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EFFECT OF FOLIAR APPLICATION OF PDKV MICRO GRADE II ON YIELD AND QUALITY OF BANANA

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ABSTRACT

Balanced micronutrient nutrition plays a vital role in improving productivity, fruit quality, and nutrient status of banana under intensive cultivation. A field experiment was conducted during 2025–26 at the Experimental Farm, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India, to evaluate the effect of foliar application of PDKV Micro Grade II on yield and quality of banana cv. Grand Naine. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with four concentrations of PDKV Micro Grade II [water spray (control), 0.5%, 1.0%, and 1.5%] and three application timings (3rd, 5th, and 7th month after planting) with three replications. The study evaluated yield per hectare, bunch weight, hands per bunch, fingers per hand, weight of finger, finger length, finger girth, pulp to peel ratio, total leaf nutrient content, TSS and total sugar content of fruit. Significant differences were observed among the treatment combinations for all the studied parameters. Foliar application of 1.0% PDKV Micro Grade II at the fifth month after planting (C3M2) recorded the highest yield (83.39 t ha⁻¹), bunch weight (22.52 kg), Hands per bunch (11.25), fingers per hand (20.51), weight of finger (200.12 g) finger length (24.00 cm), finger girth (15.65 cm), pulp: peel ratio (4.18), total leaf Zn content (32.65 ppm), total Iron content of leaf (116.00 ppm), TSS of fruit (22.48°Brix) total sugar content (18.12%). The results indicate that foliar application of 1.0% PDKV Micro Grade II at the 5th month after planting is an effective nutrient management practice for improving yield, fruit quality, bunch parameters, finger parameters and leaf nutrient status of banana cv. Grand Naine under the agro-climatic conditions of Akola.

Key words: Banana, Grand Naine, Foliar nutrition, PDKV Micro Grade II, Micronutrients, Yield, Fruit quality.

Introduction

Banana (*Musa paradisiaca* L.) is an important fruit crop with high nutritional, economic and commercial value and is widely cultivated in tropical regions. India is one of the leading banana-producing countries, with Maharashtra contributing substantially to national production (Chhuria *et al.*, 2016; Anon., 2025). Being a nutrient-exhaustive crop, banana requires an adequate and balanced supply of nutrients for optimum growth, yield and fruit quality (Thangaselvabai *et al.*, 2009; Hazarika and Ansari, 2010). Continuous cultivation may result in depletion of essential micronutrients, particularly zinc, iron, boron, manganese, copper and molybdenum, which are involved in

photosynthesis, enzyme activity, chlorophyll formation and other physiological processes (Das, 2003; Raja, 2009). Despite its high productivity, banana cultivation is often constrained by micronutrient deficiencies, particularly zinc (Zn) and iron (Fe), which adversely affect plant growth, yield, and fruit quality. Zinc is involved in enzyme activation, protein synthesis, and auxin metabolism, whereas iron plays a crucial role in chlorophyll synthesis and photosynthetic activity. Deficiency of these nutrients reduces nutrient-use efficiency, fruit development, and overall productivity. Foliar application of micronutrients has been recognized as an efficient approach to overcome these deficiencies by ensuring rapid nutrient absorption

and utilization during critical stages of crop growth (Marschner, 2012; Alloway, 2008). Foliar application of micronutrients can provide an effective means of correcting nutrient deficiencies and improving crop performance. In banana, foliar application of Zn, Fe, Cu and B has been reported to improve bunch weight and fruit quality (Kumar and Jeyakumar, 2001). Therefore, the present study was undertaken to evaluate the effect of foliar application of PDKV Micro Grade II on yield and quality of banana and to identify a suitable concentration for improving crop performance.

Materials and Methods

The present investigation entitled “Effect of Foliar Application of PDKV Micro Grade II on Yield and Quality of Banana” was conducted during the crop season 2025–2026 at the Experimental Farm, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. Laboratory analyses of leaf and fruit samples were carried out at the Analytical Laboratory of the Department of Fruit Science and the AICRP on Micronutrients, Department of Soil Science, Dr. PDKV, Akola with the objectives to study the effect of foliar application of PDKV Micro Grade II on yield and quality of banana and to identify the suitable concentration for foliar application of PDKV Micro Grade II for obtaining higher yield and better fruit quality in banana. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with twelve treatment combinations replicated thrice. The level of concentration of PDKV Micro Grade II was C1- water spray, C2- 0.5%, C3- 1.0% and C4- 1.5% and level of time of application were M1- 3rd month after planting, M2- 5th month after planting and M3- 7th month after planting. The field experiment was conducted using the banana cultivar ‘Grand Naine’, planted on 16th June 2025 at a spacing of 1.8 × 1.5 m. All recommended horticultural practices, including intercultural operations, were carried out uniformly and in a timely manner throughout the crop growth period.

