International Journal of Agriculture, Environment and Biotechnology
Citation: *IJAEB*: **17**(03): 617-620, September 2024
DOI: 10.30954/0974-1712.03.2024.6

ASSOCIATION FOR AGRICULTURE ENVIRONMENT AND BIOTECHNOLOGY

RESEARCH PAPER

Optimization of Fruit Growth and Developments of Guava (*Psidium guajava* L.) cv. L-49 Using Fertilizer & Bioinoculants

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Paper No. 1176 **Received:** 11-06-2024 **Revised:** 02-08-2024 **Accepted:** 28-08-2024

ABSTRACT

A field experiment was carried out during the year 2022-23 & 2023-24 at Fruit Research Station Imaliya, Department of Horticulture, Jawaharlal Nehru Agriculture University, Jabalpur, Madhya Pradesh to find out the effect of Nutrients and Bioinoculants on fruit growth, development and yield of guava. During both year of experimentation, the pooled data revealed that the treatment combinations T_9 (100% RDF + Biofertisol 200 ml) recorded maximum number of fruits (107.03), fruit length (7.30 cm) and fruit width (7.47 cm), fruit weight (246.36 g), fruit volume (206.35 ml) and yield (26.37 kg). The minimum number of fruits (92.97), fruit weight (203.33 g), fruit volume (175.74ml), fruit length (6.57 cm), fruit width (6.76 cm) and yield/plant (18.91 kg) were found in control (T_1).

HIGHLIGHTS

- India reigns supreme as the world's largest guava producer, contributing an impressive 45% to global production, with Uttar Pradesh and Madhya Pradesh leading the charge as the top two guava-producing states. Nutrients and Bioinoculants can improve vegetative growth, which can lead to higher fruit growth and development. For example, a combination of fertilizers and Bioinoculants – Bactobooster, Biofertisol can increase fruit yield, fruit length, diameter, weight, and volume.

Keywords: Guava, RDF, Bioinoculants, Yield, Fruit growth and Developments

Guava (*Psidium guajava* L.), commonly referred as the "poor man's fruit" or the "apple of the tropics," is a significant tropical and subtropical fruit crop in India. Despite becoming a native of tropical America, its cultivation has spread to all tropical nations including India with significant contribution (Samson, 1980). Guava is the fourth most common fruit crop in India with a cultivation area of 307 thousand hectares and a yield of 4516 thousand MT, (NHB, 2021). The leading guava producing states in India are Uttar Pradesh, Madhya Pradesh, Bihar, Andhra Pradesh, Haryana, Punjab, West Bengal, Chattisgarh, Gujarat, and Karnataka. (Anonymous, 2021). In Madhya Pradesh, the major growing districts are Jabalpur, Ujjain, Narmdapuram, Khargone, Badwani, Indore, Shivpuri. It is not only a delicious table fruit but also a crucial fruit for the processing sector due to its outstanding flavour, nutritional value and medicinal properties. It is a plentiful and affordable source of pectin and vitamin C. (Agnihotri, 1962). Maximizing fruit growth and development is crucial for enhancing yield and quality in guava production. Fertilizers and bioinoculants play significant roles in influencing fruit growth and

How to cite this article: Rai, R.K., Pandey, S.K., Pandey, C.S., Samaiya, R.K. and Upadhyay, A.K. (2024). Optimization of Fruit Growth and Developments of Guava (*Psidium guajava* L.) cv. L-49 Using Fertilizer & Bioinoculants. *Int. J. Ag. Env. Biotech.*, **17**(03): 617-620.

Source of Support: None; **Conflict of Interest:** None

development by providing essential nutrients and promoting beneficial microbial interactions in the rhizosphere. Understanding the effects of fertilizers and bioinoculants on guava fruit growth and development is essential for sustainable cultivation practices and optimizing productivity.

