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Study of the Fertigation Requirements for some Woody Trees

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ABSTRACT

This investigation was conducted at the Experimental Farm of Timber Trees Res.Dept., Hort.Res.Inst., A.R.C Egypt during two seasons (2009/2010and 2010/2011) to study the effect of three irrigation intervals (3, 5 and 7 days), with fertilizers mixture of N, P and K at the rates of control (3, 6 and 9g/pot), containing 25 kg of calcareous soil and their interaction on growth and chemical composition of *Pinus radiata* and *Robinia Pseudoacacia* transplants grown in pots. Results indicated that, prolonging irrigation interval from 3 to 7 days reduced plant height, stem diameter and fresh and dry weight of shoots and roots as well as N, P and K % in the leaves. As for fertilizer mixture, data showed that rising the level from 0 to 9 g/pot, significantly increased plant height, root length, stem diameter and fresh and dry weight of shoots and roots as well as N, P and K% during the two seasons in the two plants under investigation. Also, results revealed that interaction between irrigation intervals and fertilizer level significantly affected the height of plant, root length, stem diameter, fresh weight and dry weight of shoots and roots as well as N, P and K % as the highest records for *Pinus radiata* were with 3 days irrigation and 9g/pot fertilizer mixture during the two seasons for *Robinia pseudoacacia* these effects were recorded for plants subjected to either 3days irrigations interval and 6g/pot fertilizer mixture or 5 days irrigation and 9g/pot fertilizer mixture during the two seasons.

Key words: Pinus radiata, Black locust, fertilization, irrigation, NPK

Introduction

Pinus radiata D. Don. belongs to family Pinaceae and common name "Monterey pine" it is a coniferous evergreen tree 15-30m (49-98ft) in height in the wild, but up to 60m (200ft) in cultivation in optimum conditions. Rediata pine grows well on range of soils, from deep sands to clays, although wet heavy clays are not recommended. Radiata pine is a fast growing tree, generally managed over a 25-35 years rotation and the average growth rate of radiata pine in Victoria is currently $18m^3$/ha/yr, with more than 30 m^3/ha/yr achievable on good site while in New Zealand, growth rates of over $50m^3$/ha/yr have been recorded. (Phillips,1999).

Radiata pine may be used for a wide range of purpose, including light construction, furniture, paneling, internal flooring, moldings, joinery, veneers and pulpwood. Green foliage may be used as fodder for sheep and cattle, Moore *et al,* (2008).

The turpentine obtained from the resin of all pine trees is antiseptic, diuretic, rubefacient and vermifuge, it is also very beneficial to the respiratory system and so is useful in treating disease of the mucous, membranes and respiratory such as coughs, cold, influenza and TB (Barertt, *et al;*1990).

Robinia pseudoacacia commonly known as the black locust and false Acaciais is a tree in the subfamily Faboideae of the pea family Fabaceae, it is native to south eastern United States.

Various reports suggested that, the seeds and young pods of the black locust can be edible when cooked, since the poisons that are contained in this plant are decomposed by heat. Wood pale yellowish brown, heavy, hard, strong, and close. The wood is extremely hard, resistant to rot and durable making it prized for furniture, flooring paneling, fence posts and small water craft-black locust is highly valued as fire wood for wood-burning stoves. Because it is nitrogen fixer and has rapid juvenile growth, it is widely planted as an ornamental, for shelterbelts, and for land reclamation. It's suitable for fuel wood and pulp and provides cover for wild life browse for deer and cavities for birds Miller *et al* (1987).

Irrigation water is gradually becoming scarce not only in arid and semi-arid regions but also in the regions where rainfall is abundant. Therefore, the water saving and conservation is essential to support agricultural activities and efficient use of water by irrigation is becoming increasingly important. *(*Saleh and Ozawa, 2006*)* In nature, water is usually the most limiting factor for plant growth. If plant does not receive adequate rainfall or irrigation, the resulting drought stress can reduce growth more than all other environmental combined. *(*Khazaie, *et al,* 2008*)*

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Considerable attention has been paid in the last few years to the subject of macronutrients as a limiting factor for agriculture production in Egypt. Thus, it can be suggested that, the deficiency of N, P and K nutrients may bring about depressive effect on plant growth particularly due to their effect on either the biosynthesis or the destruction of the plant hormones. *(*Moorby and Besford, 1983*)*

