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Studies on Integrated Nutrient Management on Growth Parameters of Papaya (*Carica papaya* L.) Cv. Red Lady under Southern Telangana

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ABSTRACT

The field experiment was conducted during 2014- 15 and 2015 - 16 at College of Agriculture, Department of Horticulture, Hyderabad to studies the effect of integrated nutrient management on growth parameters under southern Telangana. The experiment laid out RBD design with ten treatments including organic, inorganic and bio fertilizers were comprised with three replications. The results revealed that the application of T_9 - 75% RDF + 10 kg VC + 100g Azotobacter +100g PSB plant^{-1} treatment gave higher values of growth characters viz., plant height (198.78 cm and 226.93 cm), trunk girth (51.20 cm and 53.77 cm), petiole length (52.09 cm and 53.77 cm), number of leaves per plant (45.38 cm and 48.31), earliness in initiation of flowering (135.44 days and 143.84 days) and lowest days taken to fruit maturity (196.11 days and 205.54 days) during both years of study. Hence, integrated nutrient management practices have been found to be an ideal option for improve growth characters and soil fertility.

Key words: *Azotobacter, Growth parameters, INM, Papaya, PSB, RDF, Vermicompost*.

INTRODUCTION

Papaya (*Carica papaya* L.) is evergreen herbaceous commercial fruit crop of tropical and subtropical region and it belongs to family caricaceae is an important fruit crop among fruit crops and attained unprecedented popularity in recent years, due to largely its ease of cultivation, quick returns, and adoptability to diverse soil and climate conditions. Moreover, papaya fruits are attractive, delicious and also rich in vitamins and minerals. It is cultivated throughout the tropics both for fresh fruits and papain.

In India it is grown in area of 133 Lakh ha with a production of 5,699 M.T. Papaya fruit has occupied a place of pride in human diet because of its striking nutritional and medicinal values. It is one of the richest source of carotene (pro-vitamin) and a fair source of vitamin C, besides being high in sugars and pectin.

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The yield and quality of papaya are known to be influenced by different factors such as nutrition, cultural practice etc. Among these, nutrition plays an important role which has great influence on vegetative growth as well as yield[7]. To maintain and sustain higher levels of soil fertility and crop productivity, organic manures are very important in the present day system of crop production. The conjunctive use of organic manures will not only improve the soil health but also helps to increase yield and quality of Papaya. Chemical fertilizers constitute the major component of inputs. Expenditure on this component is ever increasing and making the cultivation economically not viable. Besides, the continuous use of chemical fertilizers is posing new problems because of depletion of soil health. Microorganisms capable of making nutrients available to the plants offer great scope in alleviating this situation. Therefore, use of bio fertilizers in conjunction with organic manures becomes a priority[6]. The integrated nourishment paves the way to overcome the problems, which involves conjugative use of chemical fertilizers organic manures to sustain crop production and maintenance of soil health[2].

MATERIALS AND METHODS

The experiment was conducted at College of Agriculture, Prof. Jayashankar Telangana State Agricultural University, Department of horticulture, Horticulture experimental field Rajendranagar, Hyderabad during the period of 2014 - 2015 and 2015 - 2016. The experiment laid out Randomized Block Design with ten treatments and three replications. The treatments comprised likewise, T_1 - RDF (200 N: 200 P_2O_5: 250 K_2O g/plant), T_2 - RDF + 20 kg FYM plant^{-1}, T_3 - RDF + 10 kg vermicompost plant^{-1},T_4 - RDF + 5 kg Neem cake plant^{-1}, T_5 - RDF + 20 kg FYM plant^{-1} + 100g *Azotobacter* + 100g *PSB* plant^{-1}, T_6 - RDF + 10 kg VC + 100g *Azotobacter* +100g *PSB* plant^{-1}, T_7 - RDF + 5 kg NC + 100g *Azotobacter* +100g *PSB* plant^{-1}, T_8 - 75% RDF + 20 kg FYM plant^{-1} + 100g *Azotobacter* + 100g *PSB* plant^{-1}, T_9 - 75% RDF + 10 kg VC +100g *Azotobacter* +100g *PSB* plant^{-1}, T_{10} - 75% RDF + 5 kg NC + 100g *Azotobacter* + 100g *PSB* plant^{-1}. The seedlings of papaya were transplanted in the field adopting a spacing of 2.5× 2.5 m. The vegetative parameters like Plant height (cm), Trunk girth (cm), Number of leaves / Plant, Petiole length (cm), Days taken to first flowering (days) and Days taken to maturity (Days) were analysed statistically.

RESULTS AND DISCUSSION

All the vegetative parameters, viz. plant height (cm), trunk girth (cm), number of leaves per plant, petiole length (cm), days taken to first flowering (days) and days taken to maturity (Days) were significantly influenced due to the application of integrated nutrient management (Table- 1). However, the treatment T_9 - 75% RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1} had recorded significantly highest plant height (198.78 cm and 226.93 cm) as compare to control during 2014 -15 and 2015 - 16, respectively.

The maximum trunk girth was recorded in T_9 - 75% RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1} (51.20 cm and 53.77 cm) as compare to other treatments during 2014 - 15 and 2015 - 16, respectively. The increase in plant height and trunk girth may be due to improvement of physical properties of soil, higher nutrient uptake and increased activity of micro organisms which were manifested in the form of enhanced growth and higher carbohydrates production[10] (Yadav *et al*., 2011a). And, it could be because of continuous supply of available nutrient from organic and inorganic form and effect of bio active substance produced by common application of bio fertilizers. Organic manures along with biofertilizers also improve the aeration in the soil which ultimately might have improved the physiological activities inside the plant like plant height. The similar result was reported by Tandel *et al*[9]., Shivakumar[3], Suresh *et al*[8]., and Singh *et al*[5]., in papaya.

