Int.J.Curr.Microbiol.App.Sci (2021) *10*(02): 1518-1523

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 10 Number 02 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1002.181

Effect of Plant Nutrients on Yield Attributing Characters and Yield of Papaya (*Carica papaya* L.) Cv. Taiwan Red Lady

Dubbaka Naveen Kumar[1*], T. Suresh Kumar[2], Veena Joshi[3] and C. H. Raja Goud[1]

[1]*Department of Horticulture, Rajendranagar, Hyderabad, SKLTSHU, Telangana, India*
[2]*Horticultural Research Station, Konda Mallepally, Nalgonda, SKLTSHU, Telangana, India*
[3]*Department of Horticulture, Mojerla, SKLTSHU, Telangana, India*

**Corresponding author*

Keywords

Papaya, Plant nutrients, KNO_3, Ca $(NO_3)_2$, $ZnSO_4$, Borax

Article Info

Accepted:
15 January 2021
Available Online:
10 February 2021

A B S T R A C T

The present experiment was conducted on "Effect of plant nutrients on yield of papaya (*Carica papaya* L.) Cv. Taiwan Red Lady" was carried out during 2019 - 2020 in farmer's field, Pittalagudem village of Nalgonda District, Telangana. The experiment was laid out in Randomized Block Design (RBD) with nine treatments and three replications. Results enunciated that, the yield and yield attributing characters were influenced significantly by foliar application of different combinations of plant nutrients, application of T_4: KNO_3 (1.5%) + Borax (0.5%) + Ca $(NO_3)_2$ (0.5%) + $ZnSO_4$ (0.5%) per tree recorded the maximum number of fruits per tree (25.36), fruit weight (1.47 kg), fruit length (21.36 cm), fruit diameter (14.73 cm) and highest yield per tree (37.27 kg tree^{-1}).

Introduction

Papaya (*Carica papaya* L.) is a native fruit of Tropical America was introduced to India in the 16th century from Malacca and belongs to the family Caricaceae (Singh, 1990). It is one of the commercially important fruit crop of the tropics and is often considered as common man's fruit, also known as papita, papaw and true melon. The high productivity and ability to produce fruits throughout the year has added to gain popularity and commercial importance. It is rich in carotene (2020 IU 100g^{-1} precursor of vitamin A), vitamin 'C' and minerals such as calcium, phosphorus and iron (Chadha, 1992) makes papaya an important fruit crop. A new papaya cultivar Taiwan Red Lady was introduced to India from Taiwan which has replaced the traditional varieties like Pusa selections, Coorg Honey Dew and Coimbatore Selections due to its gynodioecious nature, high productivity and red colour flesh. India is the largest producer of papaya in the world, producing 61.07 lakh tonnes of fruits from an area of 1.39 lakh hectares with productivity of 58.31 lakh MT ha^{-1} (NHB, 2018-19). It is commercially cultivated in Telangana in an area of 1184.68 hectares with productivity 79274.46 MT ha^{-1}. Papaya crop needs moisture stress free environment and judicious nutrient supply at regular intervals for optimum productivity and application of different macro and micronutrients in papaya recorded a positive influence in yield (Shanmugavelu *et al.,* 1973).

In addition to recommended dose of macro-nutrients, monthly application of micronutrient sprays like zinc and boron are very important for its growth and development. Boron is necessary for calcium metabolism. Boron helps in pollen tube growth, pollination and days taken for opening of flower. It probably facilitates the translocation of sugar and starches (Brown *et al.*, 1995). Calcium sprays given during plant growth improves the establishment of root system, increases the fruit s*et al.*,ong with fruit retention and also provides a safe mode of supplementing endogenous calcium to fresh fruits which improves the cell wall strength during fruit development, (Monika *et al.*, 2018).

Zinc enhances the vegetative growth due to the presence of tryptophan, which is the precursor of auxin and stimulates flowering and to obtain good fruit set and size. It also helps in the process of translocation of metabolites to the bud itself or to the site of bud development. Zinc is a component or a functional cofactor of several enzymes including auxin. It also plays an important role in carbohydrate metabolism, protein synthesis and internodes elongation (Ryugo, 1988).

