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Full Length Research Paper

Eucalyptus plantlet growth in relation to foliar application with complete fertilizers in Southeast of Iran

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In one experiment at greenhouse, condition was established to determine the effects of complete fertilizers on growth of plantlet Eucalyptus camaldulensis in Southeast of Iran. This experiment was conducted in the Agricultural Research Center, University of Zabol, in autumn year of 2008. This study was designed as a completely randomized design with four treatments involving control treatment and three complete fertilizers (Fosamco, Albatroz and Jonoobgan fertilizer). Amount of dose was two in thousand with three replications. All fertilizer spray solutions were applied on the twigs by spraying. In this study, we conducted measurement of height of plantlet, number of leaf, leaf area and percentage of leaf extract. The results indicate that there was significant difference between leaf area, height of plantlet and number of leaf at 5% probability, and percentage of leaf extract at 1% probability. Average comparison was made by Duncan test. Our results show that Jonoobgan fertilizer compared with other fertilizers had high effect on increasing amount of leaf extract, while Albatroz fertilizer has high effect on height of plantlet, number of leaf and leaf area. Hence, we recommend the used of Albatroz fertilizer for increased growth and Jonoobgan fertilizer for increasing leaf extract plantlet of *Eucalyptus*.

Key words: Eucalyptus, complete fertilizers, leaf extract, growth of plantlet.

INTRODUCTION

Eucalyptus belongs to the family Myraceae, mostly found in tropical region and is a native to Australia. Eucalyptus spp. grows under wide range climatic and edaphic conditions in their natural habitats (Dawar et al., 2007). *Eucalyptus* is a well-developed herbaceous and shrub plant. In most cases, *eucalyptus* forms a dense stand with a closed canopy. Stand structure for this habitat may vary considerably because most *eucalyptus* has been planted into either rows for wind protection or dense groves for hardwood production and harvesting. *Eucalyptus* is often found in monotypic stands. The genus consists of over 150 species with high morphological variety (Cornell, 1909). Typically, trees may range in height from 26 to 40 m and have diameters (dbh) of 21.8 to 38.4 cm (Walters, 1980), with most growth occurring in the first 15 years. Trees in excess of 46 to 80 m are not unusual (Munz, 1974; Walters, 1980). Eucalyptus is characterized as having quick growth from shoots and seedlings, with trees reaching 70 to 90% of their height within 15 years after planting (Walters, 1980). Annual height growth of trees in experimental plots has averaged 4.3 m for the first 5 years, 1.2 m for the second 5 years, and 0.3 m for the third 5 years (Walters, 1980). Ten-year-old trees can easily achieve heights of 30 to 33 m (Howell, 1982). Canopy closure is achieved in short period and as such, they are found in locations with highly variable place characteristics.

Generally, they are found on relatively flat or gently rolling land, occasionally in the foothills. Continent conditions are typically referred to as Mediterranean, characterized by hot, dry summers and cool, gentle winters. Precipitation ranges from approximately 30 to 60 cm. Temperature regimes in sites of eucalyptus groves range from a middle monthly low of 6°C in January to 23°C in August, with low temperatures occasionally attaining 0 to 4°C and high temperatures typically exceeding 38°C (King and Krugman, 1980). *Eucalyptus* demonstrates ability to resist many temperature terms, with the barring of prolonged cold or freezing weather (King and Krugman, 1980). *Eucalyptus* should not be planted where temperatures are agreeable lower than

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5°C (Cornell, 1909). Eucalypt production differs according to the soil terms (principally in relation to drainage, soil depth and chemical fertility) (Branas et al., 2000) and also to the type of agro forestry management (González-Río et al., 1997). Foliar chemical analysis is a strong tool in tree nutrition and fertilizer research (Raupach, 1967). Several investigators reported that an increase in N rate is associated with an increase in yield of different species of fruit trees (Calvert, 1970; Koo et al, 1974). Singh and Singh (1969) showed that the effect of different N and micronutrients levels on growth and flowering of guava shoot reported a positive correlation with the growth rate, increasing the length and number of leaves and flowering shoot. Azza et al. (2006) were shown that growth characteristics of *Taxodium distichum* increased by increasing the concentration of boron up to 20 ppm as compared with control treatment. Potassium also plays an essential role in the processes of photosynthesis and transport assimilates to storage organs in the plant. Consequently, the dry matter content of the plant is directly affected by potassium. Furthermore, potassium is involved in many enzymatic reactions within plants (Krzywy, 2000), thus an important nutrient for crops. It is absorbed as K^+ ion (Lester et al., 2010). Ricard (2000) has shown that Phi-based P fertilizer applied to the soil or the leaves of plant consistently improved the yield and quality of many crops, such as celery, onion, potato, peach, orange and cotton.

