

EFFECT OF PLANTING DENSITIES AND NITROGEN ON YIELD AND QUALITY OF KEW PINEAPPLE

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Abstract: Studies on varying plant densities and nitrogen on the plant, first and second ratoon crops of kew pineapple under rainfed condition revealed that among the five plant densities tried, 53330 plants/ha (24 x 45 x 105 cm spacing) recorded the highest fruit yield/ha. Low plant density of plants/ha (30 x 60 x 120 cm spacing) increased the length, breadth and weight of fruits. The quality characters viz., TSS (Brix), reducing and total sugars were maximum under low density while high density increased the acidity and ascorbic acid contents of the fruits. The mean fruit weight and the highest hectare yield were recorded at 600 kg N/ha. Nitrogen application increased the reducing and total sugars and decreased the TSS, acidity and ascorbic acid contents of the pineapple fruit.

INTRODUCTION

Pineapple (*Ananas comosus* Merr.) is one of the important tropical fruits, ideal for table and processing industry. Higher plant densities play an important role in the yield increase of pineapple (Wee, 1969; Chadha *et al.*, 1973; Balakrishnan *et al.*, 1978). Nitrogen application also plays an influencing role in increasing the yield (Tay, 1972; Singh *et al.*, 1977). Due to high cost of nitrogen fertilizers and also due to the rainfed nature of pineapple cultivation in India, optimum nitrogen application needs a special emphasis along with optimum population. Hence, a study was undertaken to standardize the optimum plant density and nitrogen for high yield with good quality fruits.

MATERIALS AND METHODS

The study was conducted at the Central Horticultural Experiment Station, Chethalli, situated at an elevation of 950 m which receives an annual rainfall of 1700 mm during June to September months. Kew variety of pineapple was raised in a factorial RBD with three replications during 1979 to 1983. The treatments were: five planting densities viz., D₁(37037), D₂ (40400), D₃ (44440), D₄ (48480) and D₅ (53330

plants/ha) in double row system of planting with four levels of nitrogen viz., N₁ (400 kg), N₂ (500 kg), N₃ (600 kg) and N₄ (700 kg/ha). Nitrogen was applied as urea in six split doses at bimonthly intervals up to 12 months while phosphorus (100 kg P₂O₅/ha and potassium (500 kg K₂O/ha) in two and three split doses respectively. The plants were raised under rainfed conditions for one plant and two ratoon crops.

The following fruit parameters viz., fruit length, breadth and weight with crown were recorded from ten sample fruits/treatment. Hectare yield was computed by multiplying mean fruit weight with flowering percentage. Fruit quality characters viz., TSS (hand refractometer), acidity (sodium hydroxide method), ascorbic acid (dichloro indolphenol dye method) and reducing and total sugars were analysed. All the parameters were recorded for the plant, first and second ratoon crops.

RESULTS AND DISCUSSION

In the plant crop, fruit length was maximum (18.85 cm) at D₁ so also in the first and second ratoons D₁ recorded

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Table 1. Effect of plant density and nitrogen on fruit characters and yield of Kew pineapple

