



Original Research Article

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Studies on the Effect of Planting Density and Nutrient Management on Yield, Fruit Quality and Post Harvest Characters in Banana cv. Ney Poovan under Coconut

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ABSTRACT

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A field experiment was conducted during the year 2017 - 2018 to evaluate the effect of planting density and nutrient management on yield, fruit quality and post harvest characters in banana cv. Ney Poovan under coconut with nine treatments replicated thrice by using factorial randomized block design. Coconut being widely spaced owing to its morphological features provides ample opportunities for cropping in the interspaces. Active root zone of coconut is confined to 25 per cent of the available land area and the remaining area could be profitably exploited for raising subsidiary crops. The present results revealed that among the different treatments, F₆ P₁ (100 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in single row planting) recorded best values in term of yield, quality and post harvest parameters. Hence, the application of 100 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in single row planting system in banana cv. Ney Poovan under coconut is best when compared to other treatment and control.

Introduction

Banana (*Musa spp.*) is the second largest fruit crop in the world. In India, it is one of the most important commercial fruits. Banana is originated from South East Asia, a region considered as the primary centre of diversification of the crop and where earlier domestication has occurred (Simmonds, 1962). Banana and plantain are mostly grown not only for their nutritional value but also for their economic importance. Banana is a heavy feeder of nutrients and nearly 25 to 30 per cent

of cost of inputs goes for fertilizers and manures. It is estimated that a crop of 50 t ha⁻¹ of banana removes 320 kg of N, 32 kg of P₂O₅ and 325 kg of K₂O every year (Lahav and Turner, 1983). Hence, it is of importance to maintain high degree of soil fertility by timely and judicious application of NPK to achieve yield and quality of banana. However, increased use of inorganic fertilizers for production of banana has resulted in several undesirable consequences, in the fragile soil eco system leading to gradual decline in productivity (Prabhuram, 1992). Therefore,

the present investigation to study the impact of planting density and nutrient management on yield, fruit quality and post harvest characters in banana cv. Ney Poovan under coconut.

Materials and Methods

The present investigation carried out at Department of fruit crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during the period 2017 - 2018 with banana cv. Ney Poovan under coconut. The experiment was laid out in a Factorial Randomized Block Design with nine treatments and three replications. Each treatment had a net area of 200 M² having 45 plants. Guard rows were provided on all sides of the plots. Observations were taken up from centrally located ten plants. The recommended spacing of 1.8 m x 1.8 m was adopted for planting. Suckers of banana cv. Ney Poovan obtained from disease free field were planted in all the treatments. Recommended cultural practices were carried out regularly. Suckers of uniform size weighing around 1.5 kg \pm 0.5 kg of banana cv. Ney Poovan were selected for planting. The present experiment of various treatments as follows F₁ P₁ (75 per cent RDF in single row planting), F₂ P₁(100 per cent RDF in single row planting), F₃ P₁ (125 per cent RDF in single row planting), F₄ P₁ (150 per cent RDF in single row planting), F₅ P₁ (75 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in single row planting), F₆ P₁ (100 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in single row planting), F₇ P₁ (125 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in single row planting), F₈ P₁ (150 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in single row planting), F₉ P₁ (control) and F₁P₂ (75 per cent RDF in double

row planting), F₂ P₂(100 per cent RDF in double row planting), F₃ P₂ (125 per cent RDF in single row planting), F₄ P₂ (150 per cent RDF in double row planting), F₅ P₂ (75 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in double row planting), F₆ P₂ (100 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in double row planting), F₇ P₂ (125 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in double row planting), F₈ P₂ (150 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹ in double row planting), F₉ P₂ (control). The recommended dose of fertilizer (RDF) for banana cv. Ney Poovan: 110 g: 35 g: 330 g NPK plant⁻¹ year⁻¹ applied as per the treatment schedule. Ten uniform plants were selected randomly in each treatment for recording the following observations on vegetative characters at 3rd, 5th, 7th month and shooting stage after planting. The yield and quality attributes were taken after harvesting of bunches.

Results and Discussion

Yield and yield attributing characters

Among the different nutrient treatments, the plants treated with F₆ (100 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹) registered highest bunch weight more number of hands per bunch, more number of fingers per bunch, highest finger weight *viz.*, (9.47 kg), (7.77 hands), (94.45 fingers and (69.65 g) respectively compared to other treatments. Among the planting density, the highest bunch weight (8.81 kg), the more number of fingers per bunch (86.89 fingers), highest finger weight (68.76 g) registered in P₁ (single row planting) compared to other level but no significant difference in case of number

hands per bunch. The interaction effect between F and P were significantly differ in respect to yield and quality parameters, highest bunch weight (9.55 kg), more number of hands per bunch (7.75 hands), the more number of fingers per bunch (93.80 fingers), the highest finger weight (69.18 g) recorded in the treatment F₆ P₁ compared to other treatment combinations (Table 1). The results revealed that positive influence between total number of leaves produced and the yield of the crop which is maximum in the treatment F₆ P₁. It is in line with the results of vidhya, 2004. Bunch weight is a primary function of number of fingers and finger weight (Krishna and shanmugavelu, 1983). In banana, the floral differentiation requires minimum functional leaf area and high photosynthetic assimilation favoured by improved nutrient status, better differentiation, leading to more finger and better flow of assimilates to developing fingers, could be attributed for better bunch weight. The results are line with Murugan, 2003.