Materials and Methods

Transplants of *Pinus radiata* and *Robinia Pseudoacacia* one year ages were obtained from Timber Trees Res. Dept.Hort.Res.Inst., A.R.C., Egypt during two successive seasons of 2009-2010 and 2010-2011 and planted in the nursery of timber trees to study the effect of interaction between irrigation intervals and fertilizer mixtures (NPK) on growth and chemical composition of these plants. They were grown in plastic pots of 40 cm diameter and 40 cm depth, filled with 25kg calcareous soil, every pot received one transplants. In both *Pinus radiata* and *Robinia pseudoacacia* the experiment included 12 treatments according to the NPK fertilizers levels and the irrigation intervals. NPK fertilizers represented the main sub plots and irrigation intervals served as main plots. Four levels from mixture of NPK fertilizers, ammonium sulphate (21.2% N), Super phosphate (15.5% P_2O_2) and potassium sulphate (48% K_2O), were applied in ratio of 5:3:3 NPK by weight at the rates of 0, 3, 6 and 9 g/pot. This mixture was added every three months during the period of the experiment (one year) for *Pinus radiata* only, while for *Robinia pseudoacacia* , this mixture contained phosphorus and potassium only with the same ratio of the previous mixture and nitrogen was added individually at a ratio of 1g/pot before cultivation. These treatments were the combination of three irrigation intervals (3, 5 and 7 days) and four fertilizer level using tap water. The volume of water added to plants was approximately 2.87 l/pots according to 100 % field capacity when determined in this soil. The mechanical and chemical analyses of the soil under investigation are presented in Table (1).

Morphological and physiological parameters recoreded:

- Plant height (cm).
- Root length (cm).
- Stem diameter (mm) at 5cm above soil surface.
- Fresh and dry weight of shoots and roots (g).

Chemical composition:

Samples of leaves were collected at the end of each season, oven-dried at 70°C, ground and digested with H_2SO_4 and H_2O_2 for the following determinations:

– Nitrogen was determined by Nessler method according to A.O.A.C (1990).

– Potassium was determined by using flame photometer apparatus (corning M410) and Phosphorus determination was adopted calorimetrically by using the chlorostannous reduced molybdophosphoric blue color method according to King (1951).

Methods of statistical analysis:

– Growth characters and chemical composition of different parts of plant were statistically desing using split-plot design according to Snedecor and Cochran (1981). Irrigation represented the main plots and NPK levels served as sub-plots. The means were compared using L.S.D values at 5 % levels.

Table 1: Some physical and chemical properties of the experimental soil.

Mechanical				Chemical				
Clay %	Silt %	Fine sand %	Coarse sand %	PH	Ec. Moh/cm^2	$CaCO_3$	OM %	F.C %
10.80	26.90	61.50	10.70	8.1	1.35	15.3	0.70	30
Soluble cations % (100g soil)				Soluble anions % (100g soil)				
Ca^{++}	Mg^{++}	K^+	Na^+	HCO_3	Cl^{-1}	SO_4^{-2}		
2.4	0.6	0.4	0.5	0.8	1.2	1.8		

The aim of this study was to evaluate the effect of three irrigation intervals and four levels of mixture fertilizer (NPK) on growth and chemical composition in two woody trees *Pinus radiata and Robinia* pseudoacacia

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Results and Discussion

- *Effect of the interaction between irrigation intervals and mixture fertilizer on growth characteristics of Pinus radiata:*

I- Growth characteristics:

I-1 Effect of irrigation intervals:

Data presented in Table (2) demonstrated that, the irrigation interval of 3 days, produced the tallest plant during the two seasons, which recorded 83-08 and 101.20 cm in the two seasons respectively and stem diameter of 1.34 and 1.46mm in the both seasons respectively. Hower, there was a reduction in growth characters as a result of prolonging irrigation interval (7 days) in all parameters mentioned previously. Meanwhile it led to increase elongation of roots recording 63.5 and 81.05cm in the first and second seasons respectively . These results might be expected since water deficit inhibited leaf enlargement, which in turn affect the size of photosynthesis surface causing a reduction in plant growth. Similar results were obtained by Ahmed *et al.* (2003) and Ahmed & Abed El Azim (2009*),* who observed that, prolonging of irrigation intervals led to a significant decrease in growth characteristics compared to that of normal irrigation. According to the previous results, El Manayeri *et al. (1983)* reported that, this may be due to the vital roles of water supply at adequate amount for different physiological process such as photosynthesis, respiration, transpiration, translocation, enzyme reaction and cell turgidity occurs simultaneously. On the other hand, such reduction in these parameters could be attributed to a decrease in the activity of meristemic tissues responsible for elongation as well as inhibition of photosynthetic efficiency under insufficient water condition as recorded . Siddique *et al.* (1999). Similar results were obtained by Mary *et al.* (2012).