PDKV Micro Grade II is a foliar micronutrient formulation developed by Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, which contains 2.5% Fe, 3.0% Zn, 0.5% B, 1.0% Mn, 1.0% Cu, and 0.1% Mo.

During the trial yield parameters viz., bunch weight, hands per bunch, fingers per hand, weight of finger, finger length, finger girth and total yield per hectare were recorded. For getting an idea of nutrient status of banana leaf, leaf samples were collected from the third fully expanded leaf from the apex of representative banana plants. The central portion of the leaf lamina, excluding the midrib, was collected, washed with dilute detergent

followed by deionized water, oven-dried at 65–70°C and powdered for analysis (Bhargava and Chadha, 1993). For estimation of Fe and Zn, 1.0 g of the powdered sample was digested with a nitric acid–perchloric acid mixture (9:4) following the procedure of Jackson (1973). The digest was cooled, filtered and diluted to a known volume with double-distilled water. Fe and Zn concentrations were determined using an Atomic Absorption Spectrophotometer (AAS) against appropriate standards (Isaac & Kerber, 1971). Pulp: peel ratio was counted using pulp and peel weight per finger, TSS was recorded using digital refractometer. The total sugars content of the banana pulp was determined as per “Lane and Eynon method” described by (Ranganna, 1997).

Results and Discussion

Yield per hectare

Fruit yield per hectare was significantly influenced by the concentration, time of application and their interaction of PDKV Micro Grade II (Table 1). Among the concentrations, C4 (1.5%) recorded the highest mean yield of 77.95 t ha⁻¹, which was statistically at par with C3 (1.0%) with 77.17 t ha⁻¹, whereas the lowest yield was recorded with C1 (water spray) at 67.20 t ha⁻¹. With respect to application time, the 5th month after planting (M2) recorded the maximum mean yield of 79.62 t ha⁻¹, compared with 70.65 and 71.72 t ha⁻¹ under M1 and M3, respectively. The interaction between concentration and time of application was significant. The maximum yield of 83.39 t ha⁻¹ was recorded with C3M2 (1.0% PDKV Micro Grade II applied during the 5th month after planting). This was statistically at par with C4M2 (83.13 t ha⁻¹), C2M2 (82.76 t ha⁻¹), C4M3 (82.58 t ha⁻¹) and C3M1 (79.62 t ha⁻¹). The minimum yield of 66.91 t ha⁻¹ was recorded under C1M1 (water spray at 3rd month). The higher yield under micronutrient application, particularly at the 5th month, may be attributed to improved

Table 1: Effect of concentration and time of application of PDKV Micro Grade II on yield per hectare.

Treatment	Yield (t ha ⁻¹)			
	Time of application (Month)			
PDKV Micro Grade II (%)	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	66.91	67.21	67.47	67.20
C2 (0.5%)	67.95	82.76	68.32	73.01
C3 (1.0%)	79.62	83.39	68.51	77.17
C4 (1.5%)	68.14	83.13	82.58	77.95
Mean	70.65	79.62	71.72	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	2.25	1.95	3.89	
CD at 5%	6.63	5.74	11.49	

Table 2: Effect of concentration and time of application of PDKV Micro Grade II on bunch weight.

Treatment PDKV Micro Grade II (%)	Bunch weight (Kg)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	18.07	18.15	18.22	18.15
C2 (0.5%)	18.35	22.35	18.45	19.72
C3 (1.0%)	22.40	22.52	18.50	21.14
C4 (1.5%)	18.40	22.45	22.30	21.05
Mean	19.31	21.37	19.37	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.57	0.50	1.00	
CD at 5%	1.70	1.47	2.94	

micronutrient availability during active vegetative and reproductive growth, supporting photosynthesis, enzymatic activity and translocation of assimilates towards developing bunches. Similar improvement in banana yield following foliar micronutrient application was reported by Rajamanickam, 2021; Bindu 2019; mandal *et al.*, 2002; Jadhav *et al.*, 2019; Srivastava, 1964; Yadav *et al.*, 2010).

