



## Investigate growth behavior and chemical constituents of cordyline plants under kinetin spraying

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### Abstract

At greenhouse of National Research Centre, Dokki, Giza, Egypt. A pot experiment was carried out to evaluate the effect of Kinetin spraying on growth and chemical constituents of cordyline plants. The present study shows a considerable difference in the growth parameters when treated with kinetin concentrations of 0, 100, 150 and 200 ppm compared with the control plants. It was found that, increasing levels of kinetin from zero to 200 ppm increased plant height, root length, stem diameter as well as leaves number, anthocyanin pigments and K%. On the other hand, application 200 ppm recorded decreased in nitrogen and phosphor percentage compared with the control. While application of 100 ppm kinetin significantly increased chlorophyll and protein content compared with the control plants.

**Keywords:** Cordyline plants; Growth hormone; Kinetin; Ornamental plants

### 1. Introduction

*Cordyline australis* plants family (Liliaceae), that are used for beautiful shape, its height up to 3 m. and has rich colored foliage, including variegated forms, [1]. It grows under a mild climatic for shade garden and green house. *Cordyline sp* plants used for table decoration when they are young, and plants grown excellent in shade gardens and green house also as land scaping. The leaves are used for dysentery, diarrhea and young leaves eaten rous and some species of *Cordyline sp* intended for food before the sap rise in the spring. The roots contain large quantity of saccharin matter and large roots cooked and eaten to improved plant quality and quantity a great attention has been focused upon the application of endogenous plant hormone such as cytokinin. Kinetin is one of cytokinin group and acts as stimulate for cell division, retard senescence, and contract the role of some auxins which responsible for apical dominance,[2],[3],[4],[5]. The aim of this study to investigate the effect of kinetin on growth and chemical constituent of cordyline plants.

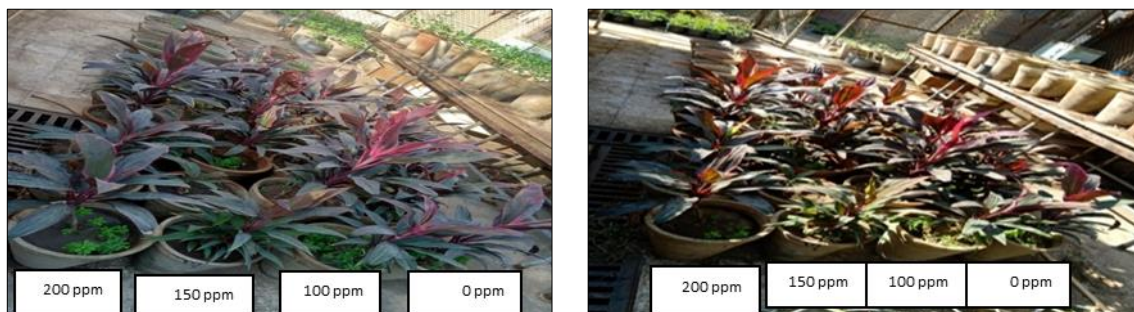
### 2. Material and methods

A pot experiment was carried out at the green house of N.R.C. Dokki, Cairo, Egypt. Shoots were transplanted in pots filled with a mixture of loamy sandy soil by volume 1:1 and fertilized as recommended dose of Ministry of Agriculture in the first week of July 2020 and 2021 of two successive seasons. After 2 months of transplanting treatments with kinetin 0, 100, 150 and 200 ppm were carried out were the kinetin were dissolved in tap water to given the required concentration two sprays were give, the first was after 2 months and the second was 15 day later and the control plants were sprayed with tap water. Every treatments as well as control were harvested after 9 months after spraying. Every treatment as well as control were separated, plant height, leaves number, roots length, stem diameter, successors

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number, leaf area index, fresh and dry weight of shoots. The plants were dried at 70°C. The dry weight of the materials were weighted and ground to determine anthocyanin content %, total chlorophyll content carbohydrates content, proteins %, carotenoids content, N content %, P content %, Na content %, K content %. Determination of pigments content (mg/g F.W.) of chlorophyll A, B and carotenoids was carried out according to the method described by [6], [7], and anthocyanin analysis according to [8], and determination of dry matter content (mg/g D.W.) of carbohydrate was carried out according to the method described by [9], as well as, soil analysis according to [10], and elements analysis of N, P, K, Na and protein content % (mg/g D.W.) according [11], and morphological data were subjected to a statistical analysis according to [12] and the means were compared. The design of the experiments was a Complete Randomized Design.