Quality and post harvest parameters

Among the different nutrient treatments, the plants treated with F₆ (100 per cent of the

RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹) registered highest total soluble solids (23.45%), highest total sugar content (18.02 %), highest reducing sugar content (12.76 %), highest non-reducing sugar content (5.60 %) respectively compared to other treatments. Among the planting density, the total sugar content (17.22 %) registered in P₁ (single row planting) compared to other level but no significant difference in case of TSS, reducing and non reducing sugar content. The interaction effect between F and P were significantly differ in respect to yield and quality parameters, the highest total soluble solids recorded in the treatment F₆ P₂ (23.48%), the highest total sugar content recorded in the treatment F₆ P₁ (18.14 %), the highest reducing sugar content recorded in the treatment F₇ P₂ (12.77 %) the highest non-reducing sugar content recorded in the treatment F₆ P₂ (5.60 %) compared to other treatment combinations (Table 2). In banana, the most important traits that decide fruit quality is total soluble solids, total sugars, acidity and ascorbic acid. The results are in line with the findings of vanilarasu *et al.*, (2018) in banana.

Table.1 Effect of planting density and nutrient management on yield and yield attributes in banana cv. Ney Poovan

Treatments	Bunch weight (kg plant ⁻¹)			Number of hands (numbers)			Number of fingers (numbers)			Finger weight (g)		
	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean
F ₁	9.31	9.91	9.25	7.38	7.35	7.36	88.82	88.63	88.72	55.10	53.15	54.12
F ₂	8.85	8.80	8.82	7.35	7.32	7.33	87.05	86.92	86.98	63.00	62.10	62.55
F ₃	9.35	9.30	9.32	7.34	7.32	7.33	87.23	87.13	87.18	66.49	62.11	64.30
F ₄	8.59	8.49	8.54	7.42	7.36	7.39	88.76	88.51	88.63	60.52	58.65	59.58
F ₅	8.42	8.32	8.38	7.42	7.37	7.39	87.54	87.32	87.43	64.31	57.26	60.78
F ₆	9.55	9.40	9.47	7.75	7.79	7.77	93.80	94.45	94.12	69.18	70.12	69.65
F ₇	8.67	8.67	8.67	7.32	7.30	7.31	85.15	84.92	85.03	65.65	61.34	63.49
F ₈	8.51	8.51	8.51	7.40	7.39	7.39	85.47	85.06	85.26	64.32	58.40	61.36
F ₉	8.10	8.07	8.08	6.49	6.50	6.49	78.24	77.97	78.10	48.54	50.00	49.21
P Mean	8.81	8.75	8.78	7.31	7.30	7.30	86.89	86.76	86.82	68.76	59.23	63.99
		SEd	CD (P=0.05)		SEd	CD (P=0.05)		SEd	CD (P=0.05)		SEd	CD (P=0.05)
P		0.03	0.06		0.041	0.078		0.516	0.861		0.46	0.78
F		0.06	0.10		0.081	0.162		0.891	1.98		0.82	1.68
P x F		0.10	0.14		0.118	0.221		1.31	2.76		1.16	2.36

Table.2 Effect of planting density and nutrient management on quality attributes in banana cv. Ney Poovan

Treatments	TSS (^o Brix)			Total sugars (%)			Reducing sugars (%)			Non - reducing Sugars (%)		
	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean
F ₁	21.14	21.16	21.14	17.48	16.39	16.93	12.09	12.10	12.08	5.39	5.38	5.39
F ₂	20.80	20.82	20.81	16.77	16.17	16.47	11.32	11.34	11.33	5.45	5.48	5.47
F ₃	20.29	20.30	20.29	17.87	16.58	17.22	12.34	12.34	12.34	5.54	5.56	5.54
F ₄	22.13	22.14	22.13	17.45	16.72	17.08	12.06	12.08	12.07	5.40	5.36	5.39
F ₅	21.98	21.98	21.98	17.50	16.50	17.00	12.23	12.25	12.24	5.27	5.26	5.27
F ₆	23.46	23.48	23.45	18.14	17.89	18.02	12.55	12.56	12.54	5.60	5.60	5.60
F ₇	23.04	23.06	23.05	17.98	16.61	17.29	12.76	12.77	12.76	5.22	5.24	5.22
F ₈	21.99	21.94	21.95	17.84	16.69	17.27	12.58	12.58	12.58	5.26	5.28	5.27
F ₉	18.70	18.62	18.67	14.00	13.07	13.54	9.42	9.37	9.39	4.50	4.42	4.46
P Mean	21.50	21.49	21.50	17.22	16.29	16.76	11.93	11.91	11.92	5.29	5.28	5.28
	SEd		CD (P=0.05)	SEd		CD (P=0.05)	SEd		CD (P=0.05)	SEd		CD (P=0.05)
P	0.116		0.237	0.097		0.197	0.063		0.128	0.010		0.022
F	0.248		0.504	0.206		0.419	0.133		0.271	0.023		0.047
P x F	0.350		0.713	0.291		0.592	0.189		0.384	0.032		0.066

