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RESPONSE OF KAPOK TREE SEEDLINGS TO SOME BIOSTIMULANT SUBSTANCES

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ABSTRACT

This experiment was executed during 2011 and 2012 seasons to figure out the response of Kapok (*Ceiba pentandra*, L.) tree seedling in term of vegetative growth and photosynthetic pigments to some biostimulant substances namely salicylic acid, ascorbic acid, citric acid, vitamin E and three mixture of amino acids (tryptophan, methionine and cysteine) each at 100 and 200 ppm, as well as, active yeast at 2.5 and 5 g/l. From the obtained results, it could be concluded that application of all biostimulant substances significantly promoted the vegetative and root growth traits of Kapok tree seedlings i.e. seedling height, stem diameter, number of leaves / seedling, fresh and dry weights of leaves / seedling, fresh and dry weights of stem without leaves / seedling, main root length, main root diameter, as well as, fresh and dry weights of roots / seedling in comparison to control treatment. Also, all biostimulant treatments augmented the three photosynthetic pigments content in the fresh leaves of the seedlings compared to control treatment. In this regard, the high concentration of each substance was effective than the low one on all growth parameters and the content of pigments. Active dry yeast at the highest concentration (5g / l.) was the most effective treatment which gave the highest values concerning the vegetative growth traits and the photosynthetic pigments of Kapok tree seedlings.

INTRODUCTION

One of the promising woody trees is *Ceiba pentandra*, commonly known as Kapok tree or silk cotton tree which belongs to Fam. Malvaceae. It is an emergent, fast growing tree

species. It can grow to 30 m tall or more, with a straight, largely branchless trunk that culminates in huge spreading and has been found to possess many medicinal and nutritional properties. (Burkill, 2000). Wood of

Ceiba pentandra is fast growing, easy to debarking and chipping. Pentosan content of wood is of higher values as it is favorable for dense and good pulping. In many places the straight trunks of Kapok tree are used to make dugout canoes. (Ueda et al., 2002 and Walia, 2009).

Nowadays, different biostimulant substances are used to promote better growth and survival of the seedlings of different tree species due to improving vigor and rapid growth of the seedlings which is the special concern among nursery management practices. Also, producing seedlings with better quality is one of the most important factors in the successful establishing of plantations.

Many authors recorded the improving and enhancing influences of different biostimulant substances i. e. antioxidants (citric acid, ascorbic acid, amino acids and vitamin E), salicylic acid and active dry yeast on the vegetative growth and the photosynthetic pigments of some plant species including trees and shrubs seedlings such as Rai (1997) on *Bauhinia purpurea*, Abd El- Aziz et al. (2006) and Ibrahim (2013) on *Khaya senegalensis*, Abou- Dahab and Abd EL- Aziz (2006) on *Philodendron erubescense*, Farahat et al. (2007) on *Cupressus semperviveus.*, Abdel- Wahid (2007) on *Brassaia arboricula*, Moustafa (2008) on *Chorisia speciosa*, El- Quesni et al. (2009) on *Hibiscuse*

rosa sinensis, Abd EL- Eziz et al (2010) on *Thuja orientalis*, Hafez et al (2013) on olive seedlings, Hassan (2013) on *Hibiscus sabdriffa*, as well as, Mustafa and Ebeid (2013) on *Albizzia lebbek* and *Taxodium distichum*.

So, the objective of this research was to study the response of Kapok, *Ceiba pentandra* tree seedlings to some biostimulant substances namely, salicylic acid, ascorbic acid, citric acid, α – tocopherol (vitamin E) and the mixture of three amino acids and active dry yeast to find out the most suitable treatment (S) for enhancing vegetative growth of the seedlings under Aswan Governorate environmental conditions.

