

## Assessment of Nutrient Composition in Banana Leaf in Hiriyur Taluk of Chitradurga District, Karnataka

Hanumanta D. L., Ashok L. B.

Received 1 September 2021, Accepted 8 October 2021, Published on 10 November 2021

### ABSTRACT

Banana gardens of Hiriyur taluk, Chitradurga district was investigated to know the composition of nutrients in the leaves. The nutrients were found to be medium in the leaves of all the gardens. Based on critical leaf nutrient standards for banana are unknown. As nutrients are becoming yield limiting factors in banana, corrective measures require development of leaf nutritional standards. The objective of this paper was to know the nutrient concentration in banana leaf. Optimum foliar concentrations for nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) and Sulfur (S) were established as 2.50-3.00, 0.18-0.40, 2.30-4.00, 0.70-1.40 and 0.25-0.40% respectively.

**Keywords** Banana, Critical levels, *Musa accuminata* L.

### INTRODUCTION

Banana (*Musa accuminata* L.) is one of the oldest fruit crop known to mankind, it is the largest plant in the world without a woody stem. India is important producer of banana in the world with 28% share. In India, banana is being cultivated with a climate ranging from humid tropical to dry mild sub-tropics. This is subsidiary food with multiple usage. Banana is cultivated all year round and is well within reach of a common man so is known as “Poor man’s fruit”.

Plant analysis is an indicator of the plant nutritional status, independent of the supplies of nutrients in the soil. Leaf analysis is based on the assumption that the behavior of plants was related to the concentration of essential minerals in the leaf tissue (Smith 1962). The leaf analysis technique is based on the principle site of plant metabolism, change in the nutrient supply is reflected in the composition of the leaf and changes in the nutrition are more pronounced as reported by Satishkumar and Sharma (1973). Leaf analysis are the best suitable alternative methods to diagnose visual deficiency, hidden hunger and incipient micronutrient deficiencies and toxicity.

### MATERIALS AND METHODS

The present investigation was carried by identifying the banana leaf margin affected gardens of Hiriyur taluk, Chitradurga district through survey. In order to characterize leaf samples were collected from 10 villages and in each village 2 sample were collected with a total of 20 samples. The study area covered

---

Hanumanta D. L. \*  
MSc Student, Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAHS, Shivamogga, India

Ashok L. B.  
Professor, Department of Soil Science and Agricultural Chemistry, College of Horticulture, COH, Hiriyur, India  
Email: hanumantlamani86@gmail.com  
lbashok@rediffmail.com  
\*Corresponding author

Babbur farm, Chillhalli, Venakalgudda, KC Roppa, Goguddu, Gudihalli, Biranhalli, Gounahalli, Vadadhalli and Bagganadu villages of Hiriya taluk, Chitradurga. The leaf samples were analyzed. The petiole of 3<sup>rd</sup> fully opened leaf from apex and leaf lamina of 20 cm<sup>2</sup> area in the central part of the leaf on both side of the midrib at bud differentiation or 16<sup>th</sup> leaf stage were collected from the plants in the fields from where soil samples were drawn. Fifteen leaves were collected for each sample. Abnormal, diseased and insect attacked leaves were avoided in the collection. Preparation of leaf samples for analysis the procedure which was followed by Munshi *et al.* (1979) was adopted for the preparation of leaf samples for analysis. The nitrogen content of leaf tissue (cold digested with concentrated sulfuric acid and then digested with hydrogen peroxide) was estimated by the micro-Kjeldahl distillation method (AOAC 1970). The phosphorus content of leaf tissue was determined by Vanado-molybdo phosphoric yellow color method by using a spectrophotometer (Jasco V-530 UV/visible spectrophotometer) at 470 nm wavelength (Jackson 1973). The concentration of potassium in diacid extract was determined by using flame photometer (Systronics flame photometer 128) (Jackson 1967). The calcium in the leaf samples was estimated by versenate titration by taking a suitable aliquot of diacid extract using murexide as an indicator in the presence of 16% sodium hydroxide (Jackson 1973). Combined estimation of calcium and magnesium was carried out in the diacid extract by Versenate titration using ammonium hydroxide and ammonium chloride buffer and Eriochrome black-indicator. Magnesium titre value was obtained by subtracting the calcium titre value from the combined estimation of calcium and magnesium (Jackson 1973). Sulfur in the diacid extract was determined by a turbidimetric method using a spectrophotometer (Jasco V-530 UV/visible spectrophotometer) at a wavelength of 420 nm (Vogel 1978).