Higher petiole length was recorded in T_9 treatment (52.09 cm and 53.77 cm) as

compare to other treatments during 2014 - 15 and 2015 - 16, respectively. More number of leaves per plant was recorded in treatment T_9 as compare to other treatment (45.38 and 48.31) during 2014 - 15 and 2015 - 16 respectively, when organic manures are added to soil along with inorganic fertilizers, complex nitrogenous compound slowly break down and make steady N supply throughout the growth period of the crop. This might have attributed to more availability of nutrient particularly nitrogen and subsequent uptake by crop. This result in higher biomass production has reflected by production of additional leaves and simultaneously increased the petiole length[1]. These findings are in conformity with above mentioned growth parameters have also been reported by Tandel *et al*[9]., lowest days taken to first flowering (135.44 days and 143.84 days) during both years as compare to other treatments. The earliness in flowering might be due to the higher net assimilation rate on account of better growth leading to the production of endogenous metabolites earlier in optimum level enabling early flower reported by Singh and Varu[4] and Yadav *et al*[10]., in papaya, and lower days taken to maturity (200.82 days) which might have improved the yield parameters by better availability and uptake of nutrient by plant roots and enhancing the source - sink relationship by increasing the movement of carbohydrates from the leaves to the fruits. Similar findings have been reported by Yadav[11], Srivastava[7] in papaya.

The application of organic manures, inorganic fertilizers and *biofertlizers* in combination significantly influenced the days taken to maturity and in T_9 treatment recorded (Table -2) lower days taken to maturity (196.11 days and 205 days). Significantly higher days taken to maturity were recorded with T_4 (218.53 days and 218.70 days) during 2014 - 15 and 2015 - 16, respectively

Table 1: Effect of integrated nutrient management on growth parameters cv. Red lady

Treatments	Plant height (cm)		Trunk girth (cm)		Petiole length (cm)	
	2014 - 15	2015 - 16	2014 - 15	2015 - 16	2014 - 15	2015 - 16
T_1 - RDF (200 N: 200 P_2O_5: 250 K_2O g/plant)	160.35	196.01	40.73	41.43	45.01	45.05
T_2 - RDF+20 kg FYM plant^{-1}	175.47	205.04	43.13	49.62	40.37	49.62
T_3 - RDF + 10kg Vermicompost plant^{-1}	178.72	196.02	45.46	46.04	41.32	43.10
T_4 - RDF + 5 kg Neem cake plant^{-1}	175.26	202.10	47.28	47.82	38.07	41.43
T_5 - RDF + 20 kg FYM plant^{-1} +100g *Azotobacter* + 100g *PSB* plant^{-1}	178.46	196.01	46.72	47.35	39.19	46.92
T_6 - RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	174.41	210.51	47.69	49.34	39.35	49.34
T_7 - RDF + 5kg NC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	179.19	184.93	45.15	51.16	41.66	51.16
T_8 - 75% RDF + 20 kg FYM plant^{-1} + 100g *Azotobacter* + 100g *PSB* plant^{-1}	186.93	213.00	48.91	52.59	48.08	52.59
T_9 - 75% RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	198.78	226.93	51.20	53.77	52.09	53.77
T_{10} - 75% RDF + 5 kg NC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	183.08	197.70	48.32	49.77	39.08	49.77
SE.m ±	1.41	2.46	0.46	0.92	0.84	0.96
CD at 5%	4.13	7.20	1.34	2.71	2.47	2.81

Table 2: Effect of integrated nutrient management on growth parameters cv. Red lady

Treatments	Number of leaves/Plant		Days taken to first flowering (Days)		Days taken to fruit maturity (Days)	
	2014 - 15	**2015 - 16**	**2014 -15**	**2015 - 16**	**2014 - 15**	**2015 - 16**
T_1 - RDF (200 N: 200 P_2O_5: 250 K_2O g/plant)	44.40	45.39	169.59	170.65	216.72	212.43
T_2 - RDF+20 kg FYM plant^{-1}	39.70	41.23	168.54	169.12	212.94	208.82
T_3 - RDF + 10kg Vermicompost plant^{-1}	41.69	43.35	169.58	170.09	208.65	215.30
T_4 - RDF + 5 kg Neem cake plant^{-1}	37.12	43.56	164.43	165.64	218.53	218.70
T_5 - RDF + 20 kg FYM plant^{-1} +100g *Azotobacter* + 100g *PSB* plant^{-1}	40.73	42.27	162.38	165.68	212.87	212.03
T_6 - RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	41.39	42.28	164.05	165.66	214.54	216.81
T_7 - RDF + 5kg NC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	40.48	41.37	161.95	163.35	213.47	217.14
T_8 - 75% RDF + 20 kg FYM plant^{-1} + 100g *Azotobacter* + 100g *PSB* plant^{-1}	43.53	45.15	166.09	166.32	203.28	216.41
T_9 - 75% RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	45.38	48.31	135.44	143.84	196.11	205.54
T_{10} - 75% RDF + 5 kg NC + 100g *Azotobacter* + 100g *PSB* plant^{-1}	40.41	44.92	168.55	163.35	208.67	213.25
SE.m ±	0.58	1.10	2.29	3.24	4.85	4.15
CD at 5%	1.70	3.24	6.71	9.51	14.21	12.17

CONCLUSIONS

The growth parameters of plants were significantly influenced by the integrated nutrient treatments as compared to control. Maximum plant height, trunk girth, higher petiole length and maximum number of leaves per plant during both years. Plants received in T_9 - 75% RDF + 10 kg VC + 100g *Azotobacter* + 100g *PSB* plant^{-1} treatment showed earliness in initiation of flowering (days) and lowest days taken to fruit maturity during the both years.

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