Deficiencies of micronutrient such as zinc and boron has been increasing in papaya and other fruit crops. The major reasons for micronutrient deficiencies are intensified agricultural practices, unbalanced fertilizer application including NPK, loss of nutrients and no replenishment. As only few studies have been taken up in papaya nutrition, there is very less information about micronutrients in papaya. In this view present investigation was undertaken to study effect of plant nutrients on yield and yield attributing characters of papaya.

Materials and Methods

A field experiment was conducted at farmer field in Pittalagudem village of Nalgonda District, Telangana on seven months old plants of papaya. The experiment was laid out in Randomized Block Design (RBD) with nine treatments and three replications *viz*., T_1: 19:19:19 (0.5%) + Borax (0.3%) + Ca $(NO_3)_2$ (0.25%) + $ZnSO_4$ (0.25%), T_2: 19:19:19 (1%) + Borax (0.5%) + Ca $(NO_3)_2$ (0.5%) +$ZnSO_4$ (0.5%), T_3: KNO_3 (1%) + Borax (0.3%) + Ca $(NO_3)_2$ (0.25%) + $ZnSO_4$ (0.25%), T_4: KNO_3 (1.5%) + Borax (0.5%) + Ca $(NO_3)_2$ (0.5%) + $ZnSO_4$ (0.5%), T_5: $ZnSO_4$ (0.25%) + Borax (0.3%) + Ca $(NO_3)_2$ (0.25%), T_6: $ZnSO_4$ (0.5%) +Borax (0.5%) + Ca $(NO_3)_2$ (0.5%), T_7: $ZnSO_4$ (0.25%) + Borax (0.3%) + KNO_3 (1%), T_8: $ZnSO_4$ (0.5%) + Borax (0.5%) + KNO_3 (1.5%), T_9: Control (water spray). Plant nutrients are applied eight times in monthly interval during July, 2019 to March, 2020. Data regarding number of fruits per tree taken based on maturity indices of fruit cumulatively and yield as per standard method. While fruit length, fruit weight and fruit diameter was recorded after harvest.

Results and Discussion

Number of fruits per tree

The maximum number of fruits $tree^{-1}$ (Table 1) was observed in T_4 (25.36) which was on par with T_3 (23.90) and minimum number of fruits in control T_9 (17.81).Increase in number of fruits per tree might be due to combined application of plant nutrients, zinc and boron directly or indirectly involved in higher synthesis of metabolites, consequently leads to higher fruit set, fruit retention and finally more number of fruits per plant, and calcium, potassium sprays along with micronutrients are also associated with photosynthesis, hormone metabolism which promotes synthesis of auxin, necessary for fruit set and fruit growth (Rajkumar *et al.*, 2014) in guava.

This finding was also in agreement with the findings of Kudada and Prasad (2002) in papaya Cv. Rajdoot, Manjunatha *et al.*, (2014), Preethi *et al.,* (2017) and Monika *et al.,* (2018) in papaya.

Fruit weight (kg)

The cumulative effect of foliar treatment of plant nutrients has resulted into maximum fruit weight (Table 1) in T_4 (1.47 kg) which was on par with treatment T_3 (1.41 kg) and minimum fruit weight was recorded in T_9 control (1.05 kg).

Increase in fruit weight was probably due to zinc, calcium and potassium sprays which involves in regulating semi-permeability of cell membranes, thus helps in faster loading and mobilizing of photo assimilates, water into fruits resulting in increase of fruit weight (Singh *et al.,* 2010). At the same time the micronutrients applied involves in hormonal metabolism, increase in cell division and expansion of cell wall.

Boron is also known to stimulate rapid mobilization of water and sugar in the fruit which in turn increased in accumulation of dry matter within the fruit (Arvind *et al.,* 2012) and the similar findings were also observed by Bhalerao *et al.,* (2014) and Manjunatha *et al.*, (2014) in papaya.