Bunch weight

Bunch weight was significantly influenced by the concentration and time of application of PDKV Micro Grade II as well as their interaction (Table 2). Among the concentrations, C3 (1.0%) recorded the highest mean bunch weight of 21.14 kg, at par with C4 (1.5%) with 21.05 kg, and C2 (0.5%) at 19.72 kg, whereas the lowest was recorded with water spray (C1) at 18.15 kg. Among the time of application, M2 (5th month) recorded the highest mean bunch weight of 21.37 kg, at par with M3 (7th month) with 19.37 kg whereas the lowest was recorded at M1 (3rd month) with 19.31 kg. Application during the 5th month after planting (M2) recorded the highest mean bunch weight of 21.37 kg. The interaction

Table 3: Effect of concentration and time of application of PDKV Micro Grade II on hands per bunch.

Treatment PDKV Micro Grade II (%)	Hands per bunch			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	8.00	8.05	8.10	8.05
C2 (0.5%)	8.80	10.25	9.35	9.47
C3 (1.0%)	10.90	11.25	9.55	10.57
C4 (1.5%)	8.85	11.10	10.15	10.03
Mean	9.14	10.16	9.29	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.24	0.21	0.41	
CD at 5%	0.70	0.61	1.22	

Table 4: Effect of concentration and time of application of PDKV Micro Grade II on fingers per hand.

Treatment PDKV Micro Grade II (%)	Fingers per hand			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	15.37	15.48	15.60	15.48
C2 (0.5%)	15.80	19.70	16.20	17.23
C3 (1.0%)	20.00	20.51	16.50	19.00
C4 (1.5%)	16.00	20.20	16.80	17.67
Mean	16.79	18.97	16.28	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.47	0.41	0.82	
CD at 5%	1.40	1.21	2.42	

was significant, with C3M2 (1.0% PDKV Micro Grade II at 5th month) recording the maximum bunch weight of 22.52 kg, which was statistically at par with C4M2 (22.45 kg), C3M1 (22.40 kg), C2M2 (22.35 kg) and C4M3 (22.30 kg). The minimum bunch weight (18.07 kg) was recorded under C1M1. The enhanced bunch weight may be associated with improved photosynthesis and assimilate translocation following micronutrient supplementation during active bunch development. Similar responses in banana have been reported by Rajamanickam (2021), Jadhav *et al.*, (2019) and Krishnamoorthy and Hanif (2017).

Hands per bunch

Hands per bunch was significantly influenced by the concentration and time of application of PDKV Micro Grade II, as well as their interaction (Table 3). Among concentrations, C3 (1.0%) recorded the highest mean of 10.57 hands per bunch, which was at par with C4 (1.5%) at 10.03, while the lowest value was observed in C1 (water spray) at 8.05. Application during the 5th month (M2) resulted in the highest mean of 10.16 hands per bunch. The interaction was significant, with C3M2 (1.0%

Table 5: Effect of concentration and time of application of PDKV Micro Grade II on weight of finger.

Treatment PDKV Micro Grade II (%)	Weight of Finger (g)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	159.63	160.24	160.85	160.24
C2 (0.5%)	161.20	197.00	165.00	174.40
C3 (1.0%)	199.20	200.12	167.00	188.77
C4 (1.5%)	161.80	199.80	191.00	184.20
Mean	170.46	189.29	170.96	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	5.15	4.46	8.91	
CD at 5%	15.19	13.15	26.31	

Table 6: Effect of concentration and time of application of PDKV Micro Grade II on finger length.

Treatment PDKV Micro Grade II (%)	Finger length (cm)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	19.36	19.42	19.48	19.42
C2 (0.5%)	19.50	23.20	19.65	20.78
C3 (1.0%)	23.50	24.00	19.80	22.43
C4 (1.5%)	19.55	23.85	21.40	21.60
Mean	20.48	22.62	20.08	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.511	0.442	0.89	
CD at 5%	1.508	1.306	2.61	

at 5th month) recording the maximum of 11.25 hands per bunch, statistically at par with C4M2 (11.10), C3M1 (10.90) and C2M2 (10.25). The minimum value was recorded under C1M1 (8.00). The improved hand formation may be associated with enhanced nutrient availability, enzyme activity and assimilate production during bunch development. Similar findings were reported by Abdel Kadar *et al.*, (1992), Ghanta and Dwivedi (1993) and Kumar and Jeyakumar (2001).