Moreover, it's clear from the results presented in Table (3) that significantly increases were achieved a in achieved a increases in fresh and dry weight of shoots and roots during the two seasons as a result of using the shortest irrigation interval (3 days) which recorded137.55 and 133.93 g and 44.30 and 45.49 g for shoots and 47.26 and 55.53 g and 21.30 and19.51 g for roots in the two seasons respectively. The reduction in these characters as result of prolonging irrigation interval might be expected since water deficit inhibited stem elongation and leaf enlargement, which in turn affect the size of photosynthesizing surface causing a reduction in growth of plants. Similar results were obtained by Ahmed and Abed El Azim, (2009).

I-2 Effect of mixture (NPK) fertilizers:

Data presented in Table (2) indicated that, a significant positive effect of fertilizers level was obtained on plant height, root length and stem diameter in the first and second of seasons as increasing the rate of fertilizer mixtures application from 0 to 9g/pot significantly affected growth characters of the plant, and the maximum increases were observed from application of this mixture at the rate of 9g/pot which recorded the highest values in plant height (91.99and 110.32cm), root length (66.70 and 92.63cm) and , stem diameter (1.41and 1.47 mm)in the first and second seasons, respectively. Moreover, the results presented in Table (2) indicated that the interaction between irrigation interval of 7 days and fertilization rate of 9 g/pot had a significant effect on root length which recorded 75.33cm. This adverse effect was observed in length of roots and may Different plants Revealed that significant effects on growth characteristics were obtained on plant. This result may be caused by the increasing level of N content in mixture fertilizers, as nitrogen may enhance the plant capacity for protein synthesis, leading to an increase of building up carbohydrate, and this in turn caused an increase in the growth characteristics. These results are in harmony with those of Ahmed and Abed El Azim (2009) and Shaheen *et al.* (2007*),* as they found that increasing nitrogen fertilization rates increased growth characters of different plants, while the maximum rate gave reduction in all parameters.

Moreover, it's clear from the results presented in Table (3) that significant increase in fresh and dry weight of shoots and roots were recorded147.66,119.07 and48.18,48.55and 64.03,52.0 and 23.73,20.34 g in the first and second seasons, respectively

As a result high NPK fertilizer supply was associated with pronounced increase in shoot height, this could be attributed to their effect on the internodes elongation by increasing plasticity of cell wall as well as enhancement of meristematic cell division (Hanafy, 1990).

I-3 Effect of the interaction between irrigation interval and mixture fertilizer:

Data presented in Table (2 ,3) indicated that, application of 9g/pot from fertilizer mixtures accompanied with irrigation 3 days interval revealed the plant height, stem diameter as well as fresh and dry weight of shoots and roots, which recorded the highest values (98.33and 119.30 cm), (1.53 and 1.60 mm) as well as (190.0,162.60 and 60.33,54.0 g) fresh and dry weight of shoots in the first and second seasons respectively and (96.07, 64.10 and 35.0,22.90g) fresh and dry weight of roots at the first and second seasons respectively and may be due to that the plants water content when is reduced enough it interferes with normal physiological plant process as a plant responds to a lack of water so roots try to extend more deeply in the soil (Koocheki *et al*, 2007).

Table 2: Effect of the interaction between irrigation intervals and mixture fertilizer level on growth characteristics of *Pinus rediata* plant during 2009/2010 and 2010/2011 seasons

		Season I					Season II				
		Plant hight s (cm)									
Fertilizer / Irrigation		Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)	Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)
3 days		65.0	80.0	89.50	98.33	83.08	80.00	95.0	110.50	119.30	101.20
5 days		60.0	75.33	85.0	91.33	77.92	73.0	90.50	106.20	116.33	96.07
7 days		53.0	59.66	80.50	85.33	69.62	68.0	75.60	92.33	95.33	82.82
Mean (A)		59.33	71.63	84.66	91.99	///////	73.67	87.03	103.01	110.32	///////
L.S.D 5%	A	2.22					2.39				
	B	2.22					2.34				
	A.B	4.85					4.76				
		Root Length (cm)									
3 days		43.0	50.33	52.33	54.33	49.99	59.0	66.0	80.20	85.0	72.55
5 days		45.0	56.90	62.44	70.43	58.47	61.0	69.0	83.30	94.90	77.05
7 days		49.0	59.0	70.00	75.33	63.50	68.0	75.0	85.0	96.20	81.05
Mean (A)		45.66	55.41	61.81	66.70	///////	62.66	70.0	89.83	92.63	///////
L.S.D 5%	A	1.15					1.12				
	B	0.72					1.11				
	A.B	1.87					1.93				
		Stem Diameter (mm)									
3 days		1.20	1.10	1.51	1.53	1.34	1.30	1.39	1.55	1.60	1.46
5 days		1.0	1.02	1.30	1.40	1.18	1.22	1.30	1.35	1.50	1.42
7 days		0.77	1.0	1.20	1.30	1.06	1.0	1.20	1.25	1.30	1.19
Mean (A)		1.06	0.96	1.04	1.41	///////	1.17	1.30	1.48	1.47	///////
L.S.D 5%	A	0.087					0.09				
	B	0.087					0.09				
	A.B	0.15					0.15				

