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Effect of integrated nutrient management in papaya (*Carica papaya* L.) cv. MADHUBINDU

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ABSTRACT : The present investigation was conducted to study the effect of integrated nutrient management in papaya cv. Madhubindu at Department of horticulture. The experiment was laid out in Randomized Block Design with total fourteen treatments combinations including different organic and inorganic nutrient were comprised with three replications. The results revealed that the applications of 1/2 RDF (100:100:125 NPK g/pl) + *Azotobacter* @ 50 g/pl + PSB @ 2.5 g/m^2 (T_8) enhanced the growth and yield parameter like highest survival per cent (98.67%), plant height at flowering and harvesting stage, stem girth at flowering and harvesting stage, number of leaves at harvesting stage (24), lower days taken to first flower and first fruit harvest, maximum harvesting span (104 days), fruit length (30 cm), fruit girth (22 cm), highest fruit weight (1670 g), maximum number of fruit/plant (45.33), fruit yield per plant (78 kg), fruit yield per plot (313 kg), fruit yield per hectare (259.97 ton) and marketable fruit yield/plot (299 kg). Similarly, qualitative parameter like reducing, non reducing and total sugars (11.10, 2.43 and 13.58 %, respectively) and total soluble solids (15.47 ^{0}B) were also noted highest in same treatment. However, it was found at par with 1/4 RDF + 3/4 *Jivamrut* (T_{13}). Likewise poor performance was observed in control for all parameter.

KEY WORDS : Papaya, Integrated, Nutrient, Vermicompost, Castor cake, *Jivamrut*, *Azotobacter*, PSB

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Papaya (*Carica papaya* Linn.) is an important fruit belong to the family Caricacae. The total 1.06 lakh ha area is covered under papaya with a total production of 41.96 lakh ton in India (Anonymous, 2011). Papaya is the highly nutrient exhaustive fruit crop because of its quick growth, continuous fruit habit throughout year and heavy fruit yield. As such judicious application of fertilizers are needed to meet out the nutritional requirement of the plants. However, continuous application of huge amount of chemical fertilizers hamper the soil health and biological environment (Kumar *et al*., 2010 and Tandan, 2000). Also energy crisis resulted into high price index of chemical fertilizers coupled with their limited production. The integrated nutrient nourishes papaya, which involves conjunctive use of chemical fertilizers and organic manures to sustain crop production and maintenance of soil health. However, biofertilizers offer an alternative to chemical inputs, which have an ability of mobilizing the nutrionally important elements from nonuseable to useable form through chemical processes and known to increase yield (Alarcón *et al.*, 2002). In this context, the present investigation was under taken with an objective of finding out the effect of integrated nutrient management in papaya.

RESEARCH METHODS

The experiment was carried out at Fruit Research Station Madhadibaugh, Department of Horticulture, Junagadh Agriculture University, Junagadh, (Gujarat) during the years 2011-12. The experiment was laid out in Randomized Block Design with fourteen treatments and three replications. The treatment comprised of fourteen integrated nutrients levels. Likewise, RDF (200:200:250 g/pl) + FYM @10 kg/pl (T_1), Vermicompost @ 20 kg/pl) (T_2), Castor cake @ 4 kg/pl (T_3), *Azotobacter* @ 50 g /pl + PSB @ 2.5 g/m^2 (T_4), *Jivamrut* @ 500 litre/ha (T_5), 1/2 RDF +1/2 vermicompost (T_6), 1/2 RDF + 1/2 castor cake (T_7), 1/2 RDF +*Azotobacter* @ 50 g/pl) + PSB @ 2.5 g/m^2 (T_8), 1/2 RDF + 1/2 *Jivamrut* (T_9), 1/4 RDF + 3/4 vermicompost (T_{10}), 1/4 RDF + 3/4 castor cake

(T_{11}) and 1/4 RDF+ *Azotobacter* @ 50 g/pl+ PSB @ 2.5 g/ m^2 (T_{12}), 1/4 RDF + 3/4 *Jivamrut* (T_{13}) and control (RDF) (T_{14}). The seedlings of papaya were transplanted in the field adopting a spacing of 2 x 1.5 m. Different organic and inorganic source of nutrients were applied according to treatments. 1/3 part of nitrogen and full doses of phosphorus and potassium were applied at the time of transplanting of papaya. The remaining dose of nitrogen was applied in two equal doses after transplanting. The source of N, P and K were ammonium sulphate, single super phosphate and muriate of potash, respectively. The data recorded on vegetative growth, yield and physico-chemical attributes were analyzed statistically (Panse and Sukhatme, 1967).