MATERIALS AND METHODS

Present study was carried out during the year 2022-23 & 2023-24 at Fruit Research Station Imaliya, Department of Horticulture, Jawaharlal Nehru Agriculture University, Jabalpur, Madhya Pradesh to find out the effect of Nutrients and Bioinoculants on fruit growth, development and yield of guava on twelve-year-old of Guava planted at a spacing of 3 m × 3 m. The experiment was conducted in a Factorial Randomized Block Design with three replications. The experiment consists of two factors viz. Factor A (Nutrients levels)– Control (N_1), 100% RDF (N_2), 75% RDF (N_3), 50% RDF(N_4) and Factor B (Bioinoculants levels) - No Bioinoculant/Control (B_1), Biofertisol 100 ml/ Plant (B_2), Bactobooster 100ml/ Plant (B_3), Biofertisol 200 ml/ Plant (B_4), Bactobooster 200 ml /Plant (B_5) having 20 treatment combinations. The observations were recorded for average length, diameter, weight, and volume etc of random sample of five fruits. The electronic weighing balance was used to determine the fruit weight(g). The fruit length, fruit diameter (cm) was measured with the help of digital vernier callipers. Volume of the fruits (ml) was determined using water displacement methods. The total number of fruits per plant were recorded by counting the harvested fruits in different pickings. To calculate the fruit yield(kg) per tree, the average fruit weight was multiplied with total number of fruits/tree.

RESULTS AND DISCUSSION

The application of fertilizers and bioinoculants separately and in combinations had a significant influence on yield and physical attributes of guava (Table 1-3). The individual effect of nutrients and Bioinoculants during the both years of pooled data showed that maximum number of fruits (105.18), fruit length (7.24 cm), fruit width (7.40 cm), fruit weight 238.56 g, fruit volume (232.26 ml) and yield (25.10 kg) was recorded in N_2-100% RDF. With respect of bioinoculants, maximum number of fruits (102.68), fruit length (7.07 cm), fruit width (7.24 cm), fruit weight (232.81 g), fruit volume (226.53 ml) and yield (23.96 kg/plant) were recorded in Biofertisol 200 ml (B_4). The treatment combinations T_9 (100% RDF + Biofertisol 200 ml) recorded maximum number of fruits (107.03), fruit length (7.30 cm) and fruit width (7.47 cm), fruit weight (246.36 g), fruit volume (240.20 ml) and yield (26.37 kg) followed by T_{14} (75% RDF + Biofertisol 200 ml) which recorded number of fruits (106.37), fruit length (7.28 cm) and fruit width (7.44 cm), fruit weight (243.55 g), fruit volume (237.26 ml) and yield (25.90 kg). whereas the minimum number of fruits (92.97), fruit length (6.57 cm) and fruit width (6.76 cm), fruit weight (203.33 g), fruit volume (197.15 ml) and yield (18.91 kg) were recorded in control (T_1).

Table 1: Effect of nutrients and bioinoculants on fruit weight and fruit volume of guava cv. L-49

Treatments	Effect of nutrients and bioinoculants on fruit weight and fruit volume of guava cv. L-49.					
	Fruit Weight (g)			Fruit Volume (ml)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Factor A (Level of nutrients)						
N1	207.65	209.69	208.67	201.45	203.63	202.54
N2	237.54	239.57	238.56	231.15	233.37	232.26
N3	234.72	236.73	235.72	228.34	230.54	229.44
N4	223.98	225.81	224.90	217.34	219.27	218.31
SEm±	0.69	0.79	0.69	0.65	0.65	0.65
CD (5%)	1.97	2.25	1.96	1.86	1.87	1.86
Factor B (Bioinoculants)						
B1	220.24	222.28	221.26	213.68	215.89	214.78
B2	225.78	227.79	226.79	219.34	221.49	220.42
B3	223.50	225.54	224.52	217.13	219.28	218.21
B4	231.80	233.82	232.81	225.43	227.64	226.53
B5	228.54	230.32	229.43	222.26	224.23	223.24
SEm±	0.77	0.88	0.77	0.73	0.73	0.73
CD (5%)	2.20	2.52	2.20	2.08	2.09	2.08
Interaction (A × B)						
N1B1	202.31	204.36	203.33	196.09	198.21	197.15
N1B2	208.24	210.23	209.23	202.04	204.10	203.07
N1B3	205.41	207.43	206.42	199.24	201.46	200.35
N1B4	212.13	214.16	213.15	205.89	208.13	207.01
N1B5	210.16	212.26	211.21	203.97	206.28	205.12
N2B1	231.36	233.42	232.39	224.55	226.84	225.70
N2B2	236.39	238.41	237.40	229.95	232.14	231.05
N2B3	235.13	237.18	236.15	228.72	230.94	229.83
N2B4	245.36	247.37	246.36	239.06	241.34	240.20
N2B5	239.47	241.48	240.48	233.48	235.59	234.54