**Figure 1** Plants experiments

**Table 1** Analysis of soil (Average of two seasons)

Appreciation	Sample
Ph (1:2.5)	7.64
EC (dSm <sup>-1</sup> ) (1:5)	0.93
<b>Soluble cations (milliliter equivalent to liter) mEq/L</b>	
Ca <sup>++</sup>	3.5
Mg <sup>++</sup>	1.5
Na <sup>+</sup>	3.6
K <sup>+</sup>	0.87
<b>Dissolved anions (mEq/L)</b>	
CO <sub>3</sub> <sup>=</sup>	-
HCO <sub>3</sub> <sup>-</sup>	0.9
Cl <sup>-</sup>	4.8
SO <sub>4</sub> <sup>=</sup>	3.77

### 3. Results

#### 3.1 Growth parameters

The present study shows a considerable difference in the growth parameters when treated with kinetin concentrations of 0, 100, 150 and 200 ppm compared with the control plants. Plant height showed a positive correlation with increasing the concentration of kinetin from zero up to 200 ppm. The increments reached 34.62 over the control plant at the higher concentration of 200 ppm. As for root length, stem diameter as well as leaves number, the highest increments reach were 19.44 %, 5 % and 78.62 %, respectively for root length, stem diameter and leaves number compared with the control. In the same table the significant in successors (the daughter of the plant) number, fresh and dry weight responded to 100 ppm of kinetin compared with control and other treatments, the increments reached 255.08 %,

255.08 % and 15.63 %, respectively for shoot fresh weight, shoot dry weight and successors number, respectively, over the control. As for leaves area, the data revealed that the different levels of kinetin induced a mark increase in leaves area compared to control plants. The high response to kinetin by 150 ppm followed by the 100 ppm will insignificant. Increasing concentration up to 200 ppm trusting decrease was record reached 17.45 % less than the control.

### 3.2 Chemical constituents

#### 3.2.1 Change in pigments content

In this work exogenous application of 100 ppm kinetin significantly increased chlorophyll content compared with the control plants, the response was pronounced in plants sprayed with 100 ppm kinetin.

#### 3.2.2 Carotenoids %

The observed increase of carotenoid pigment was recorded in table (2). The response of carotenoids appeared did not depend on the concentration of applied kinetin.

#### 3.2.3 Anthocyanin %

Drusting significant decrease in anthocyanin content % were recorded by application of kinetin to the plants, the highest decrements 0.63 and 0.68 were recorded by kinetin at concentration of 150 and 200 ppm.

#### 3.2.4 Carbohydrate %

In significant differences were recorded among kinetin treatments and control.

#### 3.2.5 Protein %

The increase of protein content % over the control depended on the concentration of kinetin this highest content of protein reached 16.8 % for 100 ppm kinetin. Then a drusting decrease was recorded by increasing kinetin concentration.

#### 3.2.6 N, P and K %

The present study in table (3) shared that sprayed kinetin at the concentration of 100 and 150 ppm compared to control plants recorded significant increase in N % content, while increasing the concentration up to 200 ppm drusting decrease was recorded reached 7.43 less than the control. The same table also revealed that kinetin streamed drusting decrease in P % content by kinetin treatments compared with the control plants. As for K % content the data in the same table revealed the kinetin treatment showed significant increment compared to the control plant, the difference between treatments were insignificant in most cases.

