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Effect of integrated nutrient management on yield and quality of winter season Guava (*Psidium guajava* L.) cv. Shweta and Lalit

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Abstract
The present experiment was carried out to investigate "Studies on the effect of nutrient management on morphological and economical parameters of Guava (*Psidium guajava* L.) cv. Sweat and Lalit" conducted on Main Experiment Station, Department of Horticulture, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) during the year 2018-2019.The experiment was conducted in Factorial Randomized Block Design (FRBD) with three replications. The two factors comprise of variety (Shweta (V_1) and Lalit (V_2) and nutrients (N_0 control, N_1= FYM + NPK (400g:300g:250g) + Zinc (0.5%), N_2 = FYM + NPK (400g:300g:250g) + Borax (1%), N_3= FYM+NPK (400g:300g:250g) +Zinc (0.5%) + Borax (0.5%) with a total of eight treatment with an objective to encourage the winter season fruiting. Based on the experimental results it can be concluded that maximum growth of guava tree fruit quality of guava *viz*. number of fruits/trees, fruit weight, diameter of fruit, fruit length and width, specific gravity of fruit and nutrients in (N_3) yield (kg/tree) and (q/tree) also found maximum this treatment. Over all it can be concluded that the variety in Lalit variety during N_3= FYM+NPK (400g: 300g: 250g) + Zinc (0.5%) + Borax (0.5%) was found best of healthy vegetative growth, higher yield and better-quality fruit of guava during winter season.

Keywords: Guava, yield, micronutrients, quality

Introduction
Guava (*Psidium guajava* L.) the apple of tropics is one of the most important tropical and subtropical fruit crops. It belongs to the family Myrtaceae. It is native of tropical America stretching from Mexico to Peru and gradually become a commercial significance in a several countries because of its shady nature, prolific bearing, high vitamin- 'C' content, pleasant, aroma and good flavor. The guava fruit is a berry with seedy core. The fruit may be smooth or ridge and waxy. Guava is a shallow rooted shrub with spreading branch. The height of 9 meters. In the indigenous area of tropical America including Peru, Mexico and Cuba, it is grown wild as bushes. The importance of guava is due to fact that it is a hardy and which can be grown poor alkaline soil or poorly drained soil. It can be grown in soil with Ph ranging 4.5-8.5 without any irrigation. It can stand above 46 ^oC temperature. It was introduced in India in the 17th century and gradually become a commercial crop all over the country. At present, guava had got well established market in more than 60 countries of the world. It is cultivated in India, Algeria, Australia, Brazil, California, China, Columbia, Costa Rica, Cuba, Egypt, Florida, Hawaii, Indonesia, Israel, Java, Kenya, Malaysia, Mexico New Zealand, Panama, Pakistan, Philippines, Spain, South Africa and U.S.A. Area and production of guava in India is 3,07,000 ha and 4,516,000 MT (Anon. 2022) and productivity is 14 MT/ha (NHB Database 2019-20). In India guava is widely grown in Uttar Pradesh, Madhya Pradesh, Maharashtra, Bihar, West Bengal, Gujarat, Andhra Pradesh, Punjab, Tamil Nadu, Karnataka and Assam. The best quality guava is produced in Uttar Pradesh. The district of Prayagraj has a reputation of growing best guava in the country as well as in the world. The Guava bears flower and fruit on current season growing twigs and is highly cross-pollinated crop and pollination is performed by insects.