A =Fertilizer level
B= Irrigation intervals A.B = Interaction

Table 3: Effect of the interaction between irrigation intervals and mixtureon frish and dry weight vegetative parts and roots of *Pinus radiata* plants during2009/2010and 2010/2011 season.

		Season I					Season II				
		F.W. of V.G(g)									
Fertilizer / Irrigation		Control	L1 3gm	L2 6gm	L3 9gm	Mean (B)	Control	L1 3gm	L2 6gm	L3 9gm	Mean (B)
3 days		75.90	120.66	163.66	190.0	137.55	90.90	135.60	146.60	162.60	133.93
5 days		70.00	85.66	139.33	147.66	108.33	85.0	130.0	140.30	155.0	127.58
7 days		60.0	64.00	97.33	105.33	81.66	75.0	80.0	118..32	130.22	98.39
Mean (A)		68.63	89.99	130.44	147.66	///////	83.63	105.30	175.07	119.07	///////
L.S.D 5%	A	4.39					4.40				
	B	4.39					4.40				
	A.B	7.6					7.80				
		D.W of V.G(g)									
3 days		30.36	35.56	50.93	60.33	44.30	36.36	43.0	48.60	54.0	45.49
5 days		28.0	28.33	45.0	49.0	37.58	34.0	40.0	46.60	51.66	43.06
7 days		24.0	21.33	33.33	35.20	28.47	32.0	34.0	39.0	40.0	36.25
Mean (A)		27.45	28.41	43.08	48.18	///////	34.12	39.0	44.73	48.55	///////
L.S.D 5%	A	2.65					2.20				
	B	2.65					2.20				
	A.B	4.31					4.10				
		F.W. of roots (g)									
3days		36.0	40.24	52.73	96.07	47.26	48.0	52.0	58.0	64.10	55.53
5 days		33.0	34.43	40.96	67.46	43.96	45.20	46.0	50.0	52.0	48.30
7 days		25.0	25.33	30.81	28.56	27.43	37.0	35.30	37.0	40.0	37.33
Mean (A)		31.33	33.33	41.50	64.03	///////	43.40	44.43	48.33	52.0	///////
L.S.D 5%	A	3.36					3.30				
	B	3.36					3.30				
	A.B	5.82					5.20				
		D.W of roots									
3 days		14.20	16.0	20.0	35.0	21.30	19.20	17.70	19.0	22.90	19..70
5 days		13.20	13.50	13.90	25.0	16.40	18.0	15.20	16.30	22.19	18.11
7days		10.0	10.30	12.0	11.20	10.88	14.90	11.80	12.50	16.0	14.58
Mean (A)		12.47	13.27	15.30	23.73	///////	17.37	14.93	15.93	20.34	///////
L.S.D 5%	A	0.477					0.42				
	B	0.477					0.42				
	A.B	0.83					0.80.				

A =Fertilizer level
B= Irrigation intervals A.B = Interaction

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II- Chemical composition:

II-1 Effect of irrigation intervals:

Data presented in Table (4) indicated that increasing irrigation period interval from 3 to 7 days significantly decreased N, P and K concentration during the two seasons, as the lowest values recorded from were 2.08 ,2.68 N%, and 0.14, 0.12 P% and 1.81,2.36 K% the first and second seasons respectively when plants were irrigated at interval of 7 days compared to the highest values which were recorded when plants were irrigated at interval 3 days, (2.73,3.36 N% and 2.32,2.59K%) in the first and second season, respectively. On the other hand, P% no had a significant positive effect for increasing irrigation intervals during the two seasons. The depression in these nutrients may be due to disturbance in energy metabolism in plants grown under the longest irrigation intervals. The longest irrigation interval cause a depression in total carbohydrate concentration and this may cause an to inhibition of photosynthesis or increasing of respiration rate. These results are in agreement with those obtained by Ahmed and Abd El-Azim (2009*).*

II-2 Effect of (NPK) mixture fertilizers:

