The Pharma Innovation Journal 2023; 12(6): 639-643

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(6): 639-645

www.thepharmajournal.com
Received: 18-03-2023
Accepted: 20-04-2023

Gunja Thakur
Department of Fruit Science, COA, IGKV Raipur, Chhattisgarh, India

Hemant Kumar Panigrahi
Department of Fruit Science, COA, IGKV Raipur, Chhattisgarh, India

Michi Tani
Department of Fruit Science, COA, IGKV Raipur, Chhattisgarh, India

Shivam Dansena
Department of Soil Science and Agricultural Chemistry, COA, Raipur Chhattisgarh, India.

Khushboo Tandon
Department of Fruit Science, COA, IGKV Raipur, Chhattisgarh, India

Aaisha Nasim
Department of Fruit Science, COA, IGKV Raipur, Chhattisgarh, India

Corresponding Author:
Gunja Thakur
Department of Fruit Science, COA, IGKV Raipur, Chhattisgarh, India

Studies on the effect of foliar application of plant growth regulators and macro and micro-nutrients on growth and yield of banana (*Musa paradisiaca* L.) cv. Grand Naine under Agro-climatic condition of Chhattisgarh plain

Gunja Thakur, Hemant Kumar Panigrahi, Michi Tani, Shivam Dansena, Khushboo Tandon and Aaisha Nasim

Abstract
The present investigation entitled "Studies on the effect of foliar application of plant growth regulators and macro and micro nutrients on growth and yield attributes of banana (*Musa paradisiaca* L.) cv. Grand Naine under Agro-climatic condition of Chhattisgarh plain" was carried out during the year 2020-2021 at Research Field of Commercial Tissue Culture Laboratory (CoEAIB), Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) employed in Randomized Block Design having eight treatments, which was replicated three times. The foliar application of micro-nutrient mixture + GA_3 300 ppm (T_3) had significant effect and registered maximum plant height (2.23 m), number of leaves (22.84), length of leaves (114.23 cm) and breadth of leaves (58.65 cm) as compared to rest of the treatments under the present trial. The flowering, fruiting and maturity characteristics of banana was significantly influenced under the treatment T_7 (micro-nutrient mixture + potassium di-hydrogen phosphate 1%), which took minimum time to flowering (230.67 days), first fruiting (248.06 days) and overall maturity of banana (320.19 days) under the present experiment. As regard yield and yield attributing parameters *i.e.* number of fingers per hand (14.59), number of hands per bunch (12.39), length of fingers (19.29 cm), diameter of fingers (13.56 cm), weight of fingers per hand (2.75 kg), weight of individual finger (152.06 g), length of bunch per plant (75.92 cm), weight of bunch per plant (31.07 kg) and yield (72.11 t/ha) were recorded maximum under the superiority of treatment T_7 followed by T_6 as compared to all other treatments.

Keywords: Foliar application, PGRs, micro-nutrients, Agro-climatic, parameters

Introduction
Banana (*Musa paradisiaca* L.) is one of the world's most common tropical and sub-tropical fruits. It is a member of the *Musa* genus, which belongs to the Scitamineae order, also known as Zingiberales and the Musaceae family. The banana (*Musa paradisiaca* L.) is a tropical South and South-east Asian fruit. Banana is revered in India for its antiquity and it is intertwined with Indian history and endowment. Banana plants are thought to reflect prosperity and fertility.

Banana is a water and micro-nutrient loving plant, cultivated in major parts of world and India. As mentioned above cultivation of banana is well distributed among the regions where rainfall is about 200 mm per annum. There are number of varieties being cultivated in banana. Banana plants produces fruits through parthenocarpy of a commercial importance.

Banana is propagated vegetatively and through the method of tissue culture. In terms of growth, yield, and efficiency, plant growth regulators such as gibberellic acid and benzyl adenine play a critical role. Some compounds, such as potassium di-hydrogen phosphate, also contribute to the enhancement of these characteristics. Potassium is a general metabolic activator that boosts respiration and photosynthesis rates. Development, yield, and quality are all influenced by plant growth regulators.