The aim of the present experiment was to determine the growth plantlet of Eucalyptus in condition involving the use of complete fertilizers and compared to control treatment. The information obtained should help to better understand the factors affecting growth of eucalypts, as well as to predict growth rates and to plan strategies to alleviate the problems detected.

MATERIAL AND METHODS

A greenhouse experiment was carried out on a Research Center of University of Zabol, Iran (61° 41′E, 30° 54′N, and altitude 483 m above sea level). The components of fertilizers used for the experiment are shown at Table 1. Concentration of fertilizer applied to foliage was 2 cc/L, while control plantlet was sprayed with water. Foliar application was used at 4 stages at growth time (of September to December). Each plot has 100 plastic flowerpots of 20 cm in length and 14 cm in diameter. For suitable drainage in flowerpots 8 holes were created on them. The type of soil for planting was sandy loamy with suitable pores. Date of planting was 5 August 2008, with each flowerpot containing five seeds, while at September they were thinned. Weed control was for all treatment by mechanical method.

The complete randomized design (CRD) was used for the three replications. The data on growth, and other parameters were analyzed by Fisher's analysis of variance technique and Duncan test at 0.05 probability level was used to compare the treatment means (Steel and Torrie, 1984). Data analyses were conducted using of SAS, (SAS Institute, 2001) as a CRD experiment to four treatments and three replicates. Treatments included complete fertilizers (Fosamco, Albatroz, Jonoobgan fertilizer and control treatment). In this study, we conducted measurement of height of plantlet, number of leaf, leaf area and percentage of leaf juice. To obtain the aforementioned factors, was selected 10 plantlet of each treatment and used the mean of this numbers. Leaf area was determined with a leaf area meter, Delta T Device Model. Moreover, dry weights were determined after the plant materials were oven-dried at 65°C for 72 h and dried samples was mills then 2 g of each sample was selected for take extract by soxhlet methods.

RESULTS AND DISCUSSION

Vegetative characteristics

Number of leaf

The results presented in Table 2 indicated that addition the complete fertilizers showed a significant effect ($P<0.05$) on the number of leaves. Comparison of means showed that Albatroz fertilizer produced a high number of leaf compared with the other treatments. All fertilizers compared to the control treatments showed significant effect on number of leaf, and Albatroz fertilizer has the highest effect on number of leaf (Table 3). Albatroz fertilizer also produced the highest amount Nitrogen compared to other treatments (Table 1).

Analysis of the effect of N level on growth (Table 2), reported a positive correlation with the growth rate, increase the length and number of leaves. These results agreed with Singh and Singh (1969) who while working on the effect of different N and micronutrients levels on growth and flowering of guava shoot, reported a positive correlation with the growth rate, increase in length and number of leaves and flowering shoot.

Length of plantlet

The results show that fertilizers treatment had significant effect on high plantlets at 5% level (Table 2). The highest Length of plantlet was shown when Albatroz fertilizer was used and the lowest length of plantlet was obtained in the control treatment (Table 3). Among all fertilizers, Albatroz fertilizer had the highest amount of nitrogen. An increase in N rate is associated with an increase in length of plantlet. Several investigators also reported that an increase in N rate is associated with an increase in yield of different species of fruit trees (Calvert, 1970; Koo et al, 1974).

Leaf area (cm^2)

Table 2 shows that significant difference was observed in leaf area in the complete fertilizers. Albatroz fertilizer gave the highest value of leaf area (120 cm^2), while the lowest value of leaf area was obtained at control treatment (70 cm^2) (Table 3). The effects of Albatroz fertilizer on leaf area could be attributed to the effects of high nitrogen in this treatment. The results show the

Table 1. Chemical constituents of complete fertilizers.