RESEARCH FINDINGS AND DISCUSSION

The effect of integrated nutrients were found significant and highest survival per cent (98.67%), plant height at flowering and harvesting stage (43.67 and 286.67cm, respectively), stem girth at flowering and harvesting stage (15 and 39 cm, respectively), number of leaves at harvesting stage (24), lowest days taken to first flower and fruit harvest (65.33 and 161 days, respectively), maximum harvesting span (104 days) (Table 1), highest fruit length (30 cm) and fruit girth (22 cm) were recorded with the soil application of 1/ 2 RDF +*Azotobacter* @ 50 g/pl + PSB @ 2.5 g/m^2(T_8) (Table 2). However, it was found at par with 1/4 RDF + 3/4 *Jivamrut* (T_{13}). Similarly, lowest seed weight per fruit (57.67g) was noted in control. The notable improvement with respect to growth parameters with the use of biofertilizers, organic manures and inorganic fertilizers may be attributed due to sufficient availability of nitrogen, phosphorus, potassium and other essential nutrients. Besides, *Azotobacter* is also associated with the production of growth promoting substances, antifungal compounds and cytokinins which in turn might have lead to better root development, better transport and uptake of nutrients which resulted in increasing growth parameters. Results are in close conformity with the findings of Yadav (2006) and Shrivastava (2008).

The increase in fruit length and girth might be due to optimum supply of plants nutrients and growth hormones in right amount during the entire crop period caused vigorously inducing the vegetative development of the plants and ultimately more photosynthesis. Similar findings have been observed by Shrivastava, 2008.

In case of yield attributes, highest fruit weight (1670 g), maximum number of fruit/plant (45.33), fruit yield per plant (78 kg), total fruit yield per plot (313.00 kg), total fruit yield per hector (259.97 ton) and marketable fruit yield/ plot (299.00 kg) were recorded with 1/2 RDF +*Azotobacter* @ 50 g/pl+ PSB @ 2.5 g/m^2(T_8) (Table 2). However, it was found at par with treatment (T_{13}) for all parameter. The application of organic manures with major nutrients helped for increasing the available major nutrients as well as other

Table 1 : Effect of integrated nutrient management on growth in papaya

Treatments	Survival (%)	Plant height at flowering stage (cm)	plant height at harvesting stage (cm)	Stem girth at flowering stage (cm)	Stem girth at harvesting stage (cm)	No of leaves /pl.	Days taken to first flowering	Days taken to first fruit harvest	Harvesting span (Days)
T_1	73.33	36.33	247.00	7.33	25.0	16.67	79.00	188.33	84.00
T_2	78.67	38.17	249.33	9.00	30.0	17.00	71.67	162.67	88.00
T_3	79.00	34.33	255.00	11.17	25.7	19.00	90.00	184.00	86.33
T_4	79.00	38.53	260.00	9.00	24.7	15.00	76.67	176.00	89.00
T_5	77.67	39.33	267.00	12.00	30.8	20.00	74.00	174.00	89.67
T_6	78.33	36.50	259.13	12.17	24.7	17.00	73.33	173.33	92.67
T_7	72.33	31.50	247.67	10.17	30.4	18.00	86.67	170.00	73.33
T_8	98.67	43.67	286.67	15.00	39.0	24.00	65.33	161.00	104.00
T_9	84.67	39.07	245.23	9.30	23.5	14.67	77.33	176.33	86.67
T_{10}	75.33	39.33	243.00	11.50	31.3	13.00	70.00	168.00	80.00
T_{11}	80.33	37.73	248.67	13.20	26.2	16.33	86.67	173.33	87.67
T_{12}	84.67	36.33	257.48	11.70	29.5	21.00	78.67	166.00	93.33
T_{13}	96.33	40.53	276.67	14.00	34.0	22.00	70.00	167.00	98.00
T_{14}	68.67	30.33	242.83	8.00	19.7	15.00	83.93	179.33	80.00
S.E..±	6.712	1.333	8.649	0.600	2.222	0.540	3.840	4.080	5.340
C.D. (P=0.05)	18.18	3.81	24.74	1.73	6.20	1.54	10.99	11.66	15.29
C.V. %	14.44	6.20	5.85	9.53	13.30	5.24	8.60	4.09	10.51