Fruit of guava develops from inferior ovary and exhibits double sigmoid growth curve. The fruit takes nearly 4-5 months to change from dark green to yellowish green to attain maturity. The fruit is highly perishable and seasonal in nature. Guava fruit is considered as one of the delicious and luscious fruit. Nutritive value of guava is very high. Therefore, it is an ideal fruit for nutritional security. Guava is one of the cheapest and good sources of vitamin-C (210-305mg/100g fruit pulp) and pectin (0.5-1.8%) but has low energy (66cal/100g). The ripe fruits contain 12.3-26.3% dry matter, 77.9-86.9% moisture, 0.51-1.02% ash,0.10-0.70% crude fat, 0.82-1.45% crude protein and 2.0-7.2% crude fiber. The fruit is also rich in minerals like Phosphorus (22.5-40.0 mg/100g pulp), Calcium (10.0-30.0 mg/100 g pulp) and Iron (0.60-1.39 mg/100g pulp) as well as vitamins like Niacin (0.20-2.32 mg/100 g pulp), Pantothenic acid, Thiamine (0.03-0.07mg/100 g pulp), Riboflavin (0.02-0.04 mg/100 g pulp) and vitamin- "A" (Mitra and Bose, 2001) [6]. Conventional (chemicals based) farming is non-sustainable because of many problems such as loss of soil health and productivity from excessive erosion and associated plant nutrient losses, surface and ground water pollution from fertilizers and sediments, impending of non-renewable resources and low farm income from high production costs. In view of these, there is an increasing awareness about alternate agriculture system known as integrated plant nutrient management which implies the maintenance or adjustment of soil fertility and of plant nutrients supply to an optimum level for sustaining the crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner. The basic concept of integrated nutrient management (INM) is the adjustment of plant nutrient supply to an optimum level for sustaining the desired crop productivity. It involves proper combination of chemical fertilizers, organic manure and biofertilizers suitable to the system of land use and ecological, social and economic conditions. Micronutrients such as zinc play important role in growth and development of fruit, vegetables and cereals. It is one of the essential elements for the formation of chlorophyll and hence useful towards photosynthetic activity. It is also a constituent of some enzymes. Zinc activates enzymes that are responsible for the synthesis of certain proteins. It is used in the formation of chlorophyll and some carbohydrates, conversion of starches to sugars and its presence in plant tissue helps the plant to withstand cold temperatures. Zinc is essential in the formation of auxins, which helps with growth regulation and stem elongation.

Materials and Methods

The present investigation was under taken at Main Experimental Station, Horticulture, A.N.D.U.A.&T., Kumarganj, (Faizabad) Ayodhya U.P. India during winter season of 2018- 19. Geographically, it is situated in typical saline alkali belt of Indo-Gangetic plains of eastern U.P. at 26.47 N latitude, 88.12°E longitudes and at an altitude of 113 meter from mean sea level. The region enjoys sub-humid and subtropical climate receiving a mean annual rainfall of about 1215 mm out of which about 85% is concentrated from mid-June to end of September with an average annual rainfall of 764.01mm and relative humidity of 66.76 percent. The winter months prevails from November to March with mild to severe cool temperature ranging from 17.9 to 33.1 ℃. The severe cold temperature 17.9 ℃ was recorded in the month of January and occasionally winter rains and frost was also noticed. The summer months occur from April to June with an average temperature of 39.2 to 41.4 ℃. The dry and hot wind waves were also noticed in the months of mid-May and June. The experimental material consists of 24 guava trees. Experiment was performed in 5-year-old guava orchard. The plants were planted at spacing 6m × 6m. The experiment was comprising of Organic manure, Fertilizers *viz*. NPK in combination of micronutrients yield and quality of winter season guava two factors comprise of variety (Shweta (V_1) and Lalit (V_2) and nutrients (N_0 control, N_1 = FYM + NPK (400g: 300g: 250g) + Zinc (0.5%), N_2 = FYM + NPK (400g:300g:250g) + Borax (1%), N_3= FYM+NPK (400g:300g:250g) +Zinc (0.5%) + Borax (0.5%). The experiment was laid out in Factorial Randomized Block Design (FRBD) consisting of 8 treatments and 3 replications. The observations were recorded on, Number of fruits per tree, fruit weight (g) and fruit diameter (cm), fruit length (cm) and fruit width (cm), specific gravity of fruit, fruit yield (kg/tree). Statistical analysis of the data obtained in the different sets of experiments were calculated, as suggested by Panse and Sukhatma (1989) [9].