N3B1	229.04	231.07	230.05	222.58	224.77	223.68
N3B2	233.12	235.13	234.13	226.70	228.94	227.82
N3B3	231.24	233.27	232.26	224.94	227.06	226.00
N3B4	242.54	244.56	243.55	236.16	238.36	237.26
N3B5	237.64	239.63	238.64	231.32	233.56	232.44
N4B1	218.26	220.28	219.27	211.50	213.73	212.61
N4B2	225.38	227.39	226.39	218.67	220.77	219.72
N4B3	222.24	224.27	223.25	215.63	217.67	216.65
N4B4	227.16	229.18	228.17	220.62	222.73	221.67
N4B5	226.88	227.91	227.39	220.27	221.48	220.88
SEm±	1.54	1.76	1.53	1.45	1.46	1.45
CD (5%)	4.40	5.03	4.39	4.16	4.18	4.16

Table 2: Effect of nutrients and bioinoculants on fruit length and fruit width of guava cv. L-49

Treatments	Effect of nutrients and bioinoculants on fruit length and fruit width of guava cv. L-49.					
	Fruit length (cm)			Fruit width (cm)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Factor A (Level of nutrients)						
N1	6.61	6.64	6.63	6.87	6.91	6.89
N2	7.23	7.26	7.24	7.38	7.42	7.40
N3	7.19	7.22	7.21	7.34	7.38	7.36
N4	6.86	6.89	6.88	7.07	7.11	7.09
SEm±	0.02	0.02	0.01	0.04	0.02	0.02
CD (5%)	0.05	0.04	0.04	0.11	0.07	0.07
Factor B (Bioinoculants)						
B1	6.88	6.91	6.90	7.06	7.10	7.08
B2	6.98	7.01	6.99	7.21	7.25	7.23
B3	6.93	6.96	6.95	7.17	7.21	7.19
B4	7.06	7.09	7.07	7.22	7.26	7.24
B5	7.03	7.06	7.04	7.18	7.22	7.20
SEm±	0.02	0.02	0.01	0.04	0.03	0.03
CD (5%)	0.05	0.05	0.04	0.13	0.08	0.08
Interaction (A × B)						
N1B1	6.55	6.58	6.57	6.74	6.78	6.76
N1B2	6.62	6.65	6.64	6.94	6.98	6.96
N1B3	6.58	6.61	6.60	6.88	6.92	6.90
N1B4	6.68	6.71	6.70	6.92	6.96	6.94
N1B5	6.64	6.67	6.66	6.87	6.91	6.89
N2B1	7.16	7.19	7.18	7.29	7.33	7.31
N2B2	7.24	7.27	7.26	7.39	7.43	7.41
N2B3	7.20	7.23	7.22	7.37	7.41	7.39
N2B4	7.28	7.31	7.30	7.45	7.49	7.47
N2B5	7.24	7.27	7.26	7.41	7.45	7.43
N3B1	7.12	7.15	7.14	7.25	7.29	7.27
N3B2	7.20	7.23	7.22	7.35	7.39	7.37
N3B3	7.17	7.20	7.19	7.33	7.37	7.35
N3B4	7.26	7.29	7.28	7.42	7.46	7.44
N3B5	7.22	7.25	7.24	7.38	7.42	7.40
N4B1	6.69	6.72	6.71	6.97	7.01	6.99
N4B2	6.84	6.87	6.86	7.16	7.20	7.18
N4B3	6.78	6.81	6.80	7.12	7.16	7.14
N4B4	7.02	7.05	7.04	7.08	7.12	7.10
N4B5	6.99	7.02	7.01	7.04	7.08	7.06
SEm±	0.04	0.04	0.03	0.09	0.06	0.06
CD (5%)	0.10	0.10	0.08	0.26	0.16	0.16

Table 3: Effect of nutrients and bioinoculants on number of fruits plant^{-1} and yield plant^{-1} of guava cv. L-49