Treatment details : RDF (200:200:250 g/pl) + FYM @10 kg/pl (T_1), Vermicompost @ 20 Kg/pl) (T_2), Castor cake @ 4 Kg/pl (T_3), Azotobactor @ 50 g /pl + PSB @ 2.5 g/m^2 (T_4), Jivamrut @ 500 litre/ha (T_5), 1/2 RDF +1/2 Vermicompost (T_6), 1/2 RDF + 1/2 castor cake (T_7), 1/2 RDF + Azotobactor @ 50 g/pl) + PSB @ 2.5 g/m^2 (T_8), 1/2 RDF + 1/2 Jivamrut (T_9), 1/4 RDF + 3/4 Vermicompost (T_{10}), 1/4 RDF + 3/4 castor cake (T_{11}) and 1/4 RDF + Azotobactor @ 50 g/pl+ PSB @ 2.5 g/m^2 (T_{12}), 1/4 RDF + 3/4 Jivamrut (T_{13}) and control (RDF) (T_{14}).

essential nutrients. The higher nutrient content and metabolic levels enhanced the growth parameters, ultimately leading to higher yield. The results are also in close conformity with the findings of Ravishanker *et al.* (2010) and Chaudhri *et al.* (2001) in papaya.

For fruit quality, highest reducing sugars (11.10 %) and non reducing sugars (2.43 %), total sugars (13.58 %) and total soluble solids (15.47 ^{0}B) were recorded with the soil application of 1/2 RDF +*Azotobacter* @ 50 g/pl + PSB @ 2.5 g/m^2 (T_8) and noted at par with treatment (T_{13}) (Table 3). Improvement in fruit quality might be due to increased continuous supply of nutrients, higher concentration of soil enzymes, soil micro organism, rapid mineralization and transformation of plant nutrients in soil and also growth

Table 2 : Effect of integrated nutrient management on fruits growth and yield in papaya

Treatments	Fruits length (cm)	Fruits girth (cm)	Fruits weight (g)	Seed weight /fruits (g)	No of fruits / plant	Fruit yield /plant (kg)	Total fruit yield /plot (kg)	Marketable fruit yield/ plot (kg)	Total fruit yield (t/ha)
T_1	26.00	17.60	1225.00	61.30	38.33	57.00	275.33	266.67	189.98
T_2	25.82	18.07	1541.67	61.67	35.90	56.67	293.33	275.79	178.64
T_3	21.93	14.90	977.67	63.45	39.33	61.50	275.67	273.92	151.64
T_4	22.27	15.63	1246.67	66.07	36.33	58.83	293.41	281.46	162.74
T_5	20.00	16.10	1332.67	68.67	40.67	64.33	296.67	283.71	214.41
T_6	23.20	18.17	1153.67	67.33	37.33	61.60	293.73	281.45	205.31
T_7	21.42	17.39	1404.00	69.17	40.00	65.63	295.19	282.32	218.74
T_8	30.00	22.00	1670.00	80.60	45.33	78.00	313.00	299.00	259.97
T_9	25.32	18.63	1239.00	73.33	40.00	59.00	280.00	275.43	189.98
T_{10}	24.98	18.33	1463.00	61.13	39.00	61.67	275.00	261.67	205.54
T_{11}	24.74	17.53	1487.00	65.00	39.33	60.33	290.00	288.10	164.41
T_{12}	24.67	18.90	1279.00	69.67	36.67	56.67	276.00	267.02	188.88
T_{13}	28.33	20.46	1559.85	76.00	42.00	74.00	300.67	290.33	246.64
T_{14}	20.33	14.00	1190.00	57.67	33.67	55.67	268.33	264.15	148.88
S.E..±	1.950	0.830	84.140	4.180	1.890	0.692	11.373	9.528	11.117
C.D. (P=0.05)	5.57	2.36	240.76	11.97	5.41	2.00	34.11	28.50	31.74
C.V. %	13.93	8.08	10.87	10.78	8.43	1.86	6.85	5.94	9.89

Table 3 : Effect of integrated nutrient management on biochemical parameter and leaf content of nitrogen, phosphorus and potassium in papaya