The results present in Table (4) indicated that, N, P and K% were enhanced by increasing fertilizer mixture levels from 3 to 9g/pot,which recorded the significantly highest value (2.64,3.58 N % , 0.19,0.16 P and 2.67,2.91 K 7%) during the two seasons when plans were t treated with 9 g/pot fertilizers . This result is in harmony with Hanafy b, (1990) and Kazakova *et al* (1990) who reported that NPK fertilizers increased plant dry weight and enhanced the accumulation of N, P, K, Ca, Mn, Fe, Cu and Zn in the plants, while the lowest values were recorded when plants were treated with 3g/pot from fertilizer mixture (2,21,2.78N% ,0.16, 0.14P% and,1.84,2.30K %) during the two seasons respectively, compared to other fertilizer treatments In this respect, it can be suggested that, the low NPK fertilizer supply probably decreased the net assimilation rate by reducing the rate of photosynthesis per unit leaf area and/or further by increasing respiration rate. Shafik and Kether (1980), Bultova and Pomoz (1984) and Amin(1994), reported that, activity of the enzyme system of IAA synthesis in all plant organs decreased with N, P and K deficiency, it is therefore possible that the effect of NPK fertilizers level on highest concentration of N, P and K observed here, may have been induced as a result of promotion or inhibition of cell elongation or cell division or by changes in endogenous plant hormone levels.

II-3 Effect of the interaction between irrigation interval and mixture fertilizer (NPK):

The effect of the interaction between irrigation interval and fertilizer mixture (NPK) levels during the two seasons, were shown in Table (4).The interaction had a significant effect on N and P%, as the highest value of N, P concentration in plant was recorded with irrigation every 3 days and 9g/pot (3.72,4.32 and 0.21,0.19%) during the two seasons respectively , while K recorded the highest value (2.99%) in the first season when plants were irrigated every 5 day received NPK of and 9g/pot ,while this effect was non significant on K% in the second season which recorded (2.59k%).

- Effect of the interaction between irrigation interval and mixture fertilizer (NPK) on growth characteristic of *Robinia pseudoacacia* during 2009-2010, and 2010-2011 seasons

I- Growth characteristics:

I-1 Effect of irrigation intervals:

Data presented in Table (5) demonstrated that, plant height and stem diameter were significantly increased with decreasing irrigation intervals from 3 to7 days for *Robinia psdudoacacia* at the first and second seasons. The values recorded were (97.13,102.08cm and 1.38 ,1.54mm) respectively, compared to the reduction observed in the same growth characters which resulted from were prolonging irrigation intervals, it was clear from data plant height and stem diameter significantly decreased with increasing irrigation intervals which recorded (66.13,69.33cm) and(0.72,1.14mm) in the first and second seasons respectively , these might be du to the greater effects of water in all the photosynthetic ally activities and via hormonal control in plants. Similar results were obtained by *Ahmed, et al. (2003),*who declared that ,greater soil water stress decreased plant height, several investigations. Concluded that, prolonging irrigation intervals decreased the vegetative growth characteristics of different plants by*),* Koockeki*, et al.* (2007), Khazale, *et al*. (2008) and Ahmed and Abed El Azim, (2009*).* However the adverse effect was observed in extension of roots which recorded the highest value with prolonging irrigation interval, (7 days) which recorded 56.11 and 72.25cm compared to the other, intervals this may be due to that when water is logd from the plant exceeds the ability of the plant roots to absorb water and

when the plants water content is reduced enough to interfere with normal plant process, a plant responds to a lack of water, so roots try to extend more deeply in the soil, Koocheki *et al*, (2007).

Table 4: Effect of the interaction between irrigation interval and mixture fertilizers on chemical composition of *Pinus rediata* during 2009-2010 and2010-2011 seasons

		Season I					Season II				
		N%									
Fertilizer / Irrigation		Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)	Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)
3 days		2.30	2.32	2.61	3.72	2.73	2.90	2.92	3.31	4.32	3.36
5 days		2.20	2.23	2.50	2.98	2.48	2.80	2.83	3.22	3.59	3.11
7days		1.90	2.01	2.20	2.23	2.08	2.50	2.60	2.80	2.83	2.68
Mean (A)		2.13	2.21	2.44	2.64	///////	2.73	2.78	3.11	3.58	///////
L.S.D 5%	A	0.10					0.09				
	B	0.10					0.09				
	A.B	0.20					0.10				
		P%									
3 days		0.18	0.19	0.20	0.21.	0.20	0.61	0.16	0.18	0.19	0.17
5 days		0.15	0.16	0.18	0.19	0.17	0.13	0.14	0.16	0.17	0.15
7 days		0.13	0.14	0.15	0.16	0.14	0.11	0.12	0.12	0.14	0.12
Mean (A)		0.15	0.16	0.18	0.19	///////	0.13	0.14	0.15	0.16	///////
L.S.D 5%	A	0.094					0.10				
	B	0.05					0.10				
	A.B	0.18					0.18				
		K%									
3days		1.80	2.20	2.59	2.69	2.32	2.30	2.50	2.55	2.99	2.59
5 days		1.40	1..93	2.63	2.99	2.23	1.60	2.40	2.90	2.59	2.37
7 days		1.20	1..40	2.30	2.35	1.81	1.80	2.00	2.50	3.17	2.36
Mean (A)		1.43	1.84	2.50	2.67	///////	1.90	2.30	2.65	2.91	///////
L.S.D 5%	A	0.07					0.07				
	B	0.03					0.07				
	A.B	0.13					0.14				