Materials and Methods
The present experiment entitled "Studies on the effect of foliar application of plant growth regulators and macro and micro-nutrients on growth, yield and quality attributes of banana (*Musa paradisiaca* L.) cv. Grand Naine under Agro-climatic condition of Chhattisgarh Plain"

has been undertaken at Research Field of Commercial Tissue Culture Laboratory (CoEAIB), Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment was laid out in Randomly Block Design and replicated thrice. Each plant in a plot were treated with different composition of PGRs and macro and micro-nutrients through foliar application.

Total of 8 treatments were formed *i.e.* $T_{0:}$ control, $T_{1:}$ micro-nutrient mixture, $T_{2:}$ micro-nutrient mixture + GA_3 200 ppm, $T_{3:}$ micro-nutrient mixture + GA_3 300 ppm, $T_{4:}$ micro-nutrient mixture + benzyl adenine 10 ppm, $T_{5:}$ micro-nutrient mixture + benzyl adenine 20 ppm, $T_{6:}$ micro-nutrient mixture + potassium di-hydrogen phosphate 0.5% and $T_{7:}$ micro-nutrient mixture + potassium di-hydrogen phosphate 1% with 300 g N + 120 g P + 300 g K per plant during crop growth period. The time of foliar application was 5th and 7th months after planting and the last application was given after the emergence of last hand. The experimental plots were always kept free from weeds by operating power tiller at early stage of crop growth and development and at later stage by removing them manually. Weeding was carried out as per requirement of the crop. De-suckering of unwanted suckers was done intermittently to turn aside the competition with the mother plants for nutrients, moisture and space etc. Peremptory plant protection measures were taken to check the insect pest and disease by applying correct dose of fungicide and insecticide at regular intervals during entire experimental periods.

Result and discussions

The result of experiment pertaining to various aspect of growth, yield and quality parameters are summarized below:

Growth parameters

The growth parameters were recorded for the following heads namely plant height (m), stem girth (cm), number of leaves per plant.

Plant height (m)

The statistical data collected on plant height after spraying of different PGRs and macro and micro-nutrients from the present investigation were recorded at 150, 180, 210, 240, 270 days after planting. The data recorded at 210 DAP showed significant variations in respect to plant height of banana cv. Grand Naine. Among the various treatments maximum plant height (1.67 m) was recorded under the superiority of treatment T_3 (micro-nutrient mixture and GA_3 300 ppm), which was found non-significant differences with T_2 having the average plant height 1.63 m at 5% level of significance. The minimum plant height (1.38 m) was registered under the treatment T_0 (untreated plot). Gibberellic acid played very important role in elongation of the cells, which automatically increases the height of the plants. Zinc sulphate plays an important role as co-factor in activating many enzymes and also helped in metabolism of starch, nucleic acid metabolism and biosynthesis of protein there by contributing in increased tissue growth and development of the plants. The present results are in close agreement with the finding of Sarolia *et al.* (2007) [24] in guava and Pathak *et al.* (2011) [21] in banana.

Stem girth (cm)

From the current experiment, the average data recorded for stem girth clearly indicates that the maximum stem girth (66.76 cm) was registered under the treatment T_7 (micro-nutrient mixture+ potassium di-hydrogen phosphate 1%), which was found non-significant differences with the treatment T_6 having the average stem girth of 65.22 cm but both were significantly different from the rest of the treatments under the present experiment. The minimum stem girth (54.32 cm) was noticed under the treatment T_0 (control), which was found statistically similar with the treatment T_1 and having average stem girth of 56.13 cm at 5% level of significance. Similar detections were also made by Ghanta and Mitra (1993) [13], Subramanian and Pillai (1997) [29] and Ram and Bose (2000) in banana. Similar observations were also observed by Haque *et al.* (2000) [17] in mandarin orange and Babu and Singh (2002) [2] in litchi.

Number of leaves per plant

The maximum number of leaves per plant per plant (22.84) was observed under the plants treated with micro-nutrient mixture + GA_3 300 ppm. The treatment T_0 (untreated plots) substantially confirmed the minimum number of leaves per plant (17.12). This might be due to Zinc stimulates photosynthesis activity and its presence is important for protein synthesis. These results are in close agreement with the findings of Singh and Rajput (1976) [27], Das and Mohan (1993) [5], Ghanta and Mitra (1993) [13], and Supriya and Bhattacharya (1993) [31] in banana and other fruit crops.

