

Effect Of Potassium Humate On Walnut Seedling Growth

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SUMMARY: This study was carried out in Ordu (Türkiye), in 1999 and 2000 years. In this study, it was researched that the effects of K-Humate (Potassium Humate 120 g/L; polymeric polyhydroxy acids, humic and fulvic acids) on diameter and length growth of walnut seedlings. As a result of this study, the doses were significant in seedling growth in both of 1999 and 2000 years. Doses X Periods interaction for diameter growth was significant. The highest length growth was obtained in total 1.50 ml (0.50 ml and three times in the growing period) K-Humate / seedling treatment. The highest diameter growth was obtained in same dose and first period (June 15-July 15).

Key words : Walnut, seedling, growth, humate, potassium.

Potasyum Humatin Cevizde Çöğür Gelişimi Üzerine Etkisi

ÖZET: Bu çalışma, 1999 ve 2000 yıllarında Ordu'da yürütülmüştür. Çalışmada, potasyum humatın (120 g/L; polimerik polyhydroxy asitler, humik and fulvik asitler) ceviz çöğürlerinde çap ve boy gelişimi üzerine etkileri araştırıldı. Çalışma sonucunda, dozların çöğür gelişimi üzerine etkisi her iki yılda da önemli bulunmuştur. Çap gelişiminde dozXperiyot interaksyonu önemli çıkmış olup, en fazla boy gelişimi çöğür başına toplam 1.50 ml (3 dönemde, 0.50'şer ml) potasyum humate'in verildiği doz2 uygulamasında ve en fazla çap gelişimi yine aynı dozda ve 1. dönemde (15 Haziran-15 Temmuz) elde edilmiştir.

Anahtar Kelimeler : Ceviz, çöğür, gelişme, humat, potasyum.

INTRODUCTION

Although, in modern fruit growing, use of vegetative rootstocks are essential for growing of young trees, seedling rootstocks have been used in walnut growing in Turkey. In the rootstock growing, period from seed sowing to selling of young trees must be shortened. In the other words, the production period for rootstocks must be shortened. So, some technical and cultural practices and ecological conditions are effect this period.

Subtropical climate conditions in coastal line of Mediterranean region are advantage for growing of young trees, and seedlings of some fruit species that its seeds are stratificated in November is grafted in early June (Küden and Kaşka, 1990).

Patch-budding grafting method is used in walnut, generally. For do this, seedlings must be 1-2 cm diameter (Şen, 1986).

Humus is composed of three groups of materials: Humic acids, fulvic acids and humins that are used in agriculture widespread, and these materials have plant growth regulators properties (Çağlar, 1958).

Humic and fulvic acids are includes same amino acids. The contents of basis amino acid in humic acids are higher than fulvic acids (Stevenson, 1982).

Humic acids improve plant nutrition, especially on uptake and suitability of micro elements (Böhme and Thi Lua, 1997). Just as, it was determined that the humic acids have a important effect on phosphorus and iron nutrition of plants (Fagbenro and Agboola, 1983; Martinez et al., 1983; Barnes and Chen, 1991; Garcia et al., 1995).

David et al. (1994) were observed that humic acid treatments were increased P, K, Ca, Mg, Mn and Zn contents in stems, and N, Ca, Fe, Zn and Cu contents in

roots in tomato seedlings. Also, humic acid treatments were increased the fresh and dry weights of seedlings.

The treatment of humic acid have been decreasing and even destroying the negative effects of chemical fertilizers and pesticides (Lee and Barlette, 1976; Linehan, 1978; Pal and Sengupta, 1985).

The aim of this research was to determine the effect of potassium humate on seedlings growth in walnut.

MATERIALS AND METHODS

This study was conducted on walnut seedlings in Ordu (Turkey) ecological conditions in 1999 and 2000 years. Seeds were sowed distance of 30 X 100 cm to field without any application at last February. Plastic tunnel was used for early germination during two months. Seeds were taken from different cultivars. Size of seed was similar, and these seeds were stored in natural conditions until last February.

Treatments were made when the seedlings were in 9.5 cm for length and 4.5 mm for diameter. Measurements were made in seedlings that were in almost similar length and diameter.

The experimental designed was a randomized complete block design with three replicates. 15 seedlings for each replicate were used, and trickle irrigation system was used.

In total 225 seedlings, diameter measurement was made in 5 cm of shoot above surface of soil, and length measurement was made between point of shoot and surface of soil in three period (15 June-15 July, 15 July-15 August, and 15 August-15 September for 1999 and 2000 years).

