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Effect of N, P & K on fruiting, yield and fruit quality in guava cv. Pant Prabhat

Pankaj Kumar, J. P. Tiwari and Raj Kumar
Department of Horticulture, G.B.P.U.A &T
Pantnagar - 246 123, India
E-mail: pundeerpankaj@indiatimes.com

ABSTRACT

Response of various combinations of NPK on fruiting, yield and fruit quality were studied in guava cv. Pant Prabhat in a field experiment, over two years. Treatments comprised of three different levels of nitrogen (0, 75 and 150g/plant/year), phosphorus (0, 50 and 100g P_2O_5/plant/year) and potassium (0, 75 and 150g K_2O/plant/year) in all the possible 27 combinations. Treatments with higher nitrogen level attained maximum yield and fruiting compared to treatments with lower nitrogen levels, in combination with phosphorus and potassium. Maximum yield of 69.64, 60.72 kg/plant and 22.66, 26.35 kg/plant, and, fruit set of 73.23%, 75.07%, 34.73% and 35.65% were recorded with 150g N, 50g P_2O_5 and 75g K_2O/plant/year in the rainy and winter seasons in both years, respectively, while treatment combinations with high potassium level recorded higher ascorbic acid and sugar content in the fruit.

Key words: Guava, fertilization, NPK, 'Pant Prabhat'

INTRODUCTION

Guava (*Psidium guajava* L.) is an important tropical and commercial fruit rich in dietary fibre, calcium, phosphorus and iron. The fruits are used for table and processing purposes (Rathore, 1976). Guava bears crop two to three times a year. The economic returns are also higher with few inputs. Judicious management is required to produce a profitable crop and that includes optimum fertilization of the orchard. Else, fruiting, yield and fruit quality are all affected adversely.

Nitrogen, phosphorus and potassium, being the essential major elements, are required by plants in relatively large quantities for building their infrastructure. These are especially responsible for maximising physiological activities of the plant and for plant, water and soil relationships, which ultimately affect fruiting and quality until the fruits attain physiological maturity (Nijjer, 1996). Requirement for nutrients and their absorption by the plant vary with the cultivar, apart from physical and chemical composition of the soil and availability of nutrients. In recent years, efforts have been made to widen the genetic base of guava by developing new varieties. A new selection of guava has been made at G.B.P.U.A &T., Pantnagar and named Pant Prabhat (Tiwari *et al,* 2003). In view of the role of major elements in optimum fruiting and quality, a fertilizer trial was laid out with cv. Pant Prabhat to work out ideal N P K levels for maximizing economic returns.

MATERIAL AND METHODS

The experiment was carried out at the Horticulture Research Centre, Patherchatta, G.B. Pant University of Agriculture & Technology, Pantnagar, during 2004 - 2006 on five year old guava plants of cv. Pant Prabhat. All the plants were subjected to standard cultural practices except for fertilization. The orchard soil is derivative from calcarious alluvial soil with sandy-loam texture at pH 7.6 and the available N, P_2O_5 and K_2O were 276, 30.24 and 136.92 kg/ha, respectively. Experimental treatments comprised of 27 treatment combinations of N (0, 75 and 150g plant/year), P (0, 50 and 100g plant/year) and K (0, 75 and 150g plant/year) and laid were out in a randomized block design, replicated thrice having two trees as a treatment unit. Half dose of nitrogen as urea and full doses of phosphorus as single super phosphate, and, potassium as muriate of potash, were given in the first week of May. The remaining dose of nitrogen was applied in the first week of December in both the years. Observations on yield per tree (in kg) were worked out by average fruit weight of ten fruits and multiplied by the total number of fruit. Fruiting parameters recorded were per cent fruit set, fruit drop and fruit retention, by selecting four branches randomly from all directions of a tree for the rainy and winter season crops during both the years. Ascorbic acid, total sugars, reducing

sugar and non-reducing sugars in the fruit pulp were estimated by the method of Lane and Eyon (Ranganna, 1986) and the results were analysed statistically.