Character	Plant density/ha						Nitrogen kg/ha				
	D ₁	D ₂	D ₃	D ₄	D ₅	CD (0.05)	N ₁	N ₂	N ₃	N ₄	CD (0.05)
PLANT CROP											
Fruit length (cm)	18.85	17.54	17.23	16.25	16.15	1.981	16.11	18.03	18.60	17.91	1.584
Fruit breadth (cm)	13.60	12.96	12.68	12.63	11.93	0.909	12.29	12.90	13.28	12.56	0.727
Fruit weight (kg)	1.881	1.733	1.534	1.515	1.456	0.141	1.432	1.643	1.784	1.683	0.141
Hectare yield (t)	53.85	55.74	57.06	61.83	92.44	6.761	54.89	63.01	67.85	63.01	5.408
FIRST RATOON											
Fruit length (cm)	17.33	16.15	15.71	15.21	15.15	1.124	15.54	15.94	16.79	15.93	0.642
Fruit breadth (cm)	13.01	12.92	12.83	12.44	12.13	0.123	12.16	12.62	13.29	12.78	0.421
Fruit weight (kg)	1.744	1.679	1.607	1.560	1.548	0.124	1.499	1.677	1.737	1.595	0.121
Hectare yield (t)	49.92	51.26	57.54	64.83	84.93	3.776	54.34	61.69	67.75	59.81	3.379
SECOND RATOON											
Fruit length (cm)	14.46	14.06	13.90	13.63	13.23	0.310	12.13	13.34	15.41	13.89	0.347
Fruit breadth (cm)	12.28	11.77	11.72	11.50	11.30	0.236	10.68	11.54	12.53	11.59	0.211
Fruit weight (kg)	1.242	1.204	1.202	1.199	1.157	0.043	0.977	1.153	1.406	1.249	0.139
Hectare yield (t)	34.95	37.36	42.59	48.08	51.21	1.835	34.85	41.29	50.43	44.78	1.641

Table 2. Effect of plant density and nitrogen on fruit quality of Kew pineapple

Character	Plant density/ha						Nitrogen kg/ha				
	D ₁	D ₂	D ₃	D ₄	D ₅	CD (0.05)	N ₁	N ₂	N ₃	N ₄	CD (0.05)
PLANT CROP											
TSS (Brix)	13.90	13.71	12.88	13.36	11.75	0.492	14.11	13.54	12.77	12.04	0.451
Acidity (%)	0.98	1.04	1.10	1.12	1.17	0.046	1.21	1.13	1.01	0.88	0.040
Ascorbic acid (mg%)	12.71	14.63	15.33	16.10	18.94	1.495	16.27	15.31	15.10	14.29	0.443
Red sugar (%)	5.75	5.23	4.91	4.65	4.45	0.370	4.20	4.69	5.26	5.85	0.431
Total sugar (%)	12.90	12.71	12.36	11.88	10.75	0.392	13.11	12.54	11.77	11.04	0.351
FIRST RATOON											
TSS (Brix)	14.00	13.53	14.23	14.55	13.27	0.463	15.29	14.37	13.74	13.07	0.414
Acidity (%)	1.63	1.65	1.78	1.88	1.89	0.043	1.97	1.85	1.71	1.54	0.038
Ascorbic acid (mg%)	14.66	18.67	19.97	20.32	22.12	1.370	20.84	19.87	18.80	17.09	0.331
Red sugar (%)	5.25	5.15	4.99	4.67	4.25	0.266	3.73	4.38	5.20	6.06	0.638
Total sugar (%)	19.42	16.58	15.32	14.70	13.31	0.391	18.41	16.78	15.09	13.18	0.404
SECOND RATOON											
TSS (Brix)	14.80	15.10	15.50	14.80	13.80	0.592	16.03	15.15	14.24	13.35	0.662
Acidity (%)	0.65	0.68	0.72	0.75	0.80	0.060	0.78	0.73	0.68	0.63	0.020
Ascorbic acid (mg%)	27.29	28.55	31.26	33.56	33.15	1.257	37.77	33.66	29.60	25.47	2.287
Red sugar (%)	4.00	3.75	3.55	3.24	2.91	0.264	2.68	3.18	3.63	4.22	0.489
Total sugar (%)	12.34	12.01	11.20	10.99	10.60	0.299	12.98	11.82	10.30	9.66	0.267

the maximum (17.33 and 14.46 cm) and the differences were significant. Highest fruit breadth was observed at D_1 in all the crops and the minimum by D_5 density. Similar results were reported by Chadha *et al.* (1973) and Norman (1977). D_1 density in the plant crop recorded the highest fruit weight with crown (1.88 kg) followed by D_2 while D_5 recorded the minimum (1.46 kg). Collins (1960) reported that the increased fruit size and weight under low density may be due to less competition from neighbouring plants and adequate soil volume for root growth. The maximum hectare yield was recorded by D_5 (92.44 t) and was significantly higher than other densities. The yield increase was mostly due to increase in the number of fruits due to high plant density as observed by Chadha *et al.* (1973), Norman (1977) and Gunjate and Limaye (1977). D_5 recorded the maximum hectare yield (84.93 and 51.21 t) accounting an increase of 70 and 40 per cent over D_1 in the first and second ratoons respectively.