Fruit length (cm)

The maximum fruit length (Table 1) was noted in foliar application of T_4 (21.36 cm) and the minimum fruit length in control T_9 (14 cm). The increase in fruit length was possibly due to accumulation of more food material in the tree that lead to efficient utilization for fruits development and boron helps in cell division, cell expansion and increased volume of intercellular spaces in the mesocarpic cells and higher mobilization of photosynthates from other parts of the plant towards the developing fruits that are extremely active metabolic sink (Singh *et al.,* 2001). Specially boron appears to have direct role in hastening the process of cell division and cell elongation due to which length of the fruit is increased. Zinc helps in regulating the cell wall permeability, thereby allowing more mobilization of water in fruits that contributed to the greater fruit length (Wali *et al.*, 2005). These results are in close confirmity with the findings of Monika *et al.,* (2018), Bhalerao *et al.,* (2014), Preethi *et al.,* (2017) in papaya, Chaitanya (1997) and Rajkumar *et al.,* (2014) in guava.

Fruit Diameter (cm)

The results showed maximum fruit diameter (Table 1) in plants treated with T_4 (14.73 cm) followed by T_3 (13.94 cm) and the minimum fruit diameter in T_9 control (10.24 cm). By optimum supply of plant nutrients at required amount during entire period of fruit growth, ultimately resulted in accumulation of more photosynthesis resulted into more fruit diameter (Singh *et al.*, 2017) in mango. A generally accepted opinion that increases in fruit size is due to enlargement of the already existing cells, calcium and zinc is found to be responsible for this enlargement. Hence, application of calcium nitrate and zinc sulphate cause fruit enlargement by increasing cell size.

Table.1 Effect of plant nutrients on yield of papaya **(***Carica papaya* L.) Cv. Taiwan Red Lady

Treatments	Number of fruits per tree	Fruit weight (kg)	Fruit Length (cm)	Fruit diameter (cm)	Fruit yield per tree (kg)
T_1 -19:19:19 (0.5%) + Borax (0.3%) + Ca $(NO_3)_2$ (0.25%) + $ZnSO_4$ (0.25%)	22.76	1.36	16.66	13.28	30.95
T_2 -19:19:19 (1%) + Borax (0.5%) + Ca $(NO_3)_2$ (0.5%) +$ZnSO_4$ (0.5%)	23.40	1.33	16.00	12.79	31.12
T_3 - KNO_3 (1%) + Borax (0.3%) + Ca $(NO_3)_2$ (0.25%) + $ZnSO_4$ (0.25%)	23.90	1.41	17.66	13.94	33.69
T_4 - KNO_3 (1.5%) + Borax (0.5%) + Ca $(NO_3)_2$ (0.5%) + $ZnSO_4$ (0.5%)	25.36	1.47	21.36	14.73	37.27
T_5 -$ZnSO_4$ (0.25%) + Borax (0.3%) + Ca $(NO_3)_2$ (0.25%)	22.10	1.19	14.83	11.37	26.29
T_6 - $ZnSO_4$ (0.5%) +Borax (0.5%) + Ca $(NO_3)_2$ (0.5%)	21.23	1.30	15.16	12.40	27.59
T_7 - $ZnSO_4$ (0.25%) + Borax (0.3%) + KNO_3 (1%)	21.80	1.24	14.50	10.72	27.03
T_8 - $ZnSO_4$ (0.5%) + Borax (0.5%) + KNO_3 (1.5%)	20.73	1.28	15.16	11.83	26.53
T_9 - Control (water spray)	17.81	1.05	14.00	10.24	18.70
S.Em.(±)	0.21	0.02	0.81	0.33	0.64
C. D. at 5%	0.64	0.06	2.44	0.99	1.94

Increase in fruit length and fruit breadth may be due to cell division initially and cell enlargement in the later stages which might pertain to the fact that calcium nitrate and zinc sulphate promote cell expansion and increase volume of intercellular space in the mesocarpic cell and enhanced mobilization of photosynthesis thereby increasing the nitrogen availability and potassium promotes in cell wall construction. The above results are in accordance with the findings of El-Rhman and Shadia (2012) in jujube and Singh *et al.*, (2009) in aonla.