Results and Discussion

Physical character

An examination of the data presented in Table-1 shows that the number of fruits per tree was significantly influenced by different treatments applied among the varieties. The maximum number of fruits per tree (77.92) was recorded with (V_2) while the minimum number of fruits per tree (56.67) was noted with (V_1) Nutrients was also found significant regarding fruits per tree. Maximum number of fruits per tree (78.00) was recorded with the nutrients (N_3) followed by (N_2) which was found significantly superior over rest of the treatments while, minimum number of fruits per tree (61.33) was recorded with Nutrients (N_0) control. The interaction between variety and nutrients on number of fruits per tree was found non-significant. The maximum number of fruits per tree (90.33) was noted with (N_3V_2). The minimum number of fruits per tree (51.67) was measured with (V_1N_0) variety of (V_1) and nutrients (N_0) control.

Data gathered on fruit weight have been portrayed in Table 1 revealed that variety was found significant with fruit weight. Maximum fruit weight (78.34g) was noted with (V_1) and minimum fruit weight (63.13g) was noted with (V_2) Nutrients was also significantly influenced the fruit weight. The maximum fruit weight (79.77g) was measured with the nutrients (N_3) followed by (N_2) whereas minimum fruit weight (63.34 g) was recorded with nutrients (N_0) control. The interaction between variety and nutrients was also found non- significant. Maximum fruit weight (84.64g) was recorded with (N_3V_1) and minimum (54.51g) was measured with (V_2N_0) variety of (V_2) in nutrients (N_0) control. Similar results were also observed by Awasthi and Lal (2009) [2].

It is clear from the data presented in Table 1 showed that variety was found significant with respect to fruit diameter. Maximum fruit diameter (6.68cm) was recorded with (V_1) and which were found at par with (V_2) and minimum (5.57 cm) with (V_2) variety Nutrients was non-significantly effect on fruit diameter however maximum fruit diameter (6.35cm) was recorded with (N_3) and minimum (5.79 cm) with nutrients (N_0) control. The interaction between variety and nutrients on fruit diameter was found non-significant. The maximum fruit diameter (6.85 cm) was recorded with (N_3V_1), whereas, minimum fruit diameter (5.08 cm) was recorded with in (N_0V_1).

It is clear from the data presented in Table 1 showed that variety was found significant with respect to fruit length. Maximum fruit length (7.03 cm) was recorded with variety (V_1) and minimum (6.29 cm) with variety (V_2) Nutrients was significantly effect on fruit length however maximum fruit

length (7.07cm) was recorded with (N_3) followed by (N_1) and minimum (5.83 cm) with nutrients (N_0) control. The interaction between variety and nutrients on fruit length was found non-significant. The maximum fruit length (7.75 cm) was recorded with (N_3V_1) whereas, minimum fruit length (5.75 cm) was recorded with control in (N_0V_1).

It is clear from the data presented in Table 1 showed that variety was found significant with respect to fruit width. The maximum fruit width (7.20 cm) was recorded with the variety (V_1) and minimum (6.22 cm) with variety (V_1) Nutrients was significantly influenced width of guava fruit. Maximum fruit width (7.32 cm) was recorded with nutrients in (N_3) followed by (N_1) and Minimum (6.11 cm) fruit width was measured with nutrients control (N_0). The interaction between variety and nutrients on fruit width was found non-significant. The maximum fruit width (7.92 cm) was recorded with (N_3V_1) whereas, minimum fruit width (5.83 cm) was recorded with (N_0V_2). These results are close conformity with findings of Prasad *et al*., (2015) [10] Pal *et al*. (2008) [8] in guava and Mishra *et al*. (2017) [5] in Aonla.