Flowering, fruiting and maturity parameters

The observations regarding average days to flowering, days to first fruiting and days to maturity was significantly influenced under different treatments under present study. Days to flowering, days to first fruiting and days to maturity was minimum under the treatment T_7 (micro-nutrient mixture + potassium di-hydrogen phosphate 1%) and maximum was noticed under control. This might be due to the effect of the micro-nutrients, PGRs and the chemical potassium di-hydrogen phosphate on net assimilation rate on account of better growth leading to production of metabolites, which are very crucial for initiation of floral bud and also for early shoot emergence of the crop. This result corroborates with the finding of Das and Mohan (1991) [11], Ghanta and Mitra (1993) [14] and Yadav *et al.* (2010) [32] in banana.

Yield and yield attributing parameters

The yield and yield attributing parameters were observed for the variables namely number of fingers per hand, number of hands per bunch, length of fingers (cm), diameter of fingers (cm), weight of fingers per hand (kg), weight of individual finger (g), length of bunch per plant (cm), weight of bunch per plant (kg) and yield (t/ha).

Number of fingers per hand

The maximum number of fingers per hand (14.59) was observed under the superiority of the treatment T_7 (micro-nutrient mixture + potassium di-hydrogen phosphate 1%) and the minimum (11.59) was noticed under the treatment T_0 (control). The response of the foliar application of micro-nutrients and plant growth regulators was consistent and found to improve the number of fingers per hand effectively. It provides quick and effective augmentation of nutrients and also prevents hidden hunger of the plants. Macro and micro-nutrients provided at reproductive stage evidently helped the plants to develop its good photosynthesis, which alternatively helped in creating a good source to sink relationship between the fruits and bunches. These finding are in close agreement

with the findings of Ghanta and Dwivedi (1993) [14], Subramanian and Pillai (1997) [29] and Kumar and Jeyakumar (2001) [18].

Number of hands per bunch

The number of hands per bunch was diversified between 10.01 to 12.39 under the different treatments. Maximum number of hands per bunch (12.39) was reported under the treatment T_7 (micro-nutrient mixture +potassium di-hydrogen phosphate 1%) and the minimum number of hands per bunch (10.01) was noticed under the treatment T_0 (control). The increment in number of hands per bunch was a significant result of the foliar application of different micro-nutrients, PGRs and potassium di-hydrogen phosphate. This might also be due to the improvement of cell elongation and division during the entire phase of plant growth and development of bunch. These findings were also supported by Hernandez and Lugolopez (1969), Abdel Kadar *et al.* (1992) [1], Ghanta and Dwivedi (1993) [15], Subramanian and Pillai (1997) [29] and Kumar and Jayakumar (2001) in banana.

Weight of fingers per hand (kg)

The maximum weight of fingers (2.75 kg) was obtained under the treatment T_7 (micro-nutrient mixture +potassium di-hydrogen phosphate 1%) and minimum (2.16 kg) weight of fingers was noticed under the treatment T_0 (control). The plants treated with plant growth regulators and macro and micro-nutrients superiorly increased the size, volume and girth of the fingers. This might also be due to the mobility of water was significantly maximized the rigidity of the cell wall and thereby increasing the weight of fingers ultimately. Similar findings related to weight of fingers was also reported by Abdel Kadar *et al.* (1992) [1] and Kumar and Jayakumar (2001) in banana.

Weight of individual finger (g)

The maximum weight of individual finger (152.06 g) was obtained under the treatment T_7 (micro-nutrient mixture + potassium di hydrogen phosphate 1%), which showed superior over all other treatments. The minimum weight of individual finger (140.29 g) was noticed under the treatment T_0 (control). The reason behind the increment of weight of individual fingers was observed due to the faster loading of the metabolites and also in the involvement of cellular activities like cell division and cell elongation, which eventually bounced back into increased weight of individual fingers. These findings were closely supported by Ghanta and Mitra (1993) [15] in Banana and Banik and Sen (1997) [3], Dutta and Dhua (2002) [7] and Dutta (2004) [9] in mango.

