₂	100:50:50 g NPK/ tree.	104.14	170.30	17.72	19.68	24.00
T ₃	150:75:75 g NPK/ tree.	104.62	175.05	18.23	20.25	27.60
T ₄	200:100:100 g NPK/tree	106.60	180.62	19.25	21.38	34.72
T ₅	250:125:125 g NPK/tree	112.18	182.13	20.47	22.74	43.29
T ₆	300:150:150 g NPK/tree	126.19	193.61	24.43	27.14	71.01
T ₇	350:175:175 g NPK/tree	123.45	188.23	23.23	25.80	62.57
T ₈	400:200:200 g NPK/tree	118.15	185.62	21.93	24.36	53.49
	S.E±	3.83	2.64	0.60	0.38	-
	C.D at 5% level	11.63	8.05	1.85	1.14	-

Quality parameters

Physical quality parameters

The data regarding physical quality aspects of guava fruits produced under influence of different levels of NPK are presented in Table 4. The data showed that, there were significant differences with regards to fruit length fruit diameter, fruit of volume, weight of pulp, weight of seeds/fruit and pulp: seed ratio due to influence of different levels of N, P, K.

Fruit length (cm)

The maximum fruit length (5.45cm) was recorded with the application of 300:150:150 g NPK/tree (T₆), which was statistically at par with the application of 350:175:175g NPK/tree (T₇), 400:200:200g NPK/tree (T₈) and 250:125:125 g NPK/tree (T₅). Whereas, minimum fruit length (4.10 cm) was observed in control (T₁) treatment.

Fruit diameter (cm)

The maximum diameter of the fruit (5.71cm) was recorded in treatment of application of 300:150:150 g NPK/tree (T₆), which was statistically at par with 350:175:175 g NPK/tree (T₇) and 400:200:200 g NPK/tree (T₈). While, the minimum fruit diameter (4.37cm) was observed in control (T₁) treatment.

Volume of fruit (ml)

The maximum volume of fruit (159.54ml) was recorded with the application of 300:150:150g NPK/tree (T₆) and it was at

par with rest of the treatments except (T₁) and (T₂). However, the lowest volume of fruit (145.43 ml) was recorded in control (T₁) treatment.

Weight of pulp (g)

The maximum weight of pulp (187.12 g) was recorded in the fruits produced with the treatment of 300:150:150 g NPK/tree (T₆) and which was statistically at par with 350:175:175 g NPK/tree (T₇) and 400:200:200 g NPK/tree (T₈). While, the minimum weight of pulp (161.83 g) was observed in control (T₁) treatment.

Weight of seeds/fruit (g)

The minimum weight of seeds (6.15 g) was recorded in the treatment of control (T₁) and it was at par with rest of the treatments except T₆, T₇ and T₈. While, the maximum weight of seeds (6.49g) was observed in 300:150:150 g NPK/tree (T₆) treatment.

Pulp: seed ratio

The maximum pulp: seed ratio (28.83) was recorded in the treatment of application of 300:150:150 g NPK/tree (T₆), which was followed by the application of 350:175:175 g NPK /tree (T₇). While, the minimum pulp: seed ratio (26.31) observed in control (T₁) treatment.

Similar trends of results has been reported by Muhammad *et al.*, (2000), Shankar *et al.*, (2002) and Ram *et al.*, (2007) which supports the present findings.

Table 4: Influence of N, P, K levels on physical quality parameters of guava fruits

Tr. No.	N, P, K levels	Fruit length (cm)	Fruit diameter (cm)	Volume of fruit (ml)	Weight of pulp (g)	Weight of seeds/fruit (g)	Pulp: seed ratio
T ₁	Control	4.10	4.37	145.43	161.83	6.15	26.31
T ₂	100:50:50 g NPK/tree	4.13	4.46	150.71	164.12	6.18	26.55
T ₃	150:75:75 g NPK/tree	4.25	4.52	154.99	168.81	6.24	27.05
T ₄	200:100:100 g NPK/tree	4.49	4.62	155.78	174.31	6.31	27.62
T ₅	250:125:125 g NPK/tree	5.34	4.79	156.69	175.77	6.36	27.63
T ₆	300:150:150 g NPK/tree	5.45	5.71	159.54	187.12	6.49	28.83
T ₇	350:175:175 g NPK/tree	5.42	5.68	159.49	181.78	6.47	28.09
T ₈	400:200:200 g NPK/tree	5.40	5.65	157.12	179.17	6.45	27.77
	S.E±	0.22	0.21	2.82	2.76	0.08	-
	C.D at 5% level	0.68	0.64	8.55	8.37	0.23	-

Biochemical attributes

The data pertaining to TSS, ascorbic acid, and acidity, reducing sugars, non-reducing sugars and total sugars, organoleptic taste, shelf life are presented in Table 5.