RESULTS AND DISCUSSION

Fruiting and yield : Maximum fruit set of 73.23%, 75.07% and 34.73%, 35.65% was recorded with 150g N, 50g P_2O_5 and 75 g K_2O in the rainy and winter season in both years, respectively (Table 1). Fruit drop percentage of 70.21 and 39.85 in rainy and winter seasons during 2004-05, and, 69.99 and 39.10 during 2005-06, were found to be maximum with 0g N, 0g P_2O_5 and 0 g K_2O and 0g N, 0g P_2O_5 and 75 g K_2O, respectively (Table 1). Minimum fruit drop percentage was recorded with 150g N, 100g P_2O_5 and 0 g K_2O in both the seasons during both years. The combination of NPK achieved significant fruit retention percentage in 2004-05 and 2005-06. Treatments with 150g N, 100g P_2O_5 and 0 g K_2O, and, 150g N, 50g P_2O_5 and 150 g K_2O exhibited maximum fruit retention of 43.25%, 73.09%, and, 47.15%, 73.15% in rainy and winter seasons, respectively, during the years of study (Table 2). In general, treatments having higher nitrogen dose reported higher fruit set and yield. During both the years maximum yield of 69.64, 60.72 kg/plant (rainy season) and 22.66, 26.35 kg/ plant (winter season) was recorded with 150g N, 50g P_2O_5 and 75 g K_2O/plant/ year.

Significant improvement in the number of fruits that set per shoot, and yield, by applying different levels of nitrogen to guava cv. Sardar was also recorded by Tasser *et al* (1989) and best results were observed with 400g N dose. Similar findings on fruit set and fruit drop percentage in sapota were observed by Singh *et al* (2003), where, per cent fruit set increased and fruit drop decreased significantly with increasing levels of nitrogen.

Chemical attributes: Treatment with 150g N, 50g P_2O_5 and 150 g K_2O was observed to induce maximum ascorbic acid content (169.67 mg/ 100 mg of pulp) during the rainy season of 2004-05, while, in the winter season 150g N, 0g P_2O_5 and 150 g K_2O was observed to induce maximum ascorbic acid content (276.63 mg/100 mg of pulp). During 2005-06, maximum fruit ascorbic acid content was recorded in rainy season with 150g N, 100g P_2O_5 and 150 g K_2O, and, in the winter season with 150g N, 50g P_2O_5 and 150 g

Table 1. Effect of NPK dose on fruit set and fruit drop in guava

Treatment combination	Fruit set (%)				Fruit drop (%)			
	2004-05		2005-06		2004-05		2005-06	
	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter
$N_0 P_0 K_0$	45.48	18.38	52.96	19.39	67.14	37.38	59.48	33.27
$N_0 P_0 K_1$	53.95	20.21	48.74	19.78	68.18	38.36	69.99	39.10
$N_0 P_0 K_2$	57.52	21.08	49.19	22.51	70.21	39.85	68.31	37.70
$N_0 P_1 K_0$	58.69	22.42	56.21	24.52	69.44	38.06	67.30	40.71
$N_0 P_1 K_1$	59.54	23.47	51.69	21.34	67.82	36.70	69.59	37.14
$N_0 P_1 K_2$	58.97	25.35	59.24	23.23	69.37	35.43	70.12	38.59
$N_0 P_2 K_O$	56.65	23.70	54.00	25.62	65.81	35.36	65.59	38.62
$N_0 P_2 K_1$	53.19	21.03	49.45	20.62	67.47	37.06	68.47	36.71
$N_0 P_2 K_2$	52.79	23.13	59.46	24.26	66.21	37.56	66.39	36.39
$N_1 P_0 K_0$	69.27	25.13	65.73	27.49	64.19	26.44	63.33	34.67
$N_1 P_0 K_1$	63.81	26.67	68.42	29.99	62.15	35.52	61.64	35.21
$N_1 P_0 K_2$	63.38	25.44	61.12	28.79	62.29	34.63	62.33	33.43
$N_1 P_1 K_0$	64.38	26.53	67.79	29.13	63.23	35.29	63.43	34.48
$N_1 P_1 K_1$	67.59	27.82	70.85	33.01	62.55	33.35	60.13	36.35
$N_1 P_1 K_2$	67.51	26.42	70.18	30.38	63.36	34.47	64.07	33.53
$N_1 P_2 K_0$	67.96	28.40	66.41	26.50	60.66	32.36	61.29	34.26
$N_1 P_2 K_1$	69.75	25.62	59.37	29.64	61.32	33.37	62.62	31.38
$N_1 P_2 K_2$	61.33	24.85	67.58	27.16	59.30	32.51	57.74	30.17
$N_2 P_0 K_0$	64.26	29.92	70.52	30.49	60.35	30.98	57.58	30.70
$N_2 P_0 K_1$	72.85	30.82	69.71	34.26	58.87	31.02	58.38	30.35
$N_2 P_0 K_2$	67.59	32.37	72.32	35.11	61.35	31.63	59.75	33.40
$N_2 P_1 K_0$	71.17	33.42	73.41	33.19	58.13	29.41	61.14	29.45
$N_2 P_1 K_1$	73.23	34.73	75.07	35.65	60.43	28.17	55.68	32.36
$N_2 P_1 K_2$	68.25	33.22	70.31	33.01	57.34	28.51	59.57	30.41
$N_2 P_2 K_0$	65.39	31.78	68.29	32.41	55.24	26.41	50.34	26.54
$N_2 P_2 K_1$	68.03	30.77	62.48	28.75	56.33	29.35	56.00	29.38
$N_2 P_2 K_2$	62.37	29.50	63.00	29.50	57.43	27.56	53.39	27.99
C.D (*P=0.05*)	6.53	3.21	8.91	7.32	6.91	8.82	7.24	5.86