Constituent of fertilizer	Kind of fertilizer		
	Fosamco	Albatroz	Jonoobgan
Nitrogen (%)	10	18	7
Magnesium (%)	0.18	0.18	0.2
Manganese (%)	0.13	0.1	0.2
Boron (%)	0.02	0.05	0.02
Molybdenum (%)	0.003	0.005	0.003
Potassium (%)	7	8	28
Iron (%)	0.008	-	0.5
Phosphorus (%)	4.4	-	2
Zinc (%)	-	0.15	0.3
Copper (%)	-	0.02	0.1
Calcium (%)	-	0.1	-

Table 2. Analysis of variance for factors measurement.

S.O.V	df	MS	C.V (%)
Number of leaf	3	67.41*	18
Length of Plantlet	3	44.11*	10
Leaf area	3	1765.41*	14
Extract of leaf	3	61.25**	17

*P < 0.05; **P<0.01.

Table 3. Effect of completes fertilizers on number of leaf, Length of Plantlet, leaf area and extract of leaf in *Eucalyptus* during the growth season.

Treatment	C_T	JF	AF	FF	Mean
Number of leaf	12^{c}	16^{b}	24^{a}	15^{b}	16.7*
Length of Plantlet (cm)	32^{b}	37b	40^{a}	34^{b}	35.7*
Leaf area (cm^2)	70^{b}	112^{a}	120^{a}	82^{b}	96*
Extract of leaf (%)	8^{c}	18^{a}	13^{b}	9^{bc}	12**

C_T (Control Treatment); JF(Jonoobgan Fertilizer); AF (Albatroz Fertilizer); FF (Fosamco Fertilizer). Mean followed by the same letter(s) within a row are not statistically different at the P= 0.05 level according to the LSR Test.

effect of nitrogen on the vegetative growth characters. In agreement with this finding are those reported by other investigators working with different fruit trees species (Jones et al., 1970; Koo, 1974; Dawoud, 1991; Calvert, 1970). Leaf area of *E. camaldulensis* seedlings grown in fertilizer treatment of Albatroz was higher when compared to other treatments (Table 3).

Extract of leaf (%)

The results presented in Table 2 indicated that addition of the complete fertilizers showed a significant effect (P<0.01) on extract of leaf. Jonoobgan fertilizer gave the highest value of extract of leaf (18%). The lowest value of extract was obtained in control treatment (8%) (Table 3). No significant difference was however observed between Albatroz and Fosamco fertilizer on extract of leaf. EL-Krammany et al. (2000) found that biofertilizers helps in availability of minerals and their forms in the composted material and increases levels of extractable N, P, K, Fe, Zn and Mn. Also, leaf area was lower in plants from control-treatment compared with other fertilizers (Table 2). Nitrogen content at Albatroz fertilizer was higher when compared to other fertilizers (Table 1).

The main effect of the Albatroz fertilizer treatment on performance of *E. camaldulensis* seedlings was to significantly retard growth. Albatroz fertilizer had high nitrogen compared to other fertilizer hence resulting in a higher number of leaf, high plantlet and leaf area when compared to other fertilizers. There is often a strong positive correlation between maximum rates of photo-

synthesis and N (Evans, 1989; Warren et al., 2000), largely because a large proportion of N (up to 75%) is present in the chloroplasts- much of it in thylakoid membranes, and as soluble proteins of the Calvin cycle, particularly the enzyme Rubisco (Evans, 1989). Jonoobgan fertilizer had significant effects on extract of leaf, thus showing higher extract leaf compared to other fertilizers. This fertilizer also had higher microelements (include Zn, Mn, Mg and Cu) and macroelement (K) when compared to other fertilizers.

Referring to the previous results, one can see that all the vegetative measurements were significantly higher with complete fertilizers as compared with control treatment. The betterment in vegetative and extractable measures resulted from complete fertilizer, which may be attributed to the photosynthesis process which certainly reflected positively on both vegetative growth and extractable of leaf (Kassem and Marzouk, 2002; Maksoud, 2000). Based on the results of this study, it is suggested to apply Albatroz fertilizer for increased vegetative growth and Jonoobgan fertilizer for increased extract of leaf. Split foliar application was used at 4 stages at different growth time (September to December) and concentrated fertilizer was applied to foliage at the concentration 2 cc/L.