Fruit yield per tree (kg)

Significantly maximum fruit yield (Table 1) was obtained in T_4 (37.27 kg) which was on par with T_3 (33.81 kg) and the minimum fruit yield in T_9 control (18.79 kg). Increase in fruit yield (kg tree^{-1}) is a cumulative effect of increase in number of fruits because of reduction in fruit drop vis-a-vis higher fruit weight by the direct and indirect effect of foliar spray of micronutrients and increased levels of nutrients which helps in assimilation of crop due to which the rate of dry matter production was enhanced in mango (Sharma *et al.*, 2016). Micronutrients like Zn and B helps in activation of starch formation, followed by rapid transportation of carbohydrates and might affect the physiological processes (increasing dry matter percentage by increasing photosynthesis) resulting in higher production of mango Cv. Alphonso (Gurjar *et al.*,2015), further secondary major nutrients supplemented through foliar application prevented the tissue degeneration and increased in the yield by 28% compared to control (Monika *et al.*, 2018) in papaya. These findings are in conformity with the results of Dalal *et al.,* (2004) in sapota and Lal and Dayal (2014) in citrus.

From this study, it can be concluded that among the different combinations of plant nutrients KNO_3 (1.5%) + Borax (0.5%) + Ca $(NO_3)_2$ (0.5%) + $ZnSO_4$ (0.5%) per tree can be recommended which showed positive effect on number of fruits, fruit weight, fruit length, fruit diameter, and fruit yield per tree.

References

Arvind, B., Mishra, N. K., Mishra, D. S. and Singh, C. P. 2012. Foliar application of potassium calcium, zinc and boron enhanced yield, quality and shelf life of mango. *HortFlora Research Spectrum*. 1(4): 300-305.

Bhalerao, P. P., Patel, B. N., Patil, S. J. and Gaikwad, S. S. 2014. Effect of foliar application of Ca, Zn, Fe and B on growth, yield and quality of papaya (*Carica papaya*) Cv. Taiwan Red Lady. *Current Horticulture*. 2(2): 35-39.

Brown, P. H., Ferguson, L. and Piccioni, G. 1995. Boron boosts pistachio yields. *Fluid Journal*. 33(1): 53-55.

Chadha, K. L. 1992. Scenario of papaya production and utilization in India. *Indian Journal of Horticulture*. 49(2): 97-119.

Chaitanya, C. G., Kumar, G., Raina, B. L. and Muthoo, A. K. 1997. Effect of foliar application of zinc and boron on yield and quality of guava. *Haryana Journal of Horticultural Science*. 261(4): 78-80.

Dalal, S. R., Gonge, V. S., Jogdande, N. D. and Moharia, A. 2004. Response of different levels of nutrients and PSB on fruit yield and economics of sapota. *Panjabrao Deshmukh Krishi Vidyapeeth Research Journal*. 28(1): 126-28.

El-Rhman, A. I. E. and Shadia, A. A. 2012. Effect of foliar sprays of urea and zinc on yield and physio chemical composition on jujube (*Ziziphus mauritiana*). *Journal of Agricultural Research*. 1(1):52-57.

Gurjar, T. D., Patel, N. L., Panchal, B. and Chaudhari, D. 2015. Effect of foliar spray of micronutrients on flowering and fruiting of Alphonso mango (*Mangifera indica* L.). *International Quarterly Journal of Life Sciences*. 10(3): 1053-1056.

Kudada, N. and Prasad, S. M. 2002. Effect of manuring on incidence of papaya ring spot virus and yield attributes of pot grown papaya Cv. Rajdoot. *Journal of Research and Development*. 52(3): 224-227.

Lal, G. and Dayal, H. 2014. Effect of integrated nutrient management on yield and quality of acid lime (*Citrus aurantifolia* Swingle). *African Journal of Agricultural Research*. 9(40): 2985-91.