Fingers per hand

Fingers per hand was significantly affected by concentration, time of application and their interaction (Table 4). (C3 (1.0%) recorded the highest mean of 19.00 fingers per hand, followed by C4 (1.5%) at 17.67, whereas C1 recorded the minimum of 15.48. The 5th month (M2) gave the highest mean of 18.97 fingers per hand. The interaction was significant, with C3M2 recording the maximum value of 20.51 fingers per hand; it was at par with C4M2 (20.20), C3M1 (20.00) and C2M2 (19.70). The lowest value was recorded in C1M1 (15.37). The response may be attributed to improved nutrient

Table 7: Effect of concentration and time of application of PDKV Micro Grade II on finger girth.

Treatment PDKV Micro Grade II (%)	Finger girth (cm)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	12.40	12.45	12.50	12.45
C2 (0.5%)	12.80	14.85	12.95	13.53
C3 (1.0%)	15.10	15.65	13.00	14.58
C4 (1.5%)	12.85	15.55	14.40	14.27
Mean	13.29	14.63	13.21	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.33	0.29	0.57	
CD at 5%	0.98	0.85	1.69	

Table 8: Effect of concentration and time of application of PDKV Micro Grade II on Pulp: Peel ratio.

Treatment PDKV Micro Grade II (%)	Finger girth (cm)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	2.03	2.03	2.05	2.04
C2 (0.5%)	2.40	3.40	2.73	2.84
C3 (1.0%)	3.48	4.18	2.86	3.51
C4 (1.5%)	2.51	3.83	2.97	3.10
Mean	2.61	3.36	2.65	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.08	0.07	0.14	
CD at 5%	0.23	0.20	0.40	

availability during the critical stage of bunch and finger development.

Weight of finger

Weight of finger was significantly influenced by concentration, time of application and their interaction (Table 5). C3 (1.0%) recorded the highest mean finger weight of 188.77 g, at par with C4 (1.5%) at 184.20 g, whereas C1 recorded the lowest value of 160.24 g. Application during the 5th month (M2) produced the highest mean finger weight of 189.29 g. The interaction was significant, with C3M2 recording the maximum finger weight of 200.12 g, statistically at par with C4M2 (199.80 g), C3M1 (199.20 g), C2M2 (197.00 g) and C4M3 (191.00 g). The minimum value was recorded under C1M1 (159.63 g). The increase in finger weight might be related to enhanced carbohydrate accumulation, cell division and elongation resulting from improved micronutrient availability. Similar responses were reported by Ghanta and Mitra (1993), Pathak *et al.*, (2011) and Rajamanickam (2021).

Finger length

Finger length was significantly affected by the

Table 9: Effect of concentration and time of application of PDKV Micro Grade II on Total Zinc content of leaf.

Treatment PDKV Micro Grade II (%)	Total Zinc content of leaf (%)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	18.80	19.10	19.40	19.10
C2 (0.5%)	22.50	27.20	24.10	24.60
C3 (1.0%)	29.50	32.65	26.00	29.38
C4 (1.5%)	25.80	31.50	28.00	28.43
Mean	24.15	27.61	24.38	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.49	0.42	0.85	
CD at 5%	1.44	1.25	2.49	

Table 10: Effect of concentration and time of application of PDKV Micro Grade II on Total Iron content of leaf.

Treatment PDKV Micro Grade II (%)	Total Iron content of leaf (%)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	82.20	82.40	82.30	82.30
C2 (0.5%)	91.00	102.50	95.00	96.17
C3 (1.0%)	107.00	116.00	98.00	107.00
C4 (1.5%)	96.50	112.50	100.00	103.00
Mean	94.18	103.35	93.83	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	1.70	1.47	2.94	
CD at 5%	5.01	4.34	8.67	

concentration and time of application of PDKV Micro Grade II as well as their interaction (Table 6). C3 (1.0%) recorded the highest mean finger length of 22.43 cm, which was statistically at par with C4 (1.5%) at 21.60 cm, while the minimum was observed with water spray (19.42 cm). The 5th month after planting (M2) recorded the maximum mean finger length of 22.62 cm, whereas the lowest was recorded at M3 (7th month) with 20.08 cm. The interaction effect was significant, with C3M2 recording the maximum finger length of 24.00 cm, statistically at par with C4M2 (23.85 cm), C3M1 (23.50 cm), C2M2 (23.20 cm) and C4M3 (21.40 cm). The minimum finger length (19.36 cm) was recorded in C1M1. The improvement might be attributed to the role of Zn and other micronutrients in auxin activity, cell elongation, photosynthesis and assimilate accumulation. Similar findings have been reported by Yadllo and Kadam (2003) and Das and Mohan (1993) in banana.