Table.3 Effect of planting density and nutrient management on quality and post harvest parameters in banana cv. Ney Poovan

Treatments	Ascorbic acid (mg 100 g ⁻¹)			Acidity (%)			Shelf life of fruit (days)			Sugar-acid ratio		
	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean	P ₁	P ₂	F Mean
F ₁	7.38	7.37	7.37	0.38	0.37	0.37	10.32	10.33	10.32	45.41	44.82	45.11
F ₂	7.48	7.46	7.46	0.34	0.34	0.33	10.45	10.46	10.45	49.41	48.18	48.79
F ₃	7.57	7.56	7.56	0.41	0.38	0.39	10.44	10.44	10.44	43.24	43.67	43.45
F ₄	7.70	7.69	7.69	0.38	0.36	0.37	10.33	10.34	10.33	45.98	46.94	46.46
F ₅	7.69	7.69	7.68	0.32	0.33	0.33	10.40	10.41	10.40	54.29	50.71	52.50
F ₆	7.93	7.92	7.91	0.26	0.27	0.26	10.81	10.80	10.80	70.05	67.17	68.61
F ₇	7.49	7.48	7.48	0.29	0.34	0.32	10.73	10.72	10.72	63.64	48.89	56.26
F ₈	7.40	7.39	7.39	0.37	0.35	0.36	10.34	10.34	10.34	48.52	47.56	48.04
F ₉	7.20	7.23	7.21	0.33	0.38	0.35	9.63	8.83	9.23	42.42	34.45	38.48
P Mean	7.53	7.52	7.53	0.34	0.34	0.34	10.38	10.29	10.33	51.45	48.04	49.74
	SEd		CD (P=0.05)	SEd		CD (P=0.05)	SEd		CD (P=0.05)	SEd		CD (P=0.05)
P	0.012		0.026	0.008		0.016	0.022		0.046	1.37		2.79
F	0.027		0.055	0.017		0.035	0.048		0.098	2.91		5.92
P x F	0.038		0.078	0.024		0.050	0.068		0.139	4.12		8.38

The highest total sugar content might be due to the role of potassium which is involved in carbohydrate synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids (Tisdale and Nelson, 1966).

Among the different nutrient treatments, the plants treated with F₆ (100 per cent of the RDF + Azospirillum @ 100 g + Phosphobacteria @ 100 g + AM fungi @ 100 g plant⁻¹) registered highest ascorbic acid content (7.91 mg. 100 g⁻¹), highest sugar - acid ratio (68.61), lowest acidity percentage (0.26 %), more shelf life of fruit (10.80 days) compared to other treatments. Among the planting density, the more shelf life of fruit (10.38 days), highest sugar - acid ratio (51.45) registered in P₁ (single row planting) compared to other level but no significant difference in case of ascorbic acid and acidity percentage. The interaction effect between F and P were significantly differ in respect to yield and quality parameters, the highest ascorbic acid content recorded in the treatment F₆P₁ (7.93 mg. 100 g⁻¹), the lowest

acidity percentage recorded in the treatment F₆ P₁ (0.26 %), the more shelf life of fruit recorded in the treatment F₆ P₁ (10.81 days), the highest sugar - acid ratio recorded in the treatment F₆ P₁ (70.05) the highest non-reducing sugar content recorded in the treatment F₆ P₂ (5.60 %) when compared to other treatment combinations (Table 3). The acidity of ripe fruit tends to decrease with the increasing rate of nitrogen application. Shelf life of fruit and total sugar increased with increase in the level of nitrogen by application of recommended dose nitrogen along with azospirillum and potassium. Adequate supply of nitrogen and potassium might have ensured optimum functioning of sucrose synthetase and suppression of hydrolytic enzymes leading to build up of greater quantity of sugars in proplastid (Nitsos and Evans,

1969). The results is line with kavino *et al.*, (2010) and Senthilkumar *et al.*, (2016).

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