Length of bunch per plant (cm)

The maximum length of bunch (75.92 cm) was recorded under the treatment T_7 (micro-nutrient mixture + potassium di-hydrogen phosphate 1%) and the minimum length of bunch (65.20) was noticed under the treatment T_0 (control). The increase in length of bunch was completely determined by the various activities performed by the plant growth regulators and macro and micro-nutrients. Gibberellic acid was recorded to increase the intercellular gap between the cells and accumulation of water. The result of the increase in cells also recorded with increase in length of different plant parts length of leaves and height of plants. The present investigation was supported by the findings of Kotoky and Bhattacharya (1991) [19], in banana cv. Jahaji, Rajmanickam and Rajmohan (2008) [18] in banana cv. Nendran and Patil *et al.* (2010) [22] in banana cv. Grand Naine.

Weight of bunch per plant (kg)

The maximum weight of bunch (31.07 kg) per plant was noticed under the treatment T_7 (micro-nutrient mixture + potassium di-hydrogen phosphate 1%) and minimum weight of bunch (21.62 kg) per plant was registered under the treatment T_0 (control). Bunch weight increased might be due to rapid multiplication and enlargement of cells. The accumulation of sugars and water resulted in expansion of cells. These results were also confirmed by Singh and Rajput (1977) [27], Subramanian and Pillai (1997) [29] and Das (1995) [6] in banana and Kumar and Jayakumar (2001) and Patel *et al.* (2010) [22] in mango.

Yield (t/ha)

The observation regarding yield (t/ha) of banana cv. Grand Naine appeared to be significant variations among the different treatments under the present experiment. Remarkably the maximum yield (72.11 t/ha) was observed under the treatment T_7 (micro-nutrient mixture + potassium di-hydrogen phosphate 1%) as compared to all other treatments. However, the minimum yield (65.22 t/ha) was noticed under the treatment T_0 (control). From the above data, it can be concluded that the significant increase in the fruit yield was due to the cumulative effect of the increase in the sub factors like increase in number of fingers, number of hands, increase in bunch weight, length and diameter of the fingers etc. The promotion of starch formation after the activation of carbohydrate formation has already graded up the functions of the plants. Foliar spray of micro-nutrient has strengthened up the yield by improving all metabolic processes under the different functions. The physiological process of banana plants have been affected by the different treatments under the present investigation resulted in higher production of the produce. Similar results were also obtained by Singh *et al.* (2003) and Dutta (2004) [9] in Mango and Sarolia *et al.* (2007) [24] in guava supported the present findings.

Table 1: Effect of foliar application of PGRs and macro and micro-nutrients on plant height (m) of banana cv. Grand Naine

Notations used	Treatment details	150 DAP	180 DAP	210 DAP	240 DAP	270 DAP
T_0	Control	0.98^{a}	1.09^{a}	1.17^{a}	1.38^{a}	1.92^{a}
T_1	Micro-nutrient mixture	0.99^{a}	1.10^{ab}	1.19^{ab}	1.49^{b}	1.99^{ab}
T_2	Micro-nutrient mixture + GA_3 (200 ppm)	1.06^{cd}	1.16^{de}	1.21^{abc}	1.63^{efg}	2.19^{ef}
T_3	Micro-nutrient mixture + GA_3 (300 ppm)	1.07^{d}	1.18^{e}	1.27^{d}	1.67^{fg}	2.23^{f}
T_4	Micro-nutrient mixture + benzyl adenine (10 ppm)	1.01^{ab}	1.13^{bcd}	1.24^{cd}	1.51^{bc}	2.03^{bc}
T_5	Micro-nutrient mixture + benzyl adenine (20 ppm)	1.03^{bc}	1.12^{abc}	1.23^{bcd}	1.54^{bcd}	2.09^{cd}
T_6	Micro-nutrient mixture + potassium di-hydrogen phosphate (0.5%)	1.04^{bcd}	1.14^{cde}	1.22^{bc}	1.57^{cde}	2.11^{cde}
T_7	Micro-nutrient Mixture + potassium di-hydrogen phosphate (1%)	1.05^{cd}	1.15^{cde}	1.20^{abc}	1.60^{de}	2.16^{de}