REFRENCES

Assa A, Sahar MZ, Yassen AA (2006). Impact of Boron Fertilizer on Growth and Chemical Constituents of Taxodium distichum Grown under Water Regime. World J. Agric. Sci. 2(4): 412-420.

Brañas J, González-Río F, Merino A (2000). Contenido de nutrientes en biomasa vegetal y suelos de plantaciones de *Eucalyptus* globulus en el norte de Galicia, Investig. Agrar. Sist. Recur. For. 9: 317– 335.

Calvert DV (1970). Response of temple orange to varying rates of nitrogen Potassium and magnesium, proceedings of Florida state Horticult. Soc. 83: 10-15

Cornell FD (1909). Hickory's younger brother. Sunset Magazine (March): pp. 274-281.

Dawar S, Summaira M, Younus M, Zaki MJ (2007). Use of *Eucalyptus* sp., in the control of root infecting fungi on mungbem and chick-pea. Pak. J. Bot. 39(3): 975-979.

Dawoud KD (1991). Response of Foster Grape fruit trees to mineral Nutrion under Nursery and orchard conditions. M.Sc [Agric] Thesis university of Khartoum Sudan.

EL-Kramany MF, Ahmed MKA, Bahr AA, Kasber MO (2000). Utilization of bio-fertilization in field crop production. Egept. J. Appl. Sci. 15: 137-149.

Evans JR (1989). Photosynthesis and nitrogen relationships in leaves of C3 plants. Oecologia, 78: 9–19.

González-Río F, López J, Astorga R, Castellanos A, Fernández O, Gómez C (1997). Fertilización y control de la vegetación accesoria en plantaciones de eucalipto, Comunicaciones II Congreso Forestal Español. 3: 271–276.

Howell JA (1982). Bay area *Eucalyptus* fire hazard. U.S. Dep. Interior, Nat'l. Park Serv., San Francisco, Calif. Unpubl. MS.

Kassem HA, Marzouk HA (2002). Effect of organic and /or mineral nitrogen fertilization on the nutritional status, yield and fruit quality of Flame seedless grape vines grown in calcareous soil.J. Adv. Res. 7: 117-126.

King JP, Krugman SL (1980). Tests of 36 *Eucalyptus* species in northern California. U.S. Dep. Agric For. Serv. (Berkeley, Calif.), Res. Pap. PSW-152.

Koo RW, Young L, Kesterson JW (1974). Effect of nitrogen, potassium and irrigation on yield and quality of lemon. J. Am. Soc. Horticult. Sci. 99(4): 289-291.

Krzywy E (2000). Nawożenie gleby i roślin. Wydawnictwo Akademii Rolniczej w Szczecinie.

Maksoud MA (2000). Response of growth and flowering of Manzanillo olive trees to different sorts of nutrients. Egypt. J. Hort. 27: 513- 523.

Munz PA (1974). A flora of southern California. Univ. of California Press, Berkeley.

Lester GE, Jifon JL, Makus DJ (2010). Impact of potassium nutrition on food quality of fruits and vegetables: A condensed and concise review of the literature. Better Crops, 94(1): 18-21.

Raupach M (1967). Soil and fertilizers requirements for forest of Pinus radiata. Adv. Agron. 19: 307-353.

SAS Institute. SAS Procedure Guide (2001). SAS Inst., Cary, NC. 8: 2.

Singh J, Singh MP (1969). Study on the effect of different levels of nitrogen and micronutrients on growth of flowering shots of guava. The Allahbad Farmer, 11(4): 271-274.

Steel RGD, Torrie JH (1984). Principles and Procedures of Statistics. 2nd Ed. McGraw Hill Book Co. Inc., Singapore. pp. 172-178.

Walters GA (1980). Saligna *Eucalyptus* growth in a 15-year old spacing study in Hawaii. U.S. Dep. Agric., For. Serv. (Berkeley, Calif.), Res. Pap. PSW-151.

Warren CR, Adams MA, Chen Z (2000). Is photosynthesis related to concentrations of nitrogen and Rubisco in leaves of Australian native plants? Aust. J. Plant Physiol. 27: 407–416.