Doses	15.06.1999/2000	15.07.1999/2000	15.08.1999/2000	Total
1-Control				
2-Dose 1	0.25 ml	0.25 ml	0.25 ml	0.75 ml
3-Dose 2	0.50 ml	0.50 ml	0.50 ml	1.50 ml
4-Dose 3	1.00 ml	1.00 ml	1.00 ml	3.00 ml
5-Dose 4	2.00 ml	2.00 ml	2.00 ml	6.00 ml

4 doses of potassium-humate (polymeric polyhydroxy acids, humic and fulvic acids, 120 g/l) were treated three times in the growing period to seedlings as follows:

RESULTS AND DISCUSSION

K-Humate doses had a significant effect on diameter and length growth in seedlings (Table 1) for first year.

The highest average length growth was for the dose 2 (11.98 cm), the lowest for the control (6.56 cm); the highest average length growth (15.61 cm) as period was for the first period between mid June and July, the lowest (2.12 cm) for the third period between mid August and September (Table 2).

The highest average diameter growth was for the dose 2 (4.71 mm), the lowest for the control (1.91); the highest average diameter growth as period was for the first period (15.06.1999-15.07.1999) (4.59 mm), the lowest for the third period (15.08.1999-15.09.1999) (2.52 mm). The highest average diameter growth (6.62 mm) was for the combination dose 2, first period, and

the lowest (0.04 mm) control, third period (Table 2).

The second year results are similar to first year results (Table 3).

The highest average length growth was for the dose 3, 2 and 1, respectively. The lowest for the control (6.60 cm); the highest average length growth (15.05 cm) as period was for the first period between mid June and July, the lowest (2.09 cm) for the third period between mid August and September (Table 4).

The highest average diameter growth was for the dose 2 (4.57 mm), the lowest for the control (1.90); the highest average diameter growth as period was for the first period (15.06.2000-15.07.2000) (4.37 mm), the lowest for the second period (15.07.2000-15.08.2000) (2.40 mm) and third period (2.66 mm). The highest average diameter growth (6.02 mm) was for the combination dose 2, first period, and the lowest (0.07 mm) control, third period (Table 4).

Table 1. Variance analysis for the effect of K-Humate on length and diameter growth in seedlings in 1999.

Source	Degree of freedom	Length growth (cm)		Diameter growth (mm)	
		Mean of squares	F	Mean of squares	F
Replicate	2	3,575	0,361 ns	0,246	0,484 ns
Doses	4	42,389	4,284 **	10,961	21,568 **
Periods	2	701,244	70,878 **	18,742	36,880 **
Dose x Period	8	5,481	0,554 ns	4,411	8,680 **
Error	28	9,894		0,508	
General	44	43,183		2,985	

ns: not significant, **: significant at 0.01 probability level.

Table 2. The length and diameter growth in walnut seedlings in 1999

Doses	Periods						Average	
	1.(15.06.-15.07)		2.(15.07-15.08)		3. (15.08-15.09)		Length growth (cm)	Diameter growth (mm)
	Length growth (cm)	Diameter growth (mm)	Length growth (cm)	Diameter growth (mm)	Length growth (cm)	Diameter growth (mm)		
Control	12,20	2,73 fg ¹	7,15	2,98 defg	0,33	0,04 h	6,56 b ²	1,91 C ³
Dose 1	16,60	4,71 bc	13,30	2,94 defg	1,57	2,80 efg	10,49 ab	3,48 B
Dose 2	17,67	6,62 a	14,77	3,28 cdefg	3,51	4,22 bcdef	11,98 a	4,71 A
Dose 3	16,60	4,39 bcde	10,74	2,48 g	4,16	4,88 b	10,50 ab	3,92 AB
Dose 4	14,96	4,52 bcd	8,19	2,50 g	1,04	0,63 h	8,06 ab	2,55 C
Average	15,61 A ⁴	4,59 a ⁵	10,83 B	2,84 b	2,12 C	2,52 b		

¹ LSD (% 1): 1.61, ² LSD (% 1): 4.10, ³ LSD (% 1): 0.93 ⁴ LSD (% 1): 3.17, ⁵ LSD (% 1): 0.72

At the result of combined analysis for two years, it was determined that K-Humate doses had a significant effect on diameter and length growth in seedlings (Table 5).

The highest average length growth was for the dose

2,3 and 1, respectively. The lowest for the control (6.58 cm); the highest average length growth (15.33 cm) as period was for the first period between mid June and mid July, the lowest (2.09 cm) for the third period between mid August and mid September (Table 6).

Table 3. Variance analysis for the effect of K-Humate on length and diameter growth in seedlings in 2000.