## RESULTS AND DISCUSSION

### Leaf composition of banana

#### *Nitrogen*

The nitrogen concentration in leaf tissues of banana

gardens varied from 2.24 to 3.25% with a mean value of 2.77%. It was noticed that nitrogen concentration of leaf was medium in banana gardens. The minimum leaf nitrogen reported in Vadadhalli village and maximum leaf nitrogen reported in the Bagganadu village. Wiebel *et al.* (1994) stated that the mean leaf nitrogen concentration of banana as 2.23 and 2.69% under a standard and progressive system of cultivation. A similar level of nitrogen has also been confirmed by Bhargava and Reddy (1998).

#### *Phosphorus*

The phosphorus concentration in leaf tissues of banana leaf margin affected gardens varied from 0.14 to 0.34% with a mean value of 0.26%. It was noticed that phosphorus concentration of leaf was low to medium in banana gardens, the minimum leaf phosphorus reported in Vadadhalli village and maximum leaf phosphorus reported in the Goguddu village. As per the ratings of leaf phosphorus concentration in banana (Tandon 2001, Sairam 1996) observed the range of 0.20 to 0.95% of leaf phosphorus in banana gardens of Kadapa and Kurnool districts.

#### *Potassium*

The potassium concentration in leaf tissues of banana gardens of Hiriya taluk varied from 2.31 to 3.48% with a mean value of 2.77%. It was noticed that potassium concentration in leaf tissue was medium, minimum leaf potassium reported in Bagganadu village and maximum leaf potassium reported in the Biranhalli village. Concentration leaf potassium as per the ratings suggested by Tandon (2001). Leaf tissue concentration of potassium was medium in banana gardens of Hiriya taluk. Similar work was comparable to the ranges of leaf potassium as observed by Adinarayana *et al.* (1986), Wiebel *et al.* (1994) and Sairam (1996).

#### *Calcium*

The results indicated that the concentration of Ca in leaf tissues of banana gardens of Hiriya taluk varied from 0.7 to 1.08% with a mean value of 0.84%.

**Table 1.** Leaf tissue concentration of macronutrient in banana leaf margin affected gardens.

Villages	Location	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
Babbur farm	1	2.82	0.32	2.66	0.84	0.43	0.32
	2	2.53	0.28	2.68	0.92	0.46	0.35
Chillahalli	3	2.60	0.30	3.25	0.87	0.35	0.31
	4	2.49	0.31	2.67	0.70	0.39	0.33
Venakalgudda	5	2.75	0.24	2.51	0.88	0.41	0.30
	6	2.84	0.21	2.42	0.87	0.42	0.36
KC Roppa	7	2.91	0.30	2.49	0.81	0.46	0.29
	8	2.86	0.32	2.80	0.74	0.44	0.24
Goguddu	9	2.76	0.31	3.15	0.88	0.42	0.35
	10	3.03	0.34	2.70	0.93	0.40	0.32
Gudihalli	11	2.65	0.29	2.36	0.82	0.46	0.38
	12	2.79	0.28	3.20	0.91	0.49	0.36
Biranhalli	13	3.01	0.29	2.46	0.79	0.42	0.38
	14	2.71	0.30	3.48	0.80	0.37	0.41
Gounahalli	15	2.68	0.21	3.38	1.08	0.48	0.34
	16	3.20	0.19	2.82	0.86	0.41	0.33
Vadadhalli	17	2.24	0.14	2.62	0.79	0.44	0.32
	18	2.95	0.26	3.24	0.76	0.43	0.29
Bagganadu	19	3.25	0.25	2.31	0.82	0.46	0.33
	20	2.51	0.18	2.39	0.86	0.58	0.32
Range	Min	2.24	0.14	2.31	0.7	0.35	0.24
	Max	3.25	0.34	3.48	1.08	0.58	0.41
	Mean	2.77	0.26	2.77	0.84	0.43	0.33
	SD	0.24	0.05	0.37	0.08	0.04	0.03

From the results, it was noticed that the leaf tissue concentration of calcium was medium in banana leaf margin affected gardens. The minimum leaf calcium reported in Chillahalli village and maximum leaf calcium reported in the Gounahalli village. It was noticed that the leaf tissue concentration of calcium and magnesium was medium in banana gardens of all the villages of Hiriya taluk. As per the ratings of leaf calcium concentration in banana leaf established by Tandon (2001) these samples were considered to be sufficient to high in calcium. Sairam (1996) reported 0.81% as mean leaf calcium concentration in banana orchards of Kadapa and Kurnool district. Similar findings were also made by Adinarayana *et al.* (1986) in banana gardens of Krishna district.

