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Effect of foliar application of silicon on leaf nutrient content and flowering of banana (*Musa paradisiaca* L.) cv. Grand Nain

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Abstract

The present experiment was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during 2017-18 and 2018-19. An experiment was laid out in a randomized block design, comprising of three levels of potassium silicate and silicic acid (1, 2 and 3 ml/l/plant) along with control. The treatments were replicated thrice. The effects of foliar applications at 2nd, 3rd and 4th months after planting of different levels of potassium silicate and silicic acid on leaf nutrient content and flowering of banana cv. Grand Nain were recorded. The results indicated that foliar application of potassium silicate @ 3ml/l/plant at 2nd, 3rd and 4th MAP recorded significantly the maximum leaf nutrient content viz., N, P, K and chlorophyll content. The same treatment significantly reduced the number of days to harvest after flower initiation and crop duration whereas number of days to flowering was found non-significant.

Keywords: Potassium silicate, silicic acid, leaf nutrient status and flowering

Introduction

Banana is a heavy feeder of nutrients and thus need balanced nutrition for optimum growth and fruit production and in turn potential yields. A deficiency or excess of nutrients can cause substantial damage to the plant. Studies have clearly demonstrated that for high productivity of banana, application of recommended dose of essential nutrients at appropriate growth stage is necessary (Thangaselvabai *et al.*, 2009)^[9]. Further the crop well responds to micronutrient and some of the beneficial element like silicon. Silicon is not considered as an essential element, but it has positive growth effect including increased dry mass and yield, enhanced pollination and most commonly increased disease resistance (Gillman *et al.*, 2003)^[3]. The role of silicon in plant biology is known to tolerate multiple stresses including biotic and abiotic stresses. It is also known to increase drought tolerance in plants by maintaining plant water balance, photosynthetic activity and erectness of leaves and structure of xylem vessels regulating transpiration rates (Melo *et al.*, 2003)^[5].

Material and Methods

The present experiment was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during 2017-18 and 2018-19. An experiment was laid out in a randomized block design, comprising of three levels of potassium silicate and silicic acid (1, 2 and 3 ml/l/plant) along with control. The treatments were replicated thrice. The effects of foliar applications at 2nd, 3rd and 4th months after planting of different levels of potassium silicate and silicic acid on leaf nutrient content and flowering of banana cv. Grand Nain were recorded.

Results and Discussion**Effect of silicon on nutrient content in the leaf (%) at flowering stage**

The foliar application of potassium silicate @ 3ml/l/plant at 2nd, 3rd and 4th MAP (T₄) had significantly gave the maximum nitrogen content in leaves of banana cv. 'Grand Nain' at flowering stage (Table 1). It might be due to silicon application avoided leaching of nitrogen from the soil and helped in more uptake (Epstein, 1999 and Matichenkov *et al.*, 2000)^[1, 4].

The uptake of phosphorus was significantly influenced by foliar application of silicon (Table 1). The foliar application of potassium silicate @ 3ml/l/plant at 2nd, 3rd and 4th MAP (T₄) gave significantly maximum phosphorus content in leaf at flowering stage in banana cv. Grand Nain'. This could be attributed to silicon in solution rendered more P available to plants reversing its fixation as silicon itself competed for P fixation and thus, slowly released P and helped in more uptake (Epstein, 1999 and Stamatakis *et al.*, 2003) [1, 7].

The foliar application of silicon on potassium uptake was significantly affected by silicon. Significantly maximum potassium content in leaf at flowering stage was noted in T₄ treatment (Table 1). This might be attributed to the reason that silicon helped in more uptake of potassium due to its synergistic effect. The K content in the treatment with potassium silicate recorded more per cent of potassium compared to silicic acid as it contains potassium along with silicon. Nesreen *et al.* (2011) [6] recorded that, the application of potassium silicate increased per cent K in leaf.

Application of different levels silicon applied in the current investigation had a significant impact on leaf chlorophyll content in banana leaves of cv. 'Grand Nain'(Table 1). Significantly maximum chlorophyll content in leaf at flowering stage was recorded in foliar spray of potassium silicate @ 3ml/l/plant at 2nd, 3rd and 4th MAP (T₄). The increased in the leaf chlorophyll content was due to the plants supplied with silicon resisted lodging (drooping, leaning, or becoming prostrate). It could increase mechanical strength of plants, which enabled them to achieve and maintain an upright growth habit and allowed maximum light interception and increased photosynthetic activity (Yasuto and Eiichi, 1983) [10].

Higher value of nutrients in leaf tissue of banana was noted

due to role of silicon in plant. Silicon improve nutrients uptake from soil and ameliorating the adverse effects of heavy metal toxicity (Melo *et al.*, 2003 and Tahr *et al.*, 2006) [5, 8]. Epstein and Bloom (2003) [2] also found that silicon stimulating antioxidant system in plants as well as immobilization of toxic metals and uptake of essential nutrients effectively.

Effect of silicon on flowering and crop duration

In banana, crop duration can be divided into two phases *viz.*, days required for flower initiation (vegetative phase) and shooting to harvest (bunch development phase). It is desirable to reduce the total crop duration in banana without compromising on productivity.

In the present study, number of days to harvest after flower initiation and crop duration was significantly reduced by different levels of silicon treatments (Table 1). However, there was no any significant difference on number of days to flowering due to foliar spray of silicon. The treatment comprising potassium silicate @ 3ml/l/plant sprayed at 2nd, 3rd and 4th MAP (T₄) recorded the minimum crop duration. The reduction in crop duration might be due to stimulation of growth by the silicon application. It's also helps in maintenance of upright growth habit and allowed maximum light interception, came from the structural components of the plants cell walls and increased photosynthetic activity as well as leaf chlorophyll content (Yasuto and Eiichi, 1983). Owing to larger leaf area per plant and better disposition of photosynthetic activity, the required net assimilation presumably was reached early in plants receiving silicon hastening the process of initiation and emergence of inflorescence, reducing the time taken for harvesting and the total crop duration.

Table 1: Effect of foliar application of silicon on leaf nutrient content and flowering in banana cv. Grand Nain (mean of two years)

Treatments		N (%)	P (%)	K (%)	Chlorophyll (mg/g)	Number of days to flowering	Number of days to harvest	Crop duration
T ₁	Control	2.67	0.22	2.40	1.16	264.08	112.92	377.00
T ₂	Potassium silicate @ 1ml/l/plant	2.86	0.23	2.64	1.71	260.08	110.08	370.17
T ₃	Potassium silicate @ 2ml/l/plant	3.07	0.27	2.68	2.14	255.50	105.75	361.25
T ₄	Potassium silicate @ 3ml/l/plant	3.20	0.33	2.75	2.36	242.42	94.17	336.58
T ₅	Silicic acid @ 1ml/l/plant	3.00	0.26	2.50	2.00	257.75	107.33	365.08
T ₆	Silicic acid @ 2ml/l/plant	3.10	0.28	2.54	2.23	252.13	101.58	353.71
T ₇	Silicic acid @ 3ml/l/plant	3.15	0.29	2.58	2.27	249.00	99.75	348.75
S Em ±		0.05	0.01	0.04	0.06	8.49	3.13	8.39
CD 0.05%		0.15	0.03	0.13	0.17	NS	9.03	24.23
Interaction (Year × Treatments)								
S Em ±	0.08	0.01	0.07	0.09	13.40	4.93	13.24	
CD 0.05%	NS	NS	NS	NS	NS	NS	NS	NS
CV %	4.65	9.63	4.63	7.92	9.12	8.18	6.39	

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