Finger girth

Finger girth was significantly influenced by concentration, time of application and their interaction (Table 7). C3 (1.0%) recorded the highest mean finger girth of 14.58 cm, which was statistically at par with C4 (1.5%) at 14.27 cm, while C1 recorded the lowest value of 12.45 cm. The 5th month (M2) recorded the highest mean finger girth of 14.63 cm. The interaction showed that C3M2 recorded the maximum finger girth of 15.65 cm, statistically at par with C4M2 (15.55 cm), C3M1 (15.10 cm), C2M2 (14.84 cm) and C4M3 (14.40 cm). The minimum value was observed under C1M1 (12.40 cm). The higher finger girth might be associated with improved photosynthesis, assimilate translocation and cell expansion due to adequate micronutrient supply. Similar observations were reported by Panigrahi *et al.*, (2018), Sarrwy *et al.*, (2012) and Bhalarao *et al.*, (2014).

Pulp: Peel ratio

Pulp: peel ratio was significantly influenced by the

Table 11: Effect of concentration and time of application of PDKV Micro Grade II on Total Soluble Solids.

Treatment PDKV Micro Grade II (%)	TSS (°Brix)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	18.65	18.95	18.57	18.72
C2 (0.5%)	20.43	21.05	19.63	20.37
C3 (1.0%)	20.85	22.48	19.97	21.10
C4 (1.5%)	20.65	21.37	19.87	20.63
Mean	20.15	20.96	19.51	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.03	0.03	0.06	
CD at 5%	0.10	0.08	0.17	

concentration and time of application of PDKV Micro Grade II as well as their interaction (Table 8). C3 (1.0%) recorded the highest mean pulp:peel ratio of 3.51, followed by C4 (1.5%) at 3.10, whereas the lowest value was recorded in C1 (water spray) at 2.04. Application during the 5th month (M2) resulted in the highest mean ratio of 3.36 and lowest mean ratio of 2.61 found during 3rd month after planting. The interaction was significant, with C3M2 recording the maximum pulp: peel ratio of 4.18, statistically at par with C4M2 (3.83). The minimum value was observed under C1M1 (2.03). The higher ratio might be associated with enhanced carbohydrate synthesis and translocation towards the developing pulp. Similar observations in banana were reported by Ghanta Dwivedi, 1993; Ningavva *et al.*, 2014; Panigrahi *et al.*, 2018; Premalatha and Suresh, 2019).

Total Zinc Content of leaf

Leaf zinc content was significantly influenced by the concentration and time of application of PDKV Micro Grade II as well as their interaction (Table 9). C3 (1.0%) recorded the highest mean leaf Zn content of 29.38 ppm, followed by C4 (1.5%) at 28.43 ppm, while the minimum was recorded with C1 (water spray) at 19.10 ppm. Application at the 5th month (M2) recorded the highest mean Zn content of 27.61 ppm, followed by M3 (7th month after planting) of 24.38 ppm and minimum Zn content of 24.15 ppm observed in M1 at 3rd month after planting. The interaction was significant, with C3M2 recording the maximum leaf Zn content of 32.65 ppm, which was statistically at par with C4M2 (31.50 ppm). The minimum value (18.80 ppm) was recorded under C1M1. The increased Zn accumulation might be attributed to greater foliar Zn availability and uptake during active crop growth. Similar improvement in leaf micronutrient status of banana following foliar micronutrient application was reported by (Ghanta and Mitra, 1993; Kumar and Jeyakumar, 2001;

Table 12: Effect of concentration and time of application of PDKV Micro Grade II on Total Sugars.