Table 2. Effect of NPK dose on fruit retention and yield in guava

Treatment combination	Fruit retention (%)				Yield (kg/plant)			
	2004-05		2005-06		2004-05		2005-06	
	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter
$N_0 P_0 K_0$	32.68	62.34	36.13	66.42	14.68	3.20	16.50	4.11
$N_0 P_0 K_1$	31.52	61.36	32.47	60.55	24.40	7.29	18.45	4.88
$N_0 P_0 K_2$	29.65	60.45	31.27	62.28	15.54	5.68	24.93	6.39
$N_0 P_1 K_0$	30.34	61.37	32.29	60.33	30.52	9.49	22.70	5.93
$N_0 P_1 K_1$	32.41	63.16	33.36	62.26	31.38	6.96	31.05	7.10
$N_0 P_1 K_2$	30.62	64.34	30.06	61.28	28.70	6.43	28.19	6.76
$N_0 P_2 K_0$	33.33	64.28	34.29	61.56	23.47	8.35	21.42	5.78
$N_0 P_2 K_1$	32.19	62.69	32.55	63.06	16.97	7.53	19.45	5.05
$N_0 P_2 K_2$	33.60	62.49	33.39	63.15	25.13	4.02	21.50	6.11
$N_1 P_0 K_0$	35.63	66.54	36.68	65.01	49.39	9.50	54.45	14.11
$N_1 P_0 K_1$	37.48	64.49	38.45	64.50	33.71	10.40	43.77	14.65
$N_1 P_0 K_2$	37.36	65.17	37.50	66.16	55.48	11.21	45.47	13.87
$N_1 P_1 K_0$	36.36	64.79	36.56	65.32	52.11	10.59	41.84	11.72
$N_1 P_1 K_1$	37.43	66.49	39.43	63.58	54.65	11.91	46.47	14.20
$N_1 P_1 K_2$	36.57	65.22	36.09	66.37	52.03	13.32	45.40	14.16
$N_1 P_2 K_0$	39.15	67.23	38.59	65.18	45.98	9.43	40.69	11.34
$N_1 P_2 K_1$	38.17	66.27	37.28	68.91	42.43	11.33	37.15	13.38
$N_1 P_2 K_2$	37.47	67.50	42.29	69.62	36.00	9.95	42.61	12.61
$N_2 P_0 K_0$	40.52	68.39	42.22	69.59	61.64	15.98	55.49	20.28
$N_2 P_0 K_1$	41.31	69.30	41.68	69.22	59.64	17.28	58.69	23.53
$N_2 P_0 K_2$	38.31	69.36	40.20	66.00	55.42	15.90	56.41	19.72
$N_2 P_1 K_0$	41.52	70.40	45.04	70.29	66.75	14.12	57.68	22.52
$N_2 P_1 K_1$	39.59	71.50	41.33	67.63	69.64	22.66	60.72	26.35
$N_2 P_1 K_2$	42.69	71.26	47.15	73.15	57.30	13.73	57.78	23.62
$N_2 P_2 K_0$	43.25	73.09	44.41	69.63	64.44	19.55	52.34	20.60
$N_2 P_2 K_1$	40.22	70.84	43.40	70.49	51.64	14.51	50.70	20.37
$N_2 P_2 K_2$	38.27	68.24	42.62	67.48	41.50	11.06	53.71	19.64
C.D (*P=0.05*)	6.11	6.73	5.66	6.85	6.34	3.82	8.95	4.12