Nitrogen application increased the length, breadth, weight of the fruit and per hectare yield of the plant, first and second ratoon crops (Table 1). N_3 (600 kg N) recorded the maximum length, breadth and weight of the fruit (1.78 kg) and was significantly higher than other levels in the plant crop. The hectare yield increased with nitrogen levels and the highest 67.85 t/ha was recorded at 600 kg N level in the plant crop. Similar results of nitrogen increasing the yield of pineapple were observed by Tay (1972) and Singh *et al.* (1977). The fruit length, breadth, weight and hectare yield recorded a minimum at 400 kg N level. Similar trend was observed in the first and second ratoons also indicating 600 kg N level produced highest fruit length, breadth, weight and hectare

yield than the other levels and the minimum was observed at 400 kg N level.

The data on quality characters such as TSS, reducing and total sugars increased while acidity and ascorbic acid contents decreased due to plant density (Table 2). Highest TSS (13.9), reducing sugar (5.75%) and total sugars (12.90%) were recorded at D_1 density while D_5 recorded the maximum acidity (1.17%) and ascorbic acid (18.94 mg) contents in the plant crop. Chadha *et al.* (1973) observed that high plant density increased the acidity of pineapple fruits. Similar trend was observed in the first and second ratoons also. Increased nitrogen levels reduced the TSS, acidity and ascorbic acid contents but increased the reducing and total sugars and the differences were significant. Similar results were reported by Singh *et al.* (1977) and Mukherjee *et al.* (1981) in pineapple. The maximum total and reducing sugars were recorded at 700 kg N while maximum TSS, acidity and ascorbic acid were observed at 400 kg N level in the plant crop. Similar trend was observed in the first and second ratoons.

Therefore, it was concluded that under rainfed conditions, a plant density of 53330 plants with a nitrogen level of 600 kg/ha was found optimum for the plant, first and second ratoons of pineapple which produced the highest hectare yield with good quality fruits of Kew pineapple.

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REFERENCES

- Balakrishnan, S., Aravindakshan, M., Nambiar, I.P.S. and Nair, K.K.R. 1978. Growth and yield of pineapple variety Kew as influenced by planting densities. *South Indian Hort.* 26: 98-102
- Chadha, K.L., Melanta, K.R. and Shikhamany, S.D. 1973. Effect of planting density on growth, yield and fruit quality in Kew pineapple. *Indian J. Hort.* 30: 461-66
- Collins, J.L. 1960. *The Pineapple*. Interscience Publishers Inc. New York
- Gunjate, R.T. and Limaye, V.P. 1977. Effect of planting densities on growth and fruiting of Kew pineapple. *Maharashtra agric. Univ.* 2: 119-121
- Mukherjee, S.K., Rao, D.P., Das, C.S. and Saha, P.K. 1981. Effect of N P K on growth, yield and quality of pineapple cv. Kew in South Bengal. *Indian J. Hort.* 38 : 141-147
- Norman, J.C. 1977. The effect of plant density on the growth, development and yield of pineapple cv. Smooth Cayenne in Ghana. *Ada Horticulturae* 53: 349 - 354
- Singh, H.P., Dass, H.C., Ganapathy, K.M. and Subramaniam T.R. 1977. Nitrogen requirement of pineapple under irrigated and rainfed conditions. *Indian J. Hort.* 34: 377-384
- Tay, T.H. 1972. Comparative study of different type of fertilizer as source of nitrogen, phosphorus and potassium in pineapple cultivation. *Trop. Agric.* (Trin) 49 : 51-59
- Wee, Y.C. 1969. Planting density trials with *Ananas comosus* Merr. var. Singapore Spanish, *Malay. agric. J.* 47: 164-174

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