It is evident from the data that, the different biochemical parameters studied were significantly influenced due to application of different levels of NPK.

Total soluble solids (⁰Brix)

The data clearly showed that, the maximum TSS (10.42 ⁰Brix) was recorded in the fruits produced with the application of 300:150:150 g NPK/tree (T₆), which was statistically at par with the rest of the treatments except control (T₁). Whereas, the minimum TSS (9.42⁰Brix) was observed in control (T₁) treatment.

Ascorbic acid (mg/100 g pulp)

The maximum ascorbic acid content (144.50mg/100g pulp) was observed in the treatment of application of 400:200:200g NPK/tree (T₈), which was statistically at par with rest of the treatments except T₁, T₂ and T₃ while, the minimum ascorbic acid content (134.58 mg/100g pulp) was recorded in control (T₁) treatment.

Acidity (%)

The minimum acidity (0.40%) was recorded in control (T₁) treatment, which was statistically at par with the application of 150:75:75 g NPK/tree (T₃) and 100:50:50g NPK/tree (T₂). Whereas, the maximum acidity (0.57%) was recorded with the application of 400:200:200 g NPK/tree (T₈).

Reducing sugars (%)

The maximum reducing sugars (3.65%) was recorded in 300:150:150 g NPK/tree (T₆) treatment, which was statistically at par with the application of 350:175:175 g NPK/tree (T₇), 400:200:200 g NPK/tree (T₈), 250:125:125 g NPK/tree (T₅) and 200:100:100 g NPK /tree (T₄). However, the lowest (3.32%) was recorded in control (T₁) treatment.

Non-reducing sugars (%)

The maximum non-reducing sugars (2.96%) was observed in the treatment of application of 150:75:75 g NPK/tree (T₃) which was statistically at par with the application of

100:50:50 g NPK/tree (T₂), 250:125:125 g NPK/tree (T₅) and 300:150:150 g NPK/tree (T₆). While, the minimum non-reducing sugars in fruits (2.80%) was recorded in control (T₁) treatment.

Total sugars (%)

The maximum total sugar (6.55%) was observed in the application of 300:150:150 g NPK/tree (T₆) which was statistically at par with the rest of the treatments except (T₁). The minimum total sugar in fruits (6.12%) was recorded in control (T₁) treatment.

Organoleptic taste

The maximum organoleptic score (20.53) of quality rating out of 25 was obtained by the fruits produced due to application of 300:150:150 g NPK/tree (T₆) which was statistically at par with the rest of the treatment except T₁ and T₂. However, the minimum score (18.18) was recorded in control (T₁) treatment.

Shelf life (days)

The maximum shelf life of fruits (6.87days) was recorded in the treatment of application of 300:150:150g NPK/tree (T₆). Which was at par with the rest of the treatments except T₁ and T₂. However, the minimum shelf life (5.07days) was recorded in control (T₁) treatment.

Table 5: Effect of levels of N, P, K on chemical attributes of guava fruits

Tr. No.	N, P, K levels	T.S.S (°Brix)	Ascorbic acid (mg/100 pulp)	Acidity (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Organoleptic score (25)	Shelf life (days)
T ₁	Control	9.42	134.58	0.40	3.32	2.80	6.12	18.18	5.07
T ₂	100:50:50 g NPK/ tree	9.80	138.12	0.42	3.40	2.95	6.35	18.96	5.52
T ₃	150:75:75 g NPK/ tree	9.82	139.12	0.43	3.41	2.96	6.37	19.12	5.81
T ₄	200:100:100 g NPK/ tree	10.38	140.44	0.45	3.60	2.87	6.47	19.20	5.83
T ₅	250:125:125 g NPK/ tree	10.39	141.46	0.48	3.61	2.91	6.52	19.24	6.81
T ₆	300:150:150 g NPK/ tree	10.42	142.10	0.51	3.65	2.90	6.55	20.53	6.87
T ₇	350:175:175 g NPK/ tree	10.41	143.41	0.54	3.64	2.89	6.53	20.31	6.85
T ₈	400:200:200 g NPK/ tree	10.40	144.50	0.57	3.63	2.88	6.51	20.17	6.83
	S.E±	0.23	1.63	0.08	0.05	0.02	0.08	0.48	0.40
	C.D at 5% level	0.70	4.95	0.03	0.16	0.06	0.25	1.45	1.20

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