Moreover, data presented in Table (6) revealed that, a significant positive effect of irrigation interval from 3 to 7 days, was clear for fresh and dry weight of shoots and roots which were significantly decreased with increasing irrigation interval during the two seasons, as recorded 38.17,52.83 and 14.03,20.90 g , fresh and dry weight of shoots and33.16,52.25 and inter d 11.53,20.90 g fresh and dry weight of root respectively . This reduction as a result of prolonging irrigation interval might be expected since water deficit inhibited stem elongation and leaf enlargement which in turn affect the size photosynthesizing surface causing a reduction in growth plant. Similar results were obtained in the second season. These result are in harmony with Baher *et al* (2002).

I-2 Effect of (NPK) fertilizer:

It is important to notice that, concern with application of nitrogen, there were more effects pronounced on *Pinus radiata* than in *Robinia pseudoacacia*, with application of N at 1g/pot once only, before planting till the end of experiment (one year). Thus, it can be assumed that, NPK requirement of Robinia seedlings is less than that of *Pinus radiata*. Legumes usually fix N and it might be assumed that growing Robinia plant obtains sufficient N to satisfy most of their requirements. Moreover the higher NPK fertilization may affect nodule development and consequently N_2 fixation. In this respect, Heyland and Puhl, (1986) with faba bean, reported that, nitrate fertilizer diminished the intensity of root infection by Rhizobium and decreased nodule development. In this respect data in Table (5) demonstrated that, significant effects were recorded in plant height, root length, stem diameter [96.78,101.78(cm), 75.96 ,93.6(cm) and 1.39,1.55(mm)] in the first and second seasons respectively which were observed for plants treated with 9g/pot from mixture fertilizer (P and K). This effect was observed at the first and second seasons compared with the reduction in values recorded for all parameters when plants were treated with the low rate of fertilizers.

Bulatova and Pomoz (1984) reported that activity of the enzyme system of IAA synthesis in all plant organs decreased with N, P and K deficiency. It is, therefore, possible that the effect of mixture fertilizers level on plant observed here may have been induced as a result of promotion or inhibition of cell elongation or cell division or by changes in endogenous plant hormone levels. These results are in agreement with those of Abd El-Wahab (2007), Mauyo, *et al*.(2008).

On the other hand, data presented in Table (6) revealed that the shortest irrigation interval (3days) produced significant effect on fresh and dry weight of shoots and roots during the two seasons which recorded 85.50,78.75 and 30.95,28.18 g and 70.38,88.25 and 24.75 ,31.75 g respectively compared to the reduction in

values recorded with increasing irrigation interval.. These results are in agreement with those of Baher *et al*, (2002) who found that increased soil water stress decreased plant height and total fresh and dry weights.

Table 5: Effect of the interaction between irrigation interval and fertilizers mixture on growth characteristic of *Robinia Pseudoacacia* during 2009/2010 and 2010/2011 seasons

		Season I					Season II				
		Plant height (cm)									
Fertilizer / Irrigation		Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)	Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)
3 days		90.20	94.0	109.0	108.0	97.13	95.0	98.0	115.0	113.0	102.08
5 days		60.0	63.0	88.0	109.0	79.75	65.0	67.0	75.0	100.33	80.0
7 days		53.20	55.67	68.66	87.0	66.13	55.30	60.0	70.0	92.0	69.33
Mean (A)		67.80	70.89	88.55	96.78	///////	71.77	75	86.67	101.78	///////
L.S.D 5%	A	3.24					3.33				
	B	3.24					3.33				
	A.B	5.62					5.30				
		Root length (cm)									
3days		30.0	31.33	56.0	71.33	47.17	50.0	55.0	67.0	85.0	64.25
5 days		36.0	36.0	62.67	75.67	52.59	45.0	60.0	74.0	95.0	68.50
7 days		39.0	38.0	66.83	80.60	56.11	43.0	69.0	78.0	99.0	72.25
Mean (A)		35.0	35.11	61.83	75.86	///////	64.0	61.33	73.00	93.0	///////
L.S.D 5%	A	1.32					1.14				
	B	1.32					1.14				
	A.B	2.29					2.13				
		Stem diameter (mm)									
3 days		0.98	1.12	1.85	1.33	1.38	1.40	1.44	1.80	1.50	1.54
5 days		0.90	0.97	1.03	1.80	1.17	1.35	1.40	1.47	1.80	1.48
7days		0.60	0.70	0.52	1.04	0.72	0.90	1.0	1.30	1.36	1.14
Mean (A)		0.83	0.93	1.13	1.39	///////	1.22	1.28	1.42	1.55	///////
L.S.D 5%	A	0.05					0.05				
	B	0.05					0.05				
	A.B	0.08					0.11				