MATERIAL AND METHODS

The present investigation was carried out during the two successive seasons of 2011 and 2012 in the Tropical Farm at Kom Ombo under directorate of Botanical Garden, Aswan which belongs to Hort. Res. Institute. Agric. Res. Centre, Giza. This experiment was concerned with the influence of five biostimulant substances, each applied at 100 or 200 ppm, namely, salicylic acid, ascorbic acid, citric acid, vitamin E (α – tocopherol) and a mixture of the three amino acids (tryptophan, methionine and cysteine), in addition to active dry yeast at 2.5 and 5.0 g/l on vegetative growth and photosynthetic

pigments of *Ceiba pentandra* tree seedlings. The seeds were sown on the first week of April for both seasons they were planted in 25x 20 cm polyethylene bags filled with 5kg of

sand and clay soil (3:1v/v). Soil analyses are shown in Table (A). The emerged seedlings were thinned to only one seedling / bag after one month from planting date.

Table (A): Some physical and chemical analysis of the experiment soil in the two seasons (2011 and 2012).

Character	Value	Character	Value
Sand%	74.0	pH (1: 2.5)	8.08
Silt %	13.0	E.C(mmhos/cm)	1.08
Clay %	13.0	Total N %	0.06
O.M %	0.95	Av.P ppm	6.05
CaCO3 %	5.50	Av.K ppm	255

The complete randomized block design was followed with three replicates and five seedlings per replicate. Seedlings were foliar sprayed with the six prementioned substances, each at low and high concentration till run off, three times after 75, 90 and 105 days from sowing date, while control seedlings were sprayed with tap water at the same schedule. All seedlings, including control ones, received mineral NPK fertilization at the rate of 9 g/bag ammonium sulphate (20.6 % N), 4.5 g/bag calcium superphosphate (15.5 % P2O5) and 3.0 g/bag potassium sulphate (48 % K2O) / bag. These amounts were divided into 3 batches and added starting from May 15th with one month interval thereafter. On the first week of October for both seasons, the following data were recorded: seedling height (cm), stem diameter

(cm), number of leaves seedling. fresh and dry weights of leaves / seedling (g), fresh and dry weights of stem without leaves / seedling (g), main root length(cm), main root diameter (cm), fresh and dry weights of root system/ seedling (g). Photosynthetic pigments including chlorophyll a, b and carotenoids were determined in the fresh leaves as mg /gm f.w. by methanol alcohol method according to Moran (1982).

All the obtained data were tabulated and statistically analyzed according to the method described by Mead *et al.*, (1993) and L.S.D. test at 5 % was used to make all comparisons between the means of treatments.

RESULTS AND DISCUSSION

1-Vegetative growth traits

Data presented in Tables (1and 2) showed the influence of different

biostimulant substances i.e. salicylic acid, ascorbic acid, citric acid vitamin E and a mixture of amino acids (tryptophan, methionine and cysteine) each at 100 and 200 ppm, as well as , active dry yeast at 2.5 and 5 g/l. on the vegetative growth traits of Kapok tree seedlings. In this concern , obtained data revealed that there were significant effects of all tested biostimulant substances on the seedling vegetative growth traits namely seedling height , stem diameter, number of leaves /seedling, as well as, fresh and dry weight of leaves and main stem without leaves / seedling compared to untreated seedlings in the two experimental seasons. In this regard, the high concentration of all tested substances was more effective than the low one in stimulating all vegetative traits of Kapok tree seedlings. The most effective treatments which gave significantly the highest values of all traits were active dry yeast at the high concentration (5g/ l) followed by the low one (2.5 g/ l)in comparison with other treatments including check one. The enhancing effects of the tested biostimulant substances on different vegetative growth traits obtained in this study were also reported by Abdel- Wahid (2007) on *Brassia arboricula* ; El- Quesni et al. (2009) on *Hibiscus rosa sinensis*, Mustafa and Ebeid (2013) on *Albizzia lebbek* and

Taxodium disticum, Hassan (2013) on *Hibiscus sabdriffa*, Hafez et al. (2013) on olive seedlings and Ibrahim (2013) on *Khaya senegalensis*,