	SE(m) ±	0.01	0.01	0.01	0.02	0.03
	C.D. at 5%	0.03	0.03	0.04	0.06	0.09

1. DAP- Days after planting
2. Micro-nutrient mixture- $ZnSO_4$ (0.5%) + $FeSO_4$ (0.2%) + $CuSO_4$ (0.2%) + B (0.1%)

The superscript letter indicates that the treatment means with the same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

Table 2: Effect of foliar application of PGRs, macro and micro-nutrients on stem girth (cm), number of leaves, days to flowering, days to first fruiting and days to maturity of banana cv. Grand Naine

Notations used	Treatment details	Stem girth (cm)	Number of leaves per plant	Days to flowering	Days to first fruiting	Days to maturity
T_0	Control	54.32^{a}	18.12^{a}	263.33^{e}	283.11^{e}	357.69^{d}
T_1	Micro-nutrient mixture	56.13^{ab}	18.32^{ab}	261.21^{e}	280.34^{de}	346.39^{cd}
T_2	Micro-nutrient mixture + GA_3 (200 ppm)	58.09^{bc}	22.48^{cd}	259.26^{e}	274.43^{cd}	341.78^{bcd}
T_3	Micro-nutrient mixture + GA_3 (300 ppm)	60.23^{cd}	22.84^{cd}	256.48^{de}	273.25^{c}	339.41^{bc}
T_4	Micro-nutrient mixture + benzyl adenine (10 ppm)	61.87^{de}	19.11^{bc}	250.73^{cd}	268.24^{b}	335.54^{abc}
T_5	Micro-nutrient mixture + benzyl adenine (20 ppm)	63.56^{ef}	19.80^{bc}	243.17^{bc}	264.14^{b}	331.28^{abc}
T_6	Micro-nutrient mixture + potassium di-hydrogen phosphate (0.5%)	65.22^{fg}	22.18^{cd}	237.54^{ab}	253.86^{a}	326.22^{ab}
T_7	Micro-nutrient Mixture + potassium di-hydrogen phosphate (1%)	66.76^{g}	21.32^{cd}	230.67^{a}	248.06^{a}	320.19^{a}
	SE(m)±	0.83	0.52	2.71	2.04	5.53
	C.D. at 5%	2.56	1.60	8.30	6.27	16.95

Micro-nutrient mixture- $ZnSO_4$ (0.5%) + $FeSO_4$ (0.2%) + $CuSO_4$ (0.2%) + B (0.1%)

The superscript letter indicates that the treatment means with the same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

Table 3: Effect of foliar application of PGRs and macro and micro-nutrients on yield attributing parameters of banana cv. Grand Naine

Notations used	Treatment details	Number of fingers per hand	Number of hands per bunch	Weight of fingers/ hand (kg)	Weight of individual fingers (g)	Length of bunch /plant (cm)
T_0	Control	11.59^{a}	10.01^{a}	2.16^{a}	140.29^{a}	65.20^{a}
T_1	Micro-nutrient mixture	11.62^{a}	10.28^{ab}	2.17^{a}	141.07^{a}	66.78^{b}
T_2	Micro-nutrient mixture + GA_3 (200 ppm)	11.67^{a}	10.47^{ab}	2.18^{a}	141.33^{a}	69.51^{c}
T_3	Micro-nutrient mixture + GA_3 (300 ppm)	12.15^{ab}	11.01^{abc}	2.29^{b}	144.80^{b}	72.63^{d}
T_4	Micro-nutrient mixture + benzyl adenine (10 ppm)	13.14^{bc}	11.23^{bc}	2.45^{c}	146.89^{c}	71.23^{d}
T_5	Micro-nutrient mixture + benzyl adenine (20 ppm)	14.45^{c}	11.88^{cd}	2.65^{d}	147.07^{c}	72.20^{d}
T_6	Micro-nutrient mixture + potassium di-hydrogen phosphate (0.5%)	14.56^{c}	12.12^{cd}	2.69^{de}	149.13^{d}	74.50^{e}
T_7	Micro-nutrient Mixture + potassium di-hydrogen phosphate (1%)	14.59^{c}	12.39^{d}	2.75^{e}	152.06^{e}	75.92^{e}
	S.E(m) ±	0.47	0.36	0.02	0.39	0.48
	C.D. at 5%	1.46	1.11	0.07	1.20	1.47