**Table 2** Effect of kinetin on growth parameters of cordyline plants. (Average of two seasons)

Measurements Treatments	Plant height (cm)	Root length (mm)	Stem diameter (mm)	Leaves number	Successors number	Leaf area index (cm <sup>2</sup> )	Fresh weight of shoots (g)	Dry weight of shoots (g)
0 ppm	52	36	1.4	12.33	1	162.33	36.33	18.67
100 ppm	61.33	31.67	1.03	26.33	2.33	227.17	129	34
150 ppm	67	43	1.47	22	1.33	229.37	89.33	21.67
200 ppm	70	34.83	1.43	20.33	1	134	124.33	24.33
L.S.D. 0.05	8.84	10.40	0.49	5.91	0.67	24.1	56.95	13.84

**Table 3** Effect of kinetin on some chemical constituents of cordyline plants. (Average of two seasons)

Measurements Treatments	Total chlorophyll (mg/g.f.)	Carotenoids (mg/g.f.w)	Carbohydrate (mg/g.f.w.)	Anthocyanin (mg/g.f.w.)	Protein %
0 ppm	1.60	2.07	4.58	2.29	9.28
100 ppm	2.65	3.45	3.33	1.09	16.8
150 ppm	2.34	3.01	4.03	0.63	10.5
200 ppm	2.53	3.44	4.65	0.68	8.58
L.S.D. 0.05	1.72	1.61	1.72	1.73	0.12

**Table 4** Effect of kinetin on elements % in leaves of cordyline plants (Average of two seasons)

Measurement Treatments	Na %	P %	K %	N %
0 ppm	0.77	0.31	2.56	1.48
100 ppm	1.12	0.25	2.88	2.69
150 ppm	0.84	0.29	2.8	1.68
200 ppm	0.91	0.28	2.96	1.37
L.S.D. 0.05	3.48	0.01	0.02	0.01

#### 4. Discussion

In our present study we proved the kinetin has stimulatory effect in plant height, leaves number, stem diameter, leaves area as well as root length. Cytokinins included compounds such as kinetin and benzyl adenine and have pronounced effect for plant growth, [13] reported that kinetin not only promoted growth parameters but also it enhanced uptake of some elements like potassium element and inhibited sodium element. In this respect [14] mentioned that cytokinin and auxin consider the two major plant growth hormones that control in all aspects of growth parameters. Also, the previous mentioned results hold true with [15] and [16] reported the effective role and effects of different plant growth regulators have been widely responses in different plant species. Also, [17] mentioned that cytokinin include all component like kinetin have biological and physiological effects with auxins and gibberellins. The functions of cytokinin are their role in the regulation in cell division and differentiation of plant tissues. [18], reported that a small amounts of plant growth, plant physiological process and plant development such as elongation and flower development.

Our present study show increased in protein, carotenoids, chlorophyll, and sodium percentage and recorded decreased in almost cases of phosphors content %, N percentage (%), carbohydrates and anthocyanin percent. In this respect, cytokines are considered growth control hormones, which enhancing protein synthesis, cell number and nutrient mobilizations,[19].

The increment in fresh and dry weight could be explained through the role of cytokinin in stimulating xylem differentiation and vascular bundle development, which lead to more absorption of water and nutrients, which was reflected in more growth. These results are in harmony with those obtained by [20] on croton plant.

The increase in most growth parameters was showed in our results and that may be due to accumulations of greater photosynthesis which leading to better growth characteristics and the role of kinetin in stimulation of cell division, elongation and number which lead to increase in root length. Our results are in similar with of those [21],[22].

#### 5. Conclusion

The results were nearly ascending order with increasing of kinetin level. Increasing kinetin to 200 ppm increased significantly the values of vegetative growth and almost all cases of chemicals constituents.

## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that they have no competing interests.

### *Statement of ethical approval*

The manuscript does not contain studies involving human participants, human or animal data, and animal or human tissue.

### *Availability of data and material*

The authors were collected data of this manuscript together.

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### *Authors' contributions*

The authors have participated and work on completing this manuscript and approved the final manuscript.

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