2- Root system

Data illustrated in Table(3) indicated that all root system parameters of Kapok tree seedlings were significantly and positively affected due to the application of different biostimulant substances including salicylic acids, ascorbic acid, citric acid, vitamin E, mixture of the three amino acids each at 100 and 200 ppm, as well as, active dry yeast at 2.5 and 5 g / l. All tested treatments led to significant improvement in root system traits i.e. main root length, main root diameter as well as, fresh and dry weights of root / seedling comparing to check treatment in the first and second seasons. In this respect, the highest concentration of each substance produced longer and thicker main root, a well as, heavier fresh and dry weights of root system / seedling than those of the lower concentration in both seasons. The longest and thickest main root and the heaviest fresh and dry root weights / seedling were resulted from spraying Kapok tree seedlings with active yeast at 5 g / l, followed by 2.5 g / l in comparison to other treatments including control one in the two growing seasons.

Table (1): Effect of some biostimulant substances on seedling height , stem diameter and leaf number of *Ceiba pentandra* seedlings during 2011 and 2012 seasons.

Treatments	Seedling height (cm)		Stem diameter(cm)		Leaf number/ seedling	
	Seasons		Seasons		Seasons	
	2011	2012	2011	2012	2011	2012
Control	115.0	124.6	1.27	1.31	27.3	30.0
Salicylic acid 100 ppm	147.5	152.7	1.50	1.66	30.8	33.2
Salicylic acid 200ppm	151.0	158.0	1.54	1.72	34.2	37.7
Ascorbic acid 100 ppm	137.1	149.5	1.42	1.58	32.1	34.0
Ascorbic acid 200ppm	149.5	163.6	1.51	1.73	36.4	38.7
Citric acid 100 ppm	137.3	139.6	1.36	1.50	30.6	33.3
Citric acid 200ppm	147.4	149.1	1.41	1.58	31.4	37.3
Vitamin E 100 ppm	142.1	148.0	1.38	1.50	30.1	32.8
Vitamin E 200ppm	148.1	152.9	1.49	1.64	33.3	35.6
Amino acids 100 ppm	130.4	135.4	1.32	1.47	28.7	30.6
Amino acids 200ppm	139.2	142.8	1.36	1.51	30.5	33.7
Active dry yeast 2.5 g/	171.1	185.2	1.53	1.80	35.4	39.6
Active dry yeast 5 g/l	176.4	192.3	1.57	1.86	38.4	42.7
L.S.D. at 5%	10.3	9.8	0.11	0.16	1.8	2.7

Table (2): Effect of some biostimulant substances on fresh and dry weight of leaves and fresh and dry weight of stem without leaves of *Ceiba pentandra* tree seedlings during 2011 and 2012 seasons.

Biostimulant treatments	Fresh weight of leaves (g)		Dry weight of leaves (g)		Fresh weight of stem (g)		Dry weight of stem (g)	
	Seasons		Seasons		Seasons		Seasons	
	2011	2012	2011	2012	2011	2012	2011	2012
Control	44.1	48.8	9.0	10.1	61.7	71.2	13.62	14.8
Salicylic acid 100 ppm	52.4	57.61	11.6	11.8	79.8	92.7	16.61	18.6
Salicylic acid 200ppm	63.5	65.0	13.6	14.2	90.8	103.0	19.87	21.1
Ascorbic acid 100 ppm	57.4	64.7	12.3	13.75	74.7	84.9	15.84	17.6
Ascorbic acid 200ppm	65.8	71.3	14.1	14.61	82.9	95.8	16.8	19.9
Citric acid 100 ppm	48.1	49.4	10.8	11.8	72.7	83.2	14.9	16.9
Citric acid 200ppm	52.3	55.9	11.9	12.4	76.7	89.6	16.6	19.4
Vitamin E 100 ppm	51.8	56.2	10.6	11.57	71.3	82.0	15.6	16.9
Vitamin E 200ppm	55.2	63.0	12.4	13.3	82.3	95.3	18.2	20.6
Amino acids 100 ppm	44.2	48.9	10.5	11.3	66.2	76.8	14.7	16.2
Amino acids 200ppm	50.0	55.0	11.6	12.2	68.2	80.4	15.6	17.3
Active dry yeast 2.5 g/l	72.9	80.1	14.6	15.6	93.0	111.5	19.6	22.8
Active dry yeast 5 g/l	79.6	83.6	16.1	16.9	105.0	124.1	22.2	25.7
L.S.D. at 5%	4.2	5.1	1.0	1.1	4.1	5.4	1.4	1.8