Source	Degree of freedom	Length growth (cm)		Diameter growth (mm)	
		Mean of squares	F	Mean of squares	F
Replicate	2	18,183	2,850 ns	0,336	0,756 ns
Doses	4	56,212	8,812 **	12,585	28,307 **
Periods	2	674,134	105,677 **	17,118	38,502 **
Dose x Period	8	8,555	1,341 ns	3,853	8,667 **
Error	28	6,379		0,445	
General	44	42,194		2,921	

ns: not significant, **: significant at 0.01 probability level.

Table 4. The length and diameter growth in walnut seedlings in 2000

Doses	Periods						Average	
	1.(15.06.-15.07)		2.(15.07-15.08)		3. (15.08-15.09)		Length growth (cm)	Diameter growth (mm)
	Length growth (cm)	Diameter growth (mm)	Length growth (cm)	Diameter growth (mm)	Length growth (cm)	Diameter growth (mm)		
Control	11,83	2,63 d ¹	7,55	3,00 cd	0,41	0,07 f	6,60 b ²	1,90 C ³
Dose 1	17,17	4,95 ab	13,07	2,16 de	1,63	2,83 d	10,62 a	3,31 B
Dose 2	14,89	6,02 a	15,44	2,66 d	4,27	5,02 ab	11,53 a	4,57 A
Dose 3	18,25	5,03 ab	14,32	2,40 de	3,07	4,43 bc	11,88 a	3,96 AB
Dose 4	13,09	3,22 cd	7,32	1,80 de	1,04	0,95 ef	7,15 b	1,99 C
Average	15,05 A ⁴	4,37 a ⁵	11,54 B	2,40 b	2,09 C	2,66 b		

¹ LSD (% 1): 1,51, ² LSD (% 1): 3,29, ³ LSD (% 1): 0,87 ⁴ LSD (% 1): 2,55, ⁵ LSD (% 1): 0,67

Table 5. The combined analysis for the effect of K-Humate on length and diameter growth in seedlings for 1999 and 2000 years.

Source	Degree of freedom	Length growth (cm)		Diameter growth (mm)	
		Mean of squares	F	Mean of squares	F
Years	1	0,031	0,004 ns	0,649	1,361 ns
ReplicateX(Year)	4	10,879	1,337 ns	0,291	0,611 ns
Doses	4	95,283	11,711 **	23,296	48,901 **
YearXDose	4	3,318	0,408 ns	0,249	0,524 ns
Periods	2	1372,334	168,666 **	35,214	73,917 **
YearXPeriod	2	3,045	0,374 ns	0,646	1,357 ns
DoseXPeriod	8	10,762	1,323 ns	7,693	16,148 **
YearXDoseX Period	8	3,273	0,402 ns	0,571	1,199 ns
Error	56	8,136		0,476	
General	89	42,209		2,927	

ns: not significant, **: significant at 0.01 probability level.

Table 6. The length growth in walnut seedlings for 1999 and 2000 years

Doses	Years	Periods			Doses average
		1. 15.06.- 15.07.	2. 15.07.- 15.08.	3. 15.08.- 15.09.	
Control	1999	12,20	7,15	0,33	
	2000	11,83	7,55	0,41	
	Average	12,02	7,35	0,37	6,58 B ¹
Dose1	1999	16,60	13,30	1,57	
	2000	17,17	13,07	1,63	
	Average	16,88	13,19	1,60	10,56 A
Dose2	1999	17,67	14,77	3,51	
	2000	14,89	15,44	4,27	
	Average	16,28	15,10	3,89	11,76 A
Dose3	1999	16,60	10,74	4,16	
	2000	18,25	14,32	3,07	
	Average	17,42	12,53	3,62	11,19 A
Dose4	1999	14,96	8,19	1,04	
	2000	13,09	7,32	1,04	
	Average	14,03	7,75	1,04	7,61 B
Periods average		15,33 A²	11,19 B	2,10 C	

¹ LSD (% 1): 2,54, ² LSD (% 1): 1,96

The highest average diameter growth was for the dose 2 (4.64 mm), the lowest for the control (1.91); the highest average diameter growth as period was for the first period (15.06.-15.07.) (4.48 mm), the lowest for the third period (15.08.-15.09.) (2.59 mm) and third period (2.66 mm). The highest average diameter growth (6.32 mm) was for the combination dose 2, first period, and the lowest (0.06 mm) control, third period (Table 7). The highest difference between first and third period point of the length growth as average of two years was determined as 35.28 cm (395.10 %) in dose 2, and the lowest difference 19.74 cm (210.00 %) in control (Table 8 and Figure 1).