Data on specific gravity was non-significantly influenced by variety and have been presented in Table 1 revealed that maximum specific gravity (1.001) was recorded with the variety (V_2) and minimum specific gravity (0.988) was recorded with the variety (V_1). Nutrients also non-significantly influenced the specific gravity. Maximum specific gravity (1.014) was recorded with nutrients in (N_3) which were found at par with (V_1) and minimum specific gravity (0.978) was recorded with nutrients in control (N_0). The interaction effect of variety and nutrients on fruit specific gravity was found non-significant. The maximum specific gravity (1.016) was recorded with nutrients in (N_3V_1) whereas, minimum specific gravity (0.970) was recorded with nutrients (N_1V_1). The results are similar to Trivedi *et al*. (2012) [12] in guava.

Yield character

It is clear from the data presented in Table 1 showed that variety significantly influenced the fruit yield (kg/tree). Maximum fruit yield (kg/tree) (4.98kg) was recorded with variety of (V_2) and minimum fruit yield (kg/tree) (4.46 kg) was recorded with variety (V_1). Nutrients was significantly influenced the fruit yield (kg/tree). The maximum fruit yield (6.15 kg) was recorded with nutrient in (N_3) followed by nutrient in (N_2) and minimum fruit yield (kg/tree) (3.80 kg) was noted with nutrient in control (N_0). The interaction between nutrients and variety time on fruit yield (kg/tree) was found non-significant. The maximum yield (6.76 kg) was recorded with (N_3V_2) and minimum (3.37 kg) was noted with control in (N_0V_1). Rajkumar *et al*. (2014) [11].

Table 1: Effect of Integrated Nutrient Management (INM), on physical parameters of guava,

Treatments	Number of fruits per tree	Fruit weight (g)	Fruit diameter (cm)	Fruit length (cm)	Fruit width (cm)	Specific gravity	Yield (kg/tree)
V_1	56.67	78.34	6.68	7.03	7.20	0.988	4.46
V_2	77.92	63.13	5.57	6.29	6.22	1.001	4.98
S.Em±	0.78	1.81	0.16	0.17	0.18	0.07	0.13
CD at 5%	2.35	5.45	0.50	0.51	0.56	NS	0.38
N_0	61.33	63.34	5.79	5.83	6.11	0.978	3.80
N_1	63.33	66.22	6.11	6.98	6.72	0.985	4.09
N_2	66.50	73.61	6.25	6.78	6.69	1.000	4.83
N_3	78.00	79.77	6.35	7.07	7.32	1.014	6.15
S.Em±	1.10	2.56	0.23	0.24	0.26	0.09	0.18
CD at 5%	3.33	7.76	NS	0.72	0.78	NS	0.54
V_1N0	51.67	72.17	6.50	5.75	6.39	0.975	3.37
V_1N_1	53.33	76.58	6.67	7.27	7.20	0.970	4.07
V_1N_2	56.00	79.97	6.70	7.37	7.30	0.990	4.49
V_1N_3	65.67	84.64	6.85	7.75	7.92	1.016	5.54
V_2N_0	71.00	54.51	5.08	5.90	5.83	0.980	3.88
V_2N_1	73.33	55.86	5.55	6.70	6.23	1.000	4.11
V_2N_2	77.00	67.24	5.81	6.18	6.08	1.010	5.17
V_2N_3	90.33	74.90	5.84	6.38	6.73	1.012	6.76
S.Em±	1.55	3.62	0.33	0.34	0.36	0.13	0.25
CD at 5%	NS	NS	NS	NS	NS	NS	NS

Conclusion

It may be concluded from the results obtained in present investigation that Lalit variety (V_2) and nutrients in (N_3) (FYM+NPK (400g: 300g: 250g) + Zinc (0.5%) + Borax (0.5%) was found to be most effective to improve growth parameters and physical parameter such as fruit weight, fruit size, fruit length, fruit width, Fruit diameter, specific gravity and also on yield attribute like number of fruits per tree, fruit yield kg per tree, fruit yield (q/ha). Therefore, Lalit variety (V_2) and nutrients in (N_3) (FYM + NPK (400g: 300g: 250g) +Zinc (0.5%) + Borax (0.5%) can be recommended to obtained higher yield and quality production of guava fruit in the Indo-Gangetic plains of eastern Uttar Pradesh.

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