Micro-nutrient mixture- $ZnSO_4$ (0.5%) + $FeSO_4$ (0.2%) + $CuSO_4$ (0.2%) + B (0.1%)

The superscript letter indicates that the treatment means with the same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

References

1. Abdel Kadar Ad M, El-Makhtum FMB, Baskawros MB. Effect of micro-nutrients foliar application of micro-nutrients on vegetative growth and yield of Hindi banana. Egyption J Agric. 1992;70(2):613-624.
2. Babu N, Singh AR. Effect of micro-nutrients sprays of zinc on fruit drop and cracking of litchi fruits. Haryana J. Hortic. Sci. 2002;13(1-2):18-21.
3. Banik BC, Sen SK. Effect of three levels of zinc, iron, boron and their interactions on growth, flowering and yield of mango cv. Fazli. Hort. J. 1997;10(1):23-29.
4. Chadha KL. Production technology of banana. Handbook of Horticulture. 1974, 464-470.
5. Das PK, Mohan NK. Effect of micro-nutrients on growth and development of banana fruits. South Indian Hort. 1993;41(4):192-197.
6. Das PK. Effect of micro-nutrients on quality of certain banana cultivars. J Agric. Sci. Soc. North-East India. 1995;8(2):211-215.
7. Dutta P, Dhua RS. Improvement on fruit quality of Himsagar mango through application of zinc, iron and manganese. Hort. J. 2002;15(2):1-9.
8. Das DK. Micro-nutrients and their behaviours in soils and plants, Kalyani pub., Ludhiana. 2003, 1-2.
9. Dutta P. Effect of foliar application of boron on panicle growth, fruit retention and physico-chemical characters