The highest difference between first and third period for the diameter growth as average of two years was 13.91 mm (424.10 %) in dose 2, and the lowest difference 4.94 mm (80.10 %) in control (Table 8).

The most rapid growing period for the length and diameter in seedlings was first period (15.06-15.07), and the slowest period was third period (15.08-15.09). This results are similar to study that was carried out in Van

(Eastern Turkey) ecological conditions in wild apricot types (Bostan and İslam, 1997).

Table 7. The diameter growth in walnut seedlings for 1999 and 2000 years

Doses	Years	Periods			Doses average
		1. 15.06.- 15.07.	2. 15.07.- 15.08.	3. 15.08.- 15.09.	
Control	1999	2,73	2,98	0,04	
	2000	2,63	3,00	0,07	
	Average	2,68 CD¹	2,99 CD	0,06 F	1,91 C ²
Dose1	1999	4,71	2,94	2,80	
	2000	4,95	2,16	2,83	
	Average	4,83 AB	2,55 CD	2,81 CD	3,40 B
Dose2	1999	6,62	3,28	4,22	
	2000	6,02	2,66	5,02	
	Average	6,32 A	2,97 CD	4,62 B	4,64 A
Dose3	1999	4,39	2,48	4,88	
	2000	5,03	2,40	4,43	
	Average	4,71 B	2,44 CD	4,66 B	3,94 B
Dose4	1999	4,52	2,50	0,63	
	2000	3,22	1,80	0,95	
	Average	3,87 BC	2,15 DE	0,79 EF	2,27 C
Periods average		4,48 A ³	2,62 B	2,59 B	

¹ LSD (% 1): 1,50, ² LSD (% 1): 0,61, ³ LSD (% 1): 0,48

The highest values obtained in dose 2 (1.50 ml K-Humate) for the both of length and diameter growth, and the lowest values were in control. Just as, in the other studies, the effects of humic acid (Eko-Fer, K-Humate and Uptake) and K-Humate on yield, yield components, nutrient element composition in pepper, seed germination in hazelnut, growth and nutrient uptake in teak seedlings, and growth in tomato seedlings were studied (Fagbenro and Agboola, 1983; Davit et al., 1994; Aydın, et al., 1999; Bostan, et al, 2000). In other words, as in the other studies, K-Humate was increased the seedling growth.

In conclusion, in our study, the K-Humate treatments increased the seedling growth, and shortened the period from seed sowing to grafting. As a result of this study, we recommended dose 2 of K-Humate for rapid growth in walnut seedlings.

Table 8. The first (15.06.1999 and 2000) and third (15.09.1999 and 2000) measurements for the length and diameter, total growth difference, and percentages of increase for length and diameter growth in seedlings

Treatment	Length (cm)				Diameter (mm)			
	15.06	15.09	Difference	%	15.06	15.09	Difference	%
Control	9,40	29,14	19,74	210,0	6,17	11,11	4,94	80,1
Dose 1	9,76	41,43	31,67	324,5	4,23	14,42	10,19	240,9
Dose 2	8,93	44,21	35,28	395,1	3,28	17,19	13,91	424,1
Dose 3	9,04	40,95	31,91	325,9	3,77	15,58	11,81	313,3
Dose 4	9,91	32,73	22,82	230,3	5,24	12,05	6,81	129,9

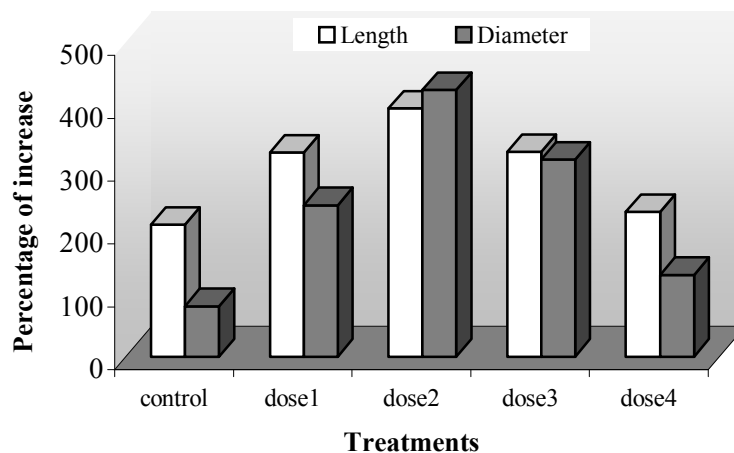


Figure 1. The effects of different K-Humate doses on percentage of increase for length and diameter growth in walnut seedlings

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