Table 3. Effect of NPK dose on ascorbic acid and total sugar content in guava

Treatment combination	Ascorbic acid (mg/100 g pulp)				Total sugars (%)			
	2004-05		2005-06		2004-05		2005-06	
	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter
$N_0 P_0 K_0$	139.66	232.00	137.00	234.33	7.78	8.75	7.32	8.89
$N_0 P_0 K_1$	142.67	235.67	141.66	236.65	8.18	8.86	7.82	9.25
$N_0 P_0 K_2$	146.33	240.35	145.62	238.60	8.35	10.16	8.16	10.44
$N_0 P_1 K_0$	141.23	233.67	140.33	234.66	8.09	9.24	7.50	9.00
$N_0 P_1 K_1$	143.00	236.00	144.66	238.66	8.37	10.14	7.99	9.62
$N_0 P_1 K_2$	145.66	239.30	147.00	240.29	8.54	10.43	8.54	10.52
$N_0 P_2 K_0$	143.32	233.36	138.30	235.61	8.13	9.38	7.71	8.92
$N_0 P_2 K_1$	145.33	239.65	144.29	239.00	8.41	10.34	8.34	9.65
$N_0 P_2 K_2$	150.00	239.34	150.00	240.66	8.71	10.58	8.84	11.00
$N_1 P_0 K_0$	161.00	253.28	163.28	251.50	8.33	9.45	7.65	9.20
$N_1 P_0 K_1$	163.00	253.66	165.58	256.00	8.41	10.55	8.41	9.98
$N_1 P_0 K_2$	163.00	259.38	169.66	257.00	8.65	10.76	8.40	10.71
$N_1 P_1 K_0$	159.67	256.00	164.00	251.64	8.16	9.80	8.17	9.28
$N_1 P_1 K_1$	161.67	257.60	165.00	254.30	8.59	10.27	8.63	9.99
$N_1 P_1 K_2$	165.65	260.32	170.64	259.35	8.73	10.87	9.03	11.12
$N_1 P_2 K_0$	161.33	255.40	161.66	254.33	8.23	9.86	7.80	9.34
$N_1 P_2 K_1$	167.00	259.66	167.33	256.38	8.44	10.48	8.39	9.96
$N_1 P_2 K_2$	167.60	261.66	171.57	259.68	8.59	10.91	8.98	11.10
$N_2 P_0 K_0$	166.35	267.00	159.67	253.59	8.18	9.72	8.08	9.14
$N_2 P_0 K_1$	168.00	273.00	167.00	257.33	8.38	10.27	8.48	9.73
$N_2 P_0 K_2$	169.33	276.63	170.67	267.33	8.66	10.57	8.89	10.60
$N_2 P_1 K_0$	165.34	260.66	164.34	257.36	8.23	9.49	7.96	9.11

Table 3. (contd.) Effect of NPK dose on ascorbic acid and total sugar content in guava

Treatment combination	Ascorbic acid (mg/100 g pulp)				Total sugars (%)			
	2004-05		2005-06		2004-05		2005-06	
	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter
N_2 P_1 K_1	167.00	269.65	169.00	261.66	8.50	10.50	8.07	10.25
N_2 P_1 K_2	169.67	270.68	171.62	267.67	8.57	10.68	8.50	10.57
N_2 P_2 K_0	163.59	261.00	160.33	255.00	8.20	9.48	7.53	9.10
N_2 P_2 K_1	167.00	265.66	168.37	262.58	8.40	10.03	7.99	9.83
N_2 P_2 K_2	169.30	268.33	175.28	267.33	8.47	10.17	8.62	10.37
C.D (*P=0.05*)	8.79	8.51	12.57	11.81	0.32	1.10	0.37	0.39