### **Magnesium**

The results indicated that the concentration of Mg in leaf tissues of banana gardens of Hiriya taluk varied from 0.35 to 0.58% with a mean value of 0.43%. From the results, it was noticed that the leaf tissue concentration of magnesium was medium in banana gardens. In banana leaf margin affected gardens, the

minimum leaf magnesium reported in Chillahalli village and maximum leaf magnesium reported in the Bagganadu village. Similarly, leaf tissue concentration of Mg was medium in banana gardens of all the villages of Hiriya taluk, as per the rating given by Tandon (2001). The sulfur content was medium to high in both banana leaf margin affected and healthy banana gardens.

### **Sulfur**

Results indicated that the concentration of sulfur in leaf tissues in banana gardens of Hiriya taluk varied from 0.24 to 0.41% with a mean value of 0.33%. From the results, it was noticed that the leaf tissue concentration of sulfur concentration was medium to high. In banana leaf margin affected gardens, the minimum leaf sulfur reported in KC Roppa village and maximum leaf sulfur reported in the Biranhalli village. Sulfur reported no significant difference between banana leaf margin affected and healthy banana gardens of Hiriya taluk. According to the leaf sulfur ratings (Tandon 2001) these leaf samples are rated as low to high category in banana gardens.

**Table 2.** Leaf tissue concentration of micronutrient in banana leaf margin affected gardens.

Villages	Location	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)	B (ppm)
Babbur farm	1	90.40	164.0	12.70	14.50	13.80
	2	72.90	155.5	13.50	12.25	13.30
Chillahalli	3	87.47	140.0	15.75	8.30	12.10
	4	84.23	150.3	15.50	16.50	15.80
Venakalgudda	5	98.22	120.5	17.50	13.80	12.50
	6	74.25	161.0	17.20	12.82	13.20
KC Roppa	7	86.34	162.0	17.60	14.25	14.40
	8	88.23	156.0	10.25	16.60	16.90
Goguddu	9	95.55	120.5	8.70	14.75	15.60
	10	89.40	133.5	17.10	15.10	12.60
Gudihalli	11	82.25	142.5	17.50	11.50	16.10
	12	79.65	122.0	9.20	16.50	14.30
Biranhalli	13	105.50	133.3	8.70	11.50	13.20
	14	80.20	122.8	8.50	11.00	15.20
Gounahalli	15	86.23	156.0	13.30	12.28	13.40
	16	73.10	142.5	12.25	13.05	15.60
Vadadhalli	17	78.60	156.8	14.30	14.45	12.50
	18	88.23	135.6	14.60	13.05	13.50
Bagganadu	19	86.30	141.4	13.10	13.32	11.90
	20	78.62	151.5	14.30	12.48	12.30
Range	Min	72.90	120.50	8.50	8.30	11.90
	Max	105.50	164.00	17.60	16.60	16.90
	Mean	85.28	143.38	13.57	13.40	13.91
	SD	8.36	14.59	3.15	2.05	1.49

### Micronutrients concentration in banana leaf

#### Zinc

The leaf zinc concentration banana gardens varied from 8.30 to 16.60 ppm with a mean value of 13.40 ppm. In banana leaf margin affected gardens, the minimum leaf tissue concentration of zinc reported in Chillahalli village and maximum zinc concentration reported in Bagganadu village of Hiriyyur. From the findings in banana leaf margin affected gardens of Hiriyyur taluk, it was found that the concentration of Zn low to medium banana margin affected gardens.

From the results, it was found that the concentration of Zn in the leaf of banana gardens was low to medium. As per the critical limit 15.00 ppm of leaf zinc concentration in banana (Chapman 1975). The similar ranges of leaf zinc content obtained were also reported by Wiebel *et al.* (1994).

#### Copper

The leaf copper concentration in banana leaf varied

from 8.5 to 17.6 ppm with a mean value of 13.57 ppm, the minimum leaf tissue concentration of Cu reported in Biranhalli village and maximum Cu concentration reported in KC Roppa village of Hiriyyur. From the findings in banana leaf margin affected gardens of Hiriyyur taluk, it was found that the concentration of Cu low to medium. From the findings in banana gardens of Hiriyyur taluk, it was found that the concentration of Cu low to medium. According to Chapman (1975) the lower critical limit for copper for banana below which deficiency occurs in 8.00 ppm. From this, a conclusion drawn that none of the leaf samples was deficient in copper. Similar findings also reported by Sairam (1996) and also observed that the leaf copper concentration of banana ranged from 8.00 to 16.38 ppm with a mean value 12.25 ppm and also confirmed the non-existence of copper deficiency in this region.