Table 6: Effect of the interaction between irrigation interval and mixture fertilizers on growth characteristic of *Robinia Pseudocacia* during 2009/2010 and 2010/2011 seasons.

		Season I					Season II				
		F.W. of V.G(g)									
Fertilizer / Irrigation		Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)	Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)
3 days		33.0	39.0	150.0	120.0	85.50	48.0	55.0	122.0	90.0	78.75
5 days		30.0	33.0	45.0	146.0	63.50	45.0	48.0	62.0	120.0	68.75
7 days		29.33	30.33	36.67	56.33	38.17	44.0	45.33	50.0	72.0	52.83
Mean (A)		30.78	34.11	77.22	107.44	///////	45.67	49.44	87.0	94.0	///////
L.S.D 5%	A	2.63					2.69				
	B	2.63					2.69				
	A.B	4.56					4.50				
		D.W. of V.G(g)									
3 days		13.20	15.60	52.0	43.0	30.95	19.20	22.0	41.0	30.50	28.18
5 days		12.0	13.20	15.17	51.33	26.17	18.0	19.30	24.0	40.0	25.33
7 days		11.60	12.0	14.40	18.10	14.03	17.60	18.0	20.0	28.0	20.90
Mean (A)		12.27	13.60	27.19	37.47	///////	18.27	19.77	28.33	32.83	///////
L.S.D 5%	A	0.69					0.77				
	B	0.69					0.77				
	A.B	1.19					1.54				
		F.W. of Roots									
3 days		30.0	35.0	121.52	95.0	70.38	50.0	80.0	125.0	98.0	88.25
5 days		29.0	37.67	49.56	120.0	59.05	43.0	75.0	89.0	123.50	82.63
7 days		25.0	30.43	31.89	45.33	33.16	29.0	45.0	65.0	70.0	52.25
Mean (A)		28.0	34.37	67.65	86.78	///////	40.67	66.67	93.0	97.17	///////
L.S.D 5%	A	1.38					1.41				
	B	1.38					1.41				
	A.B	2.39					1.90				
		D.W. of roots(g)									
3 days		12.0	14.66	40.33	32.0	24.75	20.0	32.0	42.0	33.0	31.75
5 days		11.50	15.67	16.40	40.0	20.89	17.20	30.0	33.60	41.0	30.45
7 days		10.0	9.77	10.83	15.50	11.53	11.60	18.0	26.0	28.0	20.90
Mean (A)		11.17	13.36	22.52	29.0	///////	16.27	26.67	33.87	34.0	///////
L.S.D 5%	A	0.29					1.11				
	B	0.29					1.11				
	A.B	0.51					1.31				

I-3 Effect of the interaction between irrigation interval and mixture fertilizer:

Data presented in Table (5) indicated that interaction between irrigation interval and mixture fertilization rates had significant effect on plant height and stem diameter, as the highest value was recorded when treated plants with the lowest irrigation interval and mean fertilizer level (3 days irrigation and 6g/pot fertilizer mixture) during two seasons which recorded 109,115.0 cm and 1.85,1.80 mm respectively Similar effects were obtained when plants were treated with the maximum level of fertilizer of 9g/pot and 5days, irrigation intervals. This effect was non significant on plant height and stem diameter from the other previously mentioned. Moreover, data presented in Table (6) showed that the interaction between irrigation interval and fertilization mixture rate had a significant effect on fresh and dry weight of shoots and roots during the two seasons , the highest values were recorded when plant were subjected to either (3 days irrigation interval and 6 g/pot mixture fertilizer) which recorded 150.0,122.0 and 52.0,41.0 g for shoots and 121.25,125 and 40.33,42 g for roots or 5days irrigation interval and 9 g/pot mixture fertilizer and non significant between them which recorded (146.0,120.0 and 51.33,40.0 g) for shoots and (120.0,123.50 and 40.0,41.0 g) for roots respectively. These results were in harmony with obtained by Ahmed and Abed El Azim, (2009) and Mary *et al.* (2012) who found that whole plant growth was enhanced more by minimizing water stress than by increasing fertilizer concentration.