The beneficial influence of the tested biostimulants on root system found in the present study was also recorded by many authors. Examples Al- Qubaie (2002) on *Hibiscus sabdriffa*, Abd El-Aziz et al. (2006) on *Khaya senegalensis*, Moustafa (2008) on *Chorisia speciosa*, Abd EL- Aziz et al. (2010), on *Thuja orientalis*, Mazhar et al (2011) on *Codiaium variegatum*, Hafez et al. (2013) on olive seedlings , Ibrahim (2013) on *Khaya senegalensis*, and Mustafa and Ebeid (2013) on *Albizzia lebbek* and *Taxodium distichum*.

3- Photosynthetic pigments.

Data shown in Table (4) clarified that all biostimulant substances

treatments were found to be more effective than control one on increasing the content of photosynthetic pigments i.e. chlorophyll a, b and carotenoids in the fresh leaves of Kapok tree seedlings in the two experimental seasons. In this regard, the high concentration of each tested biostimulants gave higher content of the photosynthetic pigments than the low one in both growing seasons, while the highest content of the three photosynthetic pigments was obtained from seedlings treated with active yeast at the high concentration (5g / l.) followed by the low one (2.5 g/ l.). Asimilar trend was recorded in the first and second seasons.

Table (3): Effect of some biostimulant substances on main root length, main root diameter and fresh and dry weights of roots of *Ceiba pentandra* seedlings during 2011 and 2012 seasons.

Biostimulant substances	Main root length (cm)		Main root diameter (cm)		Fresh weight of root (g)		Dry weight of root (g)	
	Seasons		Seasons		Seasons		Seasons	
	2011	2012	2011	2012	2011	2012	2011	2012
Control	25.5	27.4	1.11	1.28	16.1	18.4	3.31	3.71
Salicylic acid 100 ppm	32.2	32.8	1.39	1.63	21.5	24.9	4.28	5.05
Salicylic acid 200ppm	33.3	34.6	1.35	1.82	23.5	26.3	4.70	5.31
Ascorbic acid 100 ppm	29.5	31.6	1.20	1.74	22.2	26.1	4.44	5.22
Ascorbic acid 200ppm	33.5	35.2	1.48	1.75	24.7	28.8	4.91	5.71
Citric acid 100 ppm	28.7	31.4	1.26	1.67	20.3	22.2	4.16	4.48
Citric acid 200ppm	29.5	33.0	1.26	1.73	21.8	24.7	4.42	4.96
Vitamin E 100 ppm	28.8	30.8	1.25	1.62	19.2	21.6	3.90	4.32
Vitamin E 200ppm	31.9	33.5	1.33	1.73	20.5	23.7	4.16	4.73
Amino acids 100 ppm	26.8	28.1	1.12	1.45	16.5	18.5	3.46	3.75
Amino acids 200ppm	28.2	29.9	1.28	1.53	18.7	19.7	3.77	4.19
Active dry yeast 2.5 g/l	35.1	37.2	1.38	1.84	24.5	28.8	3.92	5.82
Active dry yeast 5 g/l	38.8	40.4	1.49	1.9	26.2	29.9	5.21	5.94
L.S.D. at 5%	2.5	2.3	0.07	0.08	1.8	1.5	0.33	0.42

Table (4): Effect of some biostimulant substances on chlorophyll a, b and carotenoides content in the leaves of *Ceiba pentandra* seedlings during 2011 and 2012 seasons.