Treatment PDKV Micro Grade II (%)	Total sugars (%)			
	Time of application (Month)			
	M1 (3 rd)	M2 (5 th)	M3 (7 th)	Mean
C1 (Water spray)	13.85	14.07	13.08	13.67
C2 (0.5%)	15.67	16.27	14.86	15.60
C3 (1.0%)	16.03	18.12	15.13	16.43
C4 (1.5%)	15.72	16.32	15.01	15.68
Mean	15.32	16.20	14.52	
Interaction effect (C × M)				
	C	M	C × M	
F-test	Sig	Sig	Sig	
SE(m)±	0.02	0.02	0.03	
CD at 5%	0.06	0.05	0.10	

Jayabaskaran and Pandey, 2008).

Total Iron content of leaf

Total iron content of leaf was significantly influenced by concentration, time of application and their interaction (Table 10). C3 (1.0%) recorded the highest mean Fe content of 107.00 ppm, followed by C4 (1.5%) at 103.00 ppm, while the lowest value was recorded in C1 at 82.30 ppm. Application during the 5th month (M2) resulted in the highest mean Fe content of 103.35 ppm. The interaction was significant, with C3M2 recording the maximum Fe content of 116.00 ppm, statistically at par with C4M2 (112.50 ppm), whereas the minimum was recorded under C1M1 (82.20 ppm). The increased Fe accumulation may be attributed to greater foliar Fe availability and absorption during active crop growth. Similar observations have been reported by Jeyabaskaran and Pandey (2008), Krishnamoorthy and Hanif (2017) and Rajamanickam (2021).

Total Soluble Solids

Total soluble solids (TSS) were significantly affected by concentration, time of application and their interaction (Table 11). C4 (1.5%) recorded the highest mean TSS of 21.10 °Brix, followed by C3 (1.0%) at 20.63 °Brix, while C1 recorded the lowest value of 18.72 °Brix. Application during the 5th month (M2) resulted in the highest mean TSS of 20.96 °Brix. The interaction was significant, with C3M2 (1.0% at 5th month) recording the maximum TSS of 22.48 °Brix, followed by C2M2 at 21.05 °Brix, whereas the minimum value was observed under C1M1 at 18.57 °Brix. The increase in TSS may be associated with improved carbohydrate synthesis, assimilate accumulation and conversion of starch and other insoluble compounds into soluble sugars during fruit development. Similar findings were reported by Ghanta and Mitra (1993), Kumar and Jeyakumar (2001), Pathak *et al.*, (2011) and Panigrahi *et al.*, (2018).

Total sugars

Total sugars was significantly influenced by the concentration and time of application of PDKV Micro Grade II as well as their interaction (Table 12). C3 (1.0% PDKV Micro Grade II) recorded the highest mean total sugars of 16.43%, followed by C4 (1.5%) at 15.68%, whereas the minimum was recorded with C1 (water spray) at 13.67%. Application at the 5th month after planting (M2) recorded the highest mean total sugars of 16.20%, followed by M1 (3rd month after planting) at 15.32%, whereas minimum total sugar content found at M3 (7th month after planting) with 14.52%. The interaction effect was significant, with C3M2 recording the maximum total sugars of 18.12%, followed by C4M2 (16.32%), while the minimum value of 13.08% was recorded under C1M3. The enhanced total sugars content in fruit might be related to increased carbohydrate metabolism and accumulation of soluble sugars in the developing fruit. Similar findings have been reported by Pathak *et al.*, (2011) in banana.

Conclusion

The present investigation demonstrated that foliar application of PDKV Micro Grade II significantly influenced yield and quality attributes of banana. Among the concentrations evaluated, 1.0% PDKV Micro Grade II (C3) was found to be the most effective treatment, particularly when applied during the 5th month after planting (M2). The C3M2 treatment recorded superior values for yield (83.39 t ha⁻¹), bunch weight (22.52 kg), Hands per bunch (11.25), fingers per hand (20.51), weight of finger (200.12 g) finger length (24.00 cm), finger girth (15.65 cm), pulp: peel ratio (4.18), total leaf Zn content (32.65 ppm), total Iron content of leaf (116.00 ppm), TSS of fruit (22.48 °Brix) total sugar content (18.12%) indicating improved crop performance under this treatment combination. Overall, the findings suggest that judicious foliar supplementation with PDKV Micro Grade II can serve as an effective nutrient management strategy for enhancing fruit development, nutritional quality and overall productivity of banana, with potential for wider adoption under comparable agro-climatic conditions.

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