Treatments	Effect of nutrients and bioinoculants on number of fruits plant^{-1}and yield plant^{-1}of guava cv. L-49.					
	Number of fruits plant^{-1}			Yield plant^{-1} (kg)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Factor A (Level of nutrients)						
N1	94.46	95.59	95.03	19.62	20.05	19.84
N2	104.62	105.75	105.18	24.86	25.34	25.10
N3	103.55	104.68	104.12	24.31	24.79	24.55
N4	98.70	99.83	99.27	22.11	22.55	22.33
SEm±	0.03	0.54	0.03	0.07	0.17	0.07
CD (5%)	0.08	1.55	0.08	0.20	0.48	0.20
Factor B (Bioinoculants)						
B1	98.42	99.55	98.99	21.72	22.17	21.95
B2	100.47	101.60	101.04	22.73	23.19	22.96
B3	99.52	100.65	100.08	22.29	22.75	22.52
B4	102.12	103.25	102.68	23.73	24.20	23.96
B5	101.13	102.26	101.70	23.16	23.60	23.38
SEm±	0.03	0.61	0.03	0.08	0.19	0.08
CD (5%)	0.09	1.73	0.09	0.22	0.54	0.22
Interaction (A × B)						
N1B1	92.40	93.53	92.97	18.70	19.12	18.91
N1B2	94.67	95.80	95.24	19.72	20.14	19.93
N1B3	93.52	94.65	94.09	19.21	19.63	19.42
N1B4	96.48	97.61	97.05	20.47	20.91	20.69
N1B5	95.23	96.36	95.79	20.01	20.45	20.23
N2B1	102.26	103.39	102.82	23.66	24.13	23.90
N2B2	104.80	105.93	105.37	24.78	25.26	25.02
N2B3	104.12	105.25	104.69	24.49	24.97	24.73
N2B4	106.46	107.59	107.03	26.13	26.62	26.37
N2B5	105.43	106.56	106.00	25.25	25.73	25.49
N3B1	101.44	102.57	102.01	23.23	23.70	23.46
N3B2	103.58	104.71	104.15	24.14	24.62	24.38

N3B3	102.31	103.44	102.88	23.66	24.13	23.90
N3B4	105.80	106.93	106.37	25.66	26.15	25.90
N3B5	104.64	105.77	105.20	24.87	25.35	25.11
N4B1	97.58	98.71	98.15	21.30	21.75	21.53
N4B2	98.84	99.97	99.40	22.27	22.73	22.50
N4B3	98.12	99.25	98.69	21.81	22.26	22.04
N4B4	99.73	100.86	100.30	22.66	23.12	22.89
N4B5	99.24	100.37	99.81	22.52	22.88	22.70
SEm±	0.06	1.21	0.06	0.15	0.38	0.15
CD (5%)	0.17	3.46	0.17	0.44	1.08	0.44

Plant metabolism is accelerated by the nutrient combinations. The presence of nitrogen positively influenced the vegetative growth of the plant, which produced more food material and when translocated into fruit bearing areas, enhanced the weight and size of the fruits. Potassium regulates water relations and phosphorus plays a vital role in carbohydrate and protein synthesis and photosynthesis. Similar results were also reported by Baviskar *et al.* (2011) in sapota, Agnihotri *et al.* (2013), Chandra *et al.* (2016), Sandhyarani *et al.* (2022) and Ahir *et al.* (2023) in guava. The application of bioinoculants has been shown to promote superior growth and the accumulation of optimal dry matter through the induction of growth hormones. These hormones serve to stimulate cell division and elongation, activate the photosynthetic process, enhance the translocation of crucial water and nutrients, and facilitate the growth and development of roots. Additionally, energy transformation is stimulated, which ultimately leads to an increase in fruit weight, number of fruit, yield and other important physical characteristics. The present findings are in accordance with the results reported by Bhobia *et al.* (2005) in guava, Dutta *et al.* (2010) in litchi, Bohane *et al.* (2014) in ber, Kumar *et al.* (2017) in guava, Rasheed and Rezan (2019) in brinjal.

CONCLUSION

Based on facts, it is concluded that application of fertilizers and bioinoculants alone and in combination enhance the yield and yield attributing characters of guava cv. L-49. The application of T_9 (100% RDF + Biofertisol 200 ml) was more conducive to obtained maximum number of fruits (107.03), fruit length (7.30 cm), fruit width (7.47 cm), fruit weight (246.36 g), fruit volume (206.35 ml) and yield (26.37 kg). The treatment combination T_{14} (75% RDF + Biofertisol 200 ml) was found next best treatment which recorded number of fruits (106.37), fruit length (7.28 cm) and fruit width (7.44 cm), fruit weight (243.55 g), fruit volume (237.26 ml) and yield (25.90 kg).

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