of mango cv. Himsagar. Indian J Hort. 2004;61(3):265-266.
10. Das PK, Mohan NK. Effect of micro-nutrients on growth and development of banana cv. Chenichampa, Jahaji and Barjahaji. South Indian J Hortic. 1993;41(4):192-197.
11. Deolankar KP, Firake NN. Effect of water-soluble fertilizers on growth and yield of banana. J Maharashtra Agric. Univ. 2001;26(3):333-334.
12. Desai BB, Deshpande PB. Influence of growth regulators on relative activities of some hydrolytic and oxidative enzymes during ripening. Indian J Pl. Physiol. 1979;22:186-191.
13. Ghanta PK, Mitra SK. Effect of micro-nutrients on growth, flowering, leaf nutrient content and yield of banana cv. Giant Governor. Crop Res. Hissar. 1993;6(2):284-287.
14. Ghanta PK, Dwivedi AK. Effect of some micro-nutrients on yield and quality of banana cv. Giant Governor. Environ. & Ecol. 1993;11(20):292-294.
15. Ghanta PK, Mitra SK. Effect of some micro-nutrients on growth, flowering, leaf nutrient content and yield of banana cv. Giant Governor. Crop Res. 1993;6(2):284-287.
16. Gomez KA, Gomez AA. Statistical procedures for agricultural research 2nd ed. John Willey and Sons, New York, 1984.
17. Haque R, Roy A, Pramanick M. Response of foliar application of Mg, Zn, Cu and B on improvement of growth, yield and quality of Mandarin orange in Darjeeling Hills of West Bengal. Hort. J. 2000;13(2):15-20.
18. Jeyakumar P, Balamohan TN. Micro-nutrients for horticultural crops. Annual Report, Horticultural Research Institute Coimbatore. 1997, 9-13.
19. Kotoky U, Battacharya RK. Bunch weight and yield of banana as influenced by organic mulches. Indian J Hort. 1991;48(2):121-123.
20. Kumar AR, Kumar N. Effect of foliar spray of Sulphate of potash on yield, quality and post-harvest life of banana. Better Crops. 2004;91(2):22-24.
21. Pathak M, Bauri FK, Mishra DK, Bandhopadhayay B, Chakraborty K. Application of micro-nutrients on growth, yield and quality of banana. J Crop and Weed. 2011;7(1):52-54.
22. Patel AR, Saranaiya SN, Patel AN, Desai KD, Patel NM, Patel JB. Effect of micro-nutrients on yield and fruit quality of banana (*Musa paradisica* L.) cv. Basrai under pair row planting method. Asian J Hort. 2010;5(1):245-248.
23. Paul AA, Nair CSJ. Effect of foliar application of nutrients on quality characters of banana (*Musa* AAB) Nendran. Int. J Appl. Pure Sci. Agric. 2015, 101-104.
24. Sarolia DK, Rathore NS, Rathore RS. Response of zinc sulphate and iron sulphate sprays on growth and productivity of guava cv. Sardar. Curr. Agric. 2007;31(1-2):73-77.
25. Sharma DD. Varietal differences in physico-chemical characteristics of the banana fruits. Indian Agric. 1976;20(2):115.
26. Singh UP, Brahmachari VS. Effect of potassium, zinc, boron and molybdenum on the physico-chemical composition of guava cv. Allahabad Safeda. Orissa J Hort. 1999;27(2):61-62.
27. Singh RR, Rajput CBS. Effect of various concentration of zinc on vegetative growth characters, flowering, fruiting and physico-chemical composition of fruit in mango. Haryana J Hort. Sci. 1997;6:10-14.
28. Singh J. Basic Horticulture. Kalyani publ., Ludhiana. 2002, 6.
29. Subramaninan V, Pillai AA. Studies on the zinc deficiency in banana growing soils of Tamil Nadu. Indian J Agric. Res. 1997;31(3):105-188.
30. Suresh S, Savithri P. Yield and quality of wetland banana as influenced by liming and nutrients application in an acid soil. Haryana J Hortic. Sci. 2001;30(122):12-13.
31. Supriya L, Bhattacharyya RK. Effect of foliar application of chelated and non-chelated zinc on growth and yield of Assam lemon. Hortic. J. 1993;6(1):13-26.
32. Yadav MK, Patel NL, Parmar BR, Kirtibarhan, Singh Parmveer. Effect of micronutrient on growth and crop duration of Banana cv. Grand Nain. Prog. Hort. 2010;42(2):162-164.
33. Yadav MK, Patel NL, Hazarika A, Paramveer S. Fruit quality and shelf life of Banana cv. Grand Naine influenced by chelated and non-chelated micro-nutrients. Andhra Agric. J. 2011;58(3):352-354.
34. Yadav VK, Jain MC, Sharma MK, Gupta NK, Singh J. Effect of micro-nutrients foliar feeding on growth and yield of pomegranate (*Punica granatum* L.). 2014;32(3-4):469-473.
35. Yadav MK, Solanki VK. Use of micro-nutrients in tropical and subtropical fruit crops. Afri. J Agric. Res. 2015;10(5):416-422.
36. Yadlod SS, Kadam BA. Effect of plant growth regulators and micro-nutrients on growth, yield and storage life of banana (*Musa* sp.) cv. Grand Naine. The Orissa J. of Hort. 2003;36(2):114-117.
37. Yadlod SS, Kadam BA. Effect of plant growth regulators and micro-nutrients on physical and chemical characters of banana (*Musa* sp.) cv. Grand Naine. Asian J Hortic. 2008a;3(2):436-438.
38. Yadlod SS, Kadam BA. Effect of plant growth regulators and micro-nutrients on growth, yield and storage life of banana (*Musa* sp.) cv. Shrimanti. Asian J Hortic. 2008b;3(2):409-411.
39. Yadlod SS, Kadam BA. Effect of plant growth regulators and micro-nutrients on growth, yield, and storage life of banana (*Musa* sp.) cv. Ardhapuri. Agric. Sci. Digest. 2008c;28(4):304-306.
40. Yadav RK, Rana GS, Ahlavat VP, Suresh Kumar. Effect of zinc application on growth and fruit drop of sweet orange (*Citrus sinensis*) cv. Jaffa. Haryana J Hortic. Sci. 2007;36(3&4):205-206.
41. Yadav MK, Solanki VK. Use of micro-nutrients in tropical and sub-tropical fruit crops. Afri. J Agric. Res. 2015;10(5):416-422.