Manjunatha, S., Swamy, G. S. K., Prakash, N. B., Jagadeesha, R. C., Chavan, M. and Shankarappa, K. S. 2014. Effect of micronutrients and silicon on growth and yield of papaya Cv. Red Lady. *Journal of Agricultural Research and Technology*. 39(1): 015-020.

Monika, G., Soorinathasundaram, K., Auxcilia, J., Chitdeshwari, T., Kavitha, C. and Muthulakshmi, P. 2018. Effect of foliar nutrition of calcium and sulphur on growth and yield of papaya (*Carica papaya* L.)*International Journal of Chemical Studies*. 6(5): 765-769.

National Horticulture Board, 2018-19. *Indian Horticulture Database*, Guargon, New Delhi.

Preethi, M. 2017. Studies on effect of

micronutrients on growth, yield and quality in papaya Cv. Red lady. *PGThesis*. Department of Horticulture. UHS, Bagalkot. pp: 115-122.

Rajkumar, J. P., Tiwari. and Shant, L. 2014. Effect of foliar application of zinc and boron on fruit yield and quality of winter season guava (*Psidium guajava*) Cv. Pant Prabhat. *Annals of Agri-Bio Research*. 19(1): 105-108.

Ryugo, K. 1988. Fruit culture. John Wiley and Sons, pp: 259- 261.

Shanmugavelu, K. G., Rao, V. N. M. and Srinivasan, C. 1973. Studies on the effect of certain plant growth regulators and boron on papaya (*Carica papaya* L.). *South Indian Horticulture*. 21(2): 19-26.

Singh, D. M., Singh, H. K., Vishwanath and Bhanu Pratap. 2009. Effect of foliar feeding of nutrients on yield and quality of aonla (*Emblica officinalis* Gaertn.) fruits. *Annals of Horticulture*. 2(1): 95-97.

Singh, D. K., Ghosh, S. K., Paul, P. K. and Suresh, C. P. 2010. Effect of Different Micronutrients on growth, yield and quality of papaya (*Carica papaya* L.) Cv. Ranchi. *International Society for Horticultural Science*. *Acta Horticulturae*. 7(3): 851-858.

Singh ID. Papaya. New Delhi, India. Oxford and IBH Publishing company private Ltd, 1990. pp: 15-23.

Singh, R., Godara, N. R., Singh, R. and Dahiya, S. S. 2001. Response of foliar application of growth regulators and nutrients in ber (*Zizyphus mauritiana* L.) Cv. Umran. *Haryana Journal of Horticultural Sciences*. 30(2): 161-164.

Singh, S., Parekh, N. S. and Pradeep, K. V. 2017. Effect of soil and foliar application of multi micronutrients on fruit quality, shelf life of fruits and nutrient content of leaf of mango (*Mangifera indica* L.) Cv. Amrapali. *International Journal of Chemical Studies*. 5(4): 305-308.

Sharma, R., Jain, P. K. and Sharma, T. R. 2016. Effect of inorganic and organic sources of nutrients on physico-chemical composition of mango (*Mangifer aindica* L.) Cv. Amrapali. *Economic Affairs New Delhi Publishers Journals*. 6(4): 677-682.

Telangana State Horticulture Department, (2017-2018). *http:// horticulture.tg.nic. in/asssets/A-pofHorticulturecrops 2017-18-opencrops. xls.*

Wali, V. K., Kaul, R. and Kher, R. 2005. Effect of foliar sprays of nitrogen, potassium and zinc on yield and physico-chemical composition of phalsa (*Grewia subinqualis*) Cv. Purple Round. *Haryana Journal of Horticultural Sciences*. 34(3): 56-57.

How to cite this article:

Dubbaka Naveen Kumar, T. Suresh Kumar, Veena Joshi and Raja Goud, C. H. 2021. Effect of Plant Nutrients on Yield Attributing Characters and Yield of Papaya (*Carica papaya* L.) Cv. Taiwan Red Lady. *Int.J.Curr.Microbiol.App.Sci.* 10(02): 1518-1523.
doi: https://doi.org/10.20546/ijcmas.2021.1002.181