Table 4. Effect of NPK dose on reducing sugars and non-reducing sugars in guava

Treatment combinations	Reducing sugars (%)				Non-reducing sugars (%)			
	2004-05		2005-06		2004-05		2005-06	
	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter	Rainy season	Winter
N_0 P_0 K_0	4.79	5.59	4.34	5.33	3.00	3.16	3.02	3.53
N_0 P_0 K_1	5.09	6.21	4.65	5.73	3.04	3.30	3.15	3.82
N_0 P_0 K_2	5.24	6.75	4.93	6.02	3.07	3.42	3.32	4.43
N_0 P_1 K_0	5.02	5.93	4.45	5.54	3.06	3.28	3.04	3.44
N_0 P_1 K_1	5.51	6.31	4.81	6.03	3.17	3.84	3.16	3.57
N_0 P_1 K_2	5.33	6.56	5.20	6.42	3.23	3.87	3.33	4.12
N_0 P_2 K_0	5.01	6.11	4.62	5.33	3.11	3.24	3.11	3.57
N_0 P_2 K_1	5.16	6.88	5.11	5.91	3.26	3.42	3.22	3.75
N_0 P_2 K_2	5.32	7.11	5.38	6.50	3.32	3.75	3.39	4.51
N_1 P_0 K_0	5.14	6.11	4.54	5.57	3.10	3.29	3.10	3.61
N_1 P_0 K_1	5.26	6.95	5.08	6.10	3.14	3.57	3.31	3.87
N_1 P_0 K_2	5.42	7.15	5.28	6.64	3.26	3.63	3.41	4.06
N_1 P_1 K_0	5.12	6.42	5.01	5.51	3.02	3.34	3.09	3.75
N_1 P_1 K_1	5.37	6.73	5.24	5.93	3.10	3.53	3.37	3.96
N_1 P_1 K_2	5.48	7.03	5.50	7.00	3.16	3.55	3.50	4.14
N_1 P_2 K_0	5.17	6.53	4.76	5.70	3.02	3.33	3.07	3.66
N_1 P_2 K_1	5.34	6.89	5.18	6.08	3.06	3.57	3.21	3.88
N_1 P_2 K_2	5.47	7.23	5.48	7.13	3.14	3.68	3.47	3.99
N_2 P_0 K_0	5.11	6.33	5.07	5.44	3.04	3.35	3.01	3.71
N_2 P_0 K_1	5.25	6.78	5.24	5.81	3.10	3.48	3.23	3.94
N_2 P_0 K_2	5.50	7.01	5.48	6.04	3.15	3.53	3.40	4.56
N_2 P_1 K_0	4.94	6.13	4.48	5.49	3.09	3.37	3.15	3.62
N_2 P_1 K_1	5.36	7.04	4.83	6.25	3.11	3.43	3.26	3.99
N_2 P_1 K_2	5.41	7.18	5.09	6.43	3.16	3.52	3.41	-4.17
N_2 P_2 K_0	5.18	6.30	4.43	5.54	3.00	3.20	3.07	3.57
N_2 P_2 K_1	5.28	6.62	4.74	6.04	3.08	3.43	3.24	3.82
N_2 P_2 K_2	5.31	7.37	5.15	6.39	3.19	3.47	3.42	3.98
C.D (*P=0.05*)	0.33	0.86	0.39	0.49	0.07	0.26	0.09	0.34

K_2O (Table 3). In general, treatments having higher nitrogen content in combination with higher potassium, attained higher ascorbic acid content (Table 2). The maximum values of total sugars 8.73% and 9.03% in rainy season and 10.87% and 11.12% in winter season were recorded with 75g N, 50g P_2O_5 and 150 g K_2O during both the years. In rainy season fruits, the maximum reducing sugars at 5.50% each were recorded with 150g N, 0g P_2O_5 and 150 g K_2O, and 75g N, 50g P_2O_5 and 150 g K_2O during 2004-05 and 2005-06, respectively; while, in the winter season fruits, reducing sugars at 7.37% and 7.13% were recorded with 150g N, 100g P_2O_5 and 150 g K_2O, and, 75g N, 100g P_2O_5 and 150 g K_2O during the two years, respectively. The maximum non-reducing sugar content of 3.325 and 3.50% in rainy season fruits in both the years was recorded under the treatment 0g N, 100g P_2O_5 and 150 g K_2O, and, 75g N, 100g P_2O_5 and 150 g K_2O, respectively; while, in the winter season, treatments with 0g N, 50g P_2O_5 and 150 g K_2O, and, 150g N, 0g P_2O_5 and 150 g K_2O gave maximum amounts of non-reducing sugars (3.87% and 4.56%) during the years of study (Table 4). The minimum values of reducing and non-reducing sugars were recorded with 0g N, 0g P_2O_5 and 0 g K_2O (Table 4). Similar findings were also recorded by Singh *et al* (2004) in pineapple and

Umashanker *et al* (2002) in guava cv. Sardar. Treatment combinations with higher nitrogen content were found to be superior in yield and fruiting attributes, while, treatments with high potassium attained higher ascorbic acid and sugar content in guava, and were *at par* with treatments of medium level potassium. This may be due to the enhancing effect of nitrogen on growth and sufficient availability of phosphorus and potassium already present in the soil.

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