#### Iron

The concentration of iron in leaf were analyzed and concentration was varied from 72.90 to 105.50 ppm

with a mean value of 85.28 ppm. The minimum leaf tissue concentration of Fe reported in Babbur farm village and maximum Fe concentration recorded in Biranhalli village of Hiriya. From the findings, it was found that in banana gardens Fe concentration was medium to high. From the investigation, it was recorded that leaf tissue concentration of Fe decreases significantly in affected gardens in comparison to healthy banana gardens. From the findings in banana leaf margin affected gardens of Hiriya taluk, it was found that the concentration of Fe medium to high, whereas in case of healthy banana gardens Fe was high. Chapman (1975) advised 50 ppm iron in banana leaf as a critical limit below which deficiency observed. Sairam (1996) reported a range of 88.60 to 584.00 ppm with a mean value of 225.00 ppm of leaf iron concentration and reported the absence of Fe deficiency in banana gardens of Kadapa district.

### **Manganese**

The concentration of manganese in leaf were analyzed, concentration of manganese was varied from 120.50 to 164.00 ppm with a mean value 143.38 ppm. The minimum leaf tissue concentration of Mn reported in Goguddu village and maximum Mn concentration reported in Babbur farm village of Hiriya. From the findings, it was found that in banana leaf margin affected gardens Mn concentration was medium. From the findings in Hiriya taluk gardens, it was found that the concentration of manganese medium in banana gardens. As per critical limit for deficiency of manganese in a banana is 15 ppm (Chapman 1975). According to him, none of the samples was rated as deficient in leaf manganese. The leaf manganese ranges obtained were in similar to those of Adinarayana *et al.* (1986) and Sairam (1996).

### **Boron**

The concentration of boron concentration in leaf were analyzed, concentration of boron was varied from 11.90 to 16.90 ppm with a mean value of 13.91 ppm in the banana gardens. The minimum leaf tissue concentration of boron reported in Bagganadu village and maximum boron concentration reported in Gounahalli

village of Hiriya. From the findings of Hiriya taluk gardens, it was found that the concentration of boron medium in the case of banana gardens. It was found that the concentration of boron was medium in the case of leaf margin affected and healthy banana gardens. The threshold level for deficiency of boron in banana leaf was 14.00 ppm (Langenegger 1985).

### **CONCLUSION**

The research on the nutrient's analysis in banana gardens of Hiriya taluk, Chitradurga district, showed that the nitrogen, potassium, calcium, magnesium, manganese and boron range was medium, phosphorus, zinc and copper concentration was low to medium, sulfur and iron was medium to high.

### **REFERENCES**

- Adinarayana K, Visweswara Rao K, Balakrishna N (1986) Critical limits of some anthropometric measurements and indices for the assessment of nutritional status. *Ind J Nutr Diet* 23(4): 88-99.
- Association of Official Analytical Chemists (1970) Official and Tentative Methods of Analysis: 1919. Association Office Agricultural Chemists.
- Bhargava BS, Reddy BMC (1998) Leaf sampling guide and nitrogen norms for optimum yield in banana. *Ind J Hort* 55: 352-373.
- Jackson ML (1967) Soil Chemical Analysis. Prentice Hall of India Private Limited, New Delhi, pp 498.
- Jackson ML (1973) Soil Chemical Analysis. Oxford IBH Publishing House, Bombay, pp 38.
- Munshi SK, Mann MS, Viji VK, Thatai SK (1979) Physico-chemical characteristics of fruit of healthy and declining sweet orange trees and their relation to various leaf and soil analysis. *Ind J Hort* 36: 406-412.
- Sairam A (1996) Nutrient status of banana (*Musa sapientum* L.) orchards in Kadapa district, Andhra Pradesh. *J Soils Crops* 6: 1-4.
- Satishkumar, Sharma RC (1973) Foliar analysis for determining nutritional requirements of fruit trees. *The Punjab Horticult J* 13: 227-229.
- Smith PF (1962) Mineral analysis of plant tissue. Annual review of plant physiology 13: 81-108.
- Tandon HLS (2001) Methods of Analysis of Soil, Plant and Fertilizers. Fertilizer Development and Consultation Organization, New Delhi, India, pp140+vi.
- Vogel AI (1978) A text book of quantitative inorganic analysis. Richard clay. The Chances Press Limited, Britain.
- Wiebel J, Ludders P, Krauss A (1994) Nutrient status of banana plantations in the Indus plains of Sindh, Pakistan. *J Potassium Res* 10: 134-139.