Biostimulant treatments	Chlorophyll a (mg/g f.w.)		Chlorophyll b (mg/g f.w.)		Carotenoides (mg/g f.w.)	
	Seasons		Seasons		Seasons	
	2011	2012	2011	2012	2011	2012
Control	3.21	3.22	1.51	1.53	1.01	1.03
Salicylic acid 100 ppm	3.27	3.30	1.69	1.71	1.15	1.15
Salicylic acid 200ppm	3.30	3.31	1.72	1.74	1.18	1.19
Ascorbic acid 100 ppm	3.29	3.33	1.70	1.71	1.16	1.17
Ascorbic acid 200ppm	3.33	3.35	1.72	1.75	1.19	1.20
Citric acid 100 ppm	3.27	3.27	1.53	1.55	1.05	1.07
Citric acid 200ppm	3.32	3.33	1.55	1.56	1.06	1.09
Vitamin E 100 ppm	3.30	3.33	1.53	1.56	1.05	1.05
Vitamin E 200ppm	3.33	3.36	1.57	1.58	1.09	1.09
Amino acids 100 ppm	3.24	3.26	1.52	1.54	1.03	1.04
Amino acids 200ppm	3.27	3.29	1.55	1.56	1.06	1.07
Active dry yeast 2.5 g/l	3.38	3.42	1.65	1.67	1.19	1.19
Active dry yeast 5 g/l	3.49	3.54	1.76	1.76	1.20	1.22
L.S.D. at 5%	0.05	0.06	0.03	0.02	0.04	0.03

The efficiency of the biostimulants in augmenting the photosynthetic pigments content obtained in this work was also recorded by many investigators such as Ismail (2004) on *Beaucarnea recurvata*, Abd El- Aziz et al (2006) and Ibrahim (2013) on *Khaya senegalensis*, Eid and Abou Leila (2006) on croton, Farahat et al. (2007) on *Cupressus sempervirens*, Abdou et al. (2010) on *Chorisia speciosa*, El-Quesni et al (2009) on *Hibiscusa rosa sinensis*, as well as, Abd- Alla (2009) and Hassan (2013) on *Hibiscus sabdriffa*.

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الملخص العربي

استجابة شتلات الكابوك لبعض المواد الحيوية المنشطة

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أجريت هذه التجربة خلال موسمين متتالين 2011 و 2012 لدراسة استجابة شجره الكابوك (*Ceiba pentandra, L.*) من حيث النمو الخضري وصبغات البناء الضوئي لبعض المواد الحيوية المنشطة وهي الساليسيليك و الاسكوربيك و حمض الستريك و فيتامين هـ وخليط من أحماض أمينية (التريتوفان - الميثونين و السيستين) كل منهم بتركيز 100 و 200 جزء في المليون وكذلك الخميرة النشطة بتركيز 5 و 2،5 جم / لتر.

أوضحت النتائج أن جميع المواد المستخدمة لها تأثير معنوي مشجع علي صفات النمو الخضري والجذري وهي طول الشتلة وسمك الساق وعدد الاوراق ووزنها الطازج والجاف لكل شتله كذلك وزن الساق (بدون أوراق) الطازج والجاف لكل شتله وطول الجذر الرئيسي وسمك الساق الرئيسي والوزن الطازج والجاف للجذر / شتله وذلك مقارنة بمعامله المقارنة كذلك أدي استخدام كل المواد المشجعة إلي زيادة محتوى الأوراق الطازجة للشتلات من صبغات البناء الضوئي الثلاث مقارنة بمعامله الكنترول وفي هذا المجال فان التركيز العالي أكثر فعالية من المنخفض حيث أدي إلي زيادة في صفات النمو الخضري ومحتوي الأوراق من الصبغات. تعتبر الخميرة الجافة النشطة بالتركيز العالي 5 جم / لتر) هي المعاملة الأكثر تأثيراً حيث أعطت اعلي القيم الخاصة بصفات النمو الخضري وصبغات البناء الضوئي لشتلات أشجار الكابوك والتي يمكن ان يوصي باستعمالها في هذا الصدد.