Treatments	Reducing sugars (%)	Non-Reducing sugars (%)	Total sugar (%)	TSS (^{0}B)	N content (%)	P content (%)	K content (%)
T_1	8.25	0.76	10.91	12.29	1.21	0.182	2.46
T_2	7.90	0.93	8.83	11.85	1.23	0.179	2.52
T_3	8.76	1.01	9.77	13.06	1.24	0.178	2.45
T_4	9.34	0.60	9.93	12.13	1.19	0.178	2.40
T_5	9.92	1.00	10.92	11.00	1.19	0.183	2.53
T_6	10.18	1.20	11.38	11.99	1.22	0.178	2.57
T_7	9.92	0.92	10.83	13.81	1.25	0.181	2.44
T_8	11.10	2.43	13.58	15.47	1.37	0.186	2.72
T_9	10.19	1.42	11.61	11.67	1.25	0.178	2.62
T_{10}	8.03	1.16	9.20	12.51	1.25	0.177	2.39
T_{11}	9.35	0.70	10.05	11.82	1.18	0.176	2.45
T_{12}	9.82	1.03	10.84	12.97	1.16	0.180	2.52
T_{13}	10.37	2.22	12.59	13.16	1.30	0.177	2.64
T_{14}	7.33	0.45	7.78	9.19	1.11	0.165	2.35
S.E..±	0.467	0.351	0.611	0.759	0.030	0.001	0.073
C.D. (P=0.05)	1.33	1.05	1.74	2.17	0.08	0.05	0.21
C.V. %	8.69	5.53	10.00	10.65	4.36	1.86	5.09

promoting substances produced by microorganism. The results are in accordance with the finding of Kumar *et al.* (2010) and Yadav *et al.* (2011).

For leaf content, significantly highest nitrogen, phosphorus and potassium content (1.37, 0.186 and 2.72%, respectively) was observed in 1/2 RDF +*Azotobacter* @ 50 g/pl + PSB @ 2.5 g/m^2(T_8) (Table 3). The results are also accordance with the finding of Muller *et al.* (1979).

The notable improvement with respect to leaf nutrient content with the use of biofertilizers, organic manures and inorganic fertilizers may be attributed due to sufficient availability of nitrogen, phosphorus, potassium and other essential nutrients.

REFERENCES

Anonymous (2011). National Horticulture Board, Data Base, Guagaon.

Alarcón, A., Frederick, T., Davies, J., Johnatan, N.E., Theodore, C.F., Arturo, A.E. and Ferrera, C.R. (2002). Short term effects of *Glomus claroideum* and *Azospirillum brasilense* on growth and root acid phosphates activity of *Carica papaya* L. under phosphorus stress. *Revista Latinoamericana de microbiology,* **44** (1): 31 – 37

Chaudhri, S.M., Shinde, S.H., Dahiwalkar, S.D., Dana wale, N.J., Shiras, H.K. and Berad, S.M. (2001). Effect of fertigation through drip on productivity of papaya. *J. Maharashtra Agric. Univ.*, **26**(1):18-20.

Kumar, N., Soorianathasundaram, K., Minakshi, N., Manivannan, M.I., Suresh, J. and Nosov, V. (2010). Balanced fertilizer in papaya for higher yield and quality.*Acta Hort.*, **851** : 425-428.

Muller, C.H., Reis, G.G. and Muller, A.A. (1979). Effect of FYM on the growth and nutrient accumulation in pawpaw stems and leaves. *Scientia Agricola*, **30** : 14-18.

Panse, V.C. and Sukhatme, P.V. (1967). *Statistical methods for agricultural workers*, ICAR, New Delhi (INDIA).

Ravishankar, H., Karunakaran, G. and Srinivasamurthy (2010). Performance of coorg honey dew papaya under organic farming regimes in the Hill Zone of Karnataka. *Acta Hort.*,**851** : 259-262.

Shrivastava, A. (2008). Integrated nutrient management *(Carica papaya* L.). Ph.D. Thesis, N.D. University of Agriculture and Technology, Faizabad (U.P.) INDIA.

Tandan, H.L.S. (2000). Fertilizer, organic manures, recyclable waste and biofertilizers. Fertilizer Development and Consultation Organization, New Delhi, 98 pp.

Yadav, P.K. (2006). Effect of integrated nutrient management on growth, yield and quality of papaya *(Carica papaya* L.) fruit. Ph.D. Thesis, C.S.A. University of Agriculture and Technology, Kanpur (U.P.) INDIA.

Yadav, P.K., Yadav, A.L., Yadav, A.S. and Yadav, H.C. (2011). Effect of integrated nutrient nourishment on vegetative growth and physico-chemical attributes of papaya (*Carica papaya* L.) fruit cv. PUSA DWARF. *Plant Archives,* **11** (1): 327-329.