Table 7: Effect of the interaction between irrigation interval and mixture fertilizers on chemical composition of *Robinia Pseudoacacia* during 2009/2010and 2010/2011 seasons.

		Season I					Season II				
		N%									
Fertilizer / Irrigation		Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)	Control	L_1 3gm	L_2 6gm	L_3 9gm	Mean (B)
3 days		3.50	4.61	4.98	5.72	4.70	3.20	5.31	5.70	5.70	5.03
5 days		2.30	2.94	4.61	5.62	3.86	2.80	4.64	5.31	5.36	4.53
7 days		2.20	2.86	4.23	4.61	3.47	2.50	4.55	4.85	4.90	4.20
Mean (A)		2.66	3.47	4.60	5.31	///////	2.83	4.83	5.29	5.39	///////
L.S.D 5%	A	0.11						0.08			
	B	0.11						0.08			
	A.B	0.21						0.16			
		P%									
3 days		0.18	0.29	0.47	0.62	0.50	0.20	0.31	0.50	0.65	6.42
5 days		0.15	0.27	0.30	0.45	0.29	0.17	0.30	0.33	0.49	0.33
7 days		0.10	0.20	0.24	0.28	0.21	0.12	0.22	0.27	0.32	0.23
Mean (A)		0.14	0.25	0.34	0.45	///////	0.16	0.28	0.34	0.49	///////
L.S.D 5%	A	0.07						0.08			
	B	0.05						0.07			
	A.B	0.01						0.02			
		K%									
3 days		3.30	3.78	3.99	4.30	4.75	3.00	3.50	3.69	3.90	3.52
5 days		3.20	3.31	3.90	4.00	3.60	2.90	3.20	3.60	3.80	3.27
7 days		2.60	2.93	3.18	3.37	3.02	2.30	2.60	2.80	3.0 0	2.67
Mean (A)		3.03	3.34	3.69	3.89	///////	2.73	3.10	3.36	3.56	///////
L.S.D 5%	A	0.14						0.13			
	B	0.22						0.14			
	A.B	0.26						0.17			

II- Chemical composition:

I1-1 Effect of irrigation intervals:

Data presented in Table (7) demonstrated that, prolonging irrigation interval from 3 to 7 days significantly decreased N, P and K% during the two seasons as, the highest depression in these nutrients was observed when plant irrigation interval was 7 days during the two seasons which recorded 3.47,4.20 N%, 0.21,0.23 P% and3.02,2.85. K% respectively. According to the previous results, this may be due to the vital role of water supply at adequate amount for different physiological processes *(*El Manayeri, *et al.,* 1983*)*. Also inhibition of photosynthetic efficiency under insufficient water condition. *(Siddique, et al., 1999)*.

II-2 Effect of NPK fertilizers:

Data presented in Table (7) showed that, N, P and K% enhanced by increasing fertilizer mixtures level from 3 to 9g/pot as the significant positive effect in N, P and K (5.31,5.39N%, 0.45,.0.49 P% and 3.56,3.66 K%) during the two seasons respectively was obtained at 9g mixture fertilizer/pot. Rathore *et al, (*1991) found that application of P increased uptake of N, P and K, also Lal and Lal*, (1990)* reported that uptake of N, P and, K increased as N,P , K rate increased. Similar results were obtained by Amin, (1994*)*. Increasing nitrogen dose by

nitrogen fertilization enhanced the plant to absorb more nitrogen at more rapid rate than the other constituents of plant tissues (, Ahmed and Abed El Azim.,2009).

II-3 Effect the of interaction between irrigation interval and mixture fertilizer:

Data presented in Table (7) indicated that, the interaction between irrigation interval and fertilization rates on N, P, K%, was significant, the highest values were recorded with irrigation every 3 days and 9g/pot from fertilizer mixture, as5.72,5.70N%, 0.62,0.65P%, and4.30,3.90K %. during the two seasons, respectively. Plant growth was enhanced more by minimizing water stress than by increasing fertilizer concentration.

Conclusion:

- In two plants under investigation (*Pinus radiate* and *Robinia pseudoacacia*),it was observed that, whole plant growth was affected more by water deficiency than by increasing fertilizer level.
- Thus, fertilization schedule should be taken into consideration to fulfill the optimum nutritional plant requirements.
- Also we need more studies to achieve the ideal requirements of each plant for water to help for more prevention of water loss.

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