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Effect of Some Chemical and Bio-Fertilizer Treatments on Growth of Kochia, *Kochia scoparia* L. Plant

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Abstract: The experiment was carried out on Kochia scoparia L. plant at the nursery of Department of Ornamental Horticulture Plants, Faculty of Agriculture, Cairo University in two seasons of 2013 and 2014. The plants grown in 30 cm plastic pots filled with loamy soil. The plants were treated with different levels and combinations of Ammonium sulphate, Nitrobein and Phosphorein. Results showed that Nitrobein at 1 g/pot treatment achieved the tallest plants. Nitrobein at 2 g/pot treatment gave the greatest plant circumference. Ammonium sulphate at 6 g/pot+ Nitrobein at 2 g/pot + Phosphorein at 2 g/pot treatment resulted in the highest fresh and dry weights of vegetative growth. Nitrobein at 3 g/pot treatment gave the highest content of total carbohydrates. Ammonium sulphate at 9 g/pot + Nitrobein at 3 g/pot+ Phosphorein at 3 g/pot treatment achieved the highest nitrogen %. It is recommended for fertilization of Kochia scoparia L. plants to apply Ammonium sulphate at 6 g/pot + Nitrobein at 2 g/pot+ Phosphorein at 2 g/pot.

Key words: *Kochia scoparia* · Ammonium sulphate · Nitrobein · Phosphorein · Growth

INTRODUCTION

Kochia scoparia L. Schrader (Summer-cypress) of the family Chenopodiaceae is an herb, distributed along the roadsides, canal banks, field margins and other waste places in salt marsh, sedge-rush, mountain brush. Originally native to southern and Eastern Russia, it was introduced to North America from Europe. Because of low water requirement and resistance to diseases and insects, it has been grown as a drought-resistant forage crop and nicknamed as poor man's alfalfa [1].

Nitrogen is a constituent of many important molecules, including proteins, nucleic acids, certain hormones (e.g., indole-3-acetic acid; cytokinin) and chlorophyll. Phosphorus (P) is second only to Nitrogen (N) as the most limiting element for plant growth [2]. The concentration of soluble Phosphorus in soil ranges from 0.05 to 10 ppm and in soil, more than 80% of Phosphorus becomes immobile and unavailable for plant uptake because of adsorption, precipitation or conversion to organic form [3, 4]. The fixed form in alkaline soil is tri-calcium phosphate, Ca3 (PO4)2, while in acidic soil, it is mainly FePO4 and AlPO4 [5].

Biofertilizers consist mainly of beneficial microorganisms that can release nutrients from raw materials and plant residues in the soil and make them available [6].

Most soils of Egypt have alkaline pH, which result in converting phosphorus content to unavailable form, mainly as tri-calcium phosphate. Applying phosphate solubilizing bacteria increase the available phosphorus for plants [7].

Objective of this study was to investigate the effect of some chemical and bio fertilizers treatments on growth of *Kochia scoparia* L. plant.

MATERIAL AND METHODS

The experiment was carried out at the nursery of the Department of Ornamental Horticulture Plants, Faculty of Agriculture, Cairo University in the two seasons of 2013 and 2014, The seeds of *Kochia scoparia* L. plants were sown in the sunny nursery on the 5th of March. One month later, seedlings were transplanted individually

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into 30cm plastic pots filled with loamy soil the physical and chemical characteristics of the soil experiment field were determined and are shown in (Table, a) [8]. Pots of the experiment were divided into 13 groups where received a certain fertilization treatment. Each treatment was replicated 3 times, with 6 pots in each replicate.

Table a: Physical and chemical characteristics of the nursery soil used for growing *Kochia scoparia* L. during two seasons 2013 and 2014

Physical characteristics			Chemical characteristics		
	2013	2014		2013	2014
Texture	Clay	Clay	Soluble cations (meq/l)		
Clay(%)	37.1	40.5	Ca++	7.00	7.22
Silt(%)	36.2	35.1	Mg++	2.87	2.98
Fine sand (%)	22.9	21.0	K+	0.27	0.33
Coarse sand (%)	3.80	3.40	Na+	5.88	6.22
Ph	8.03	7.88	Soluble anions (meq/l)		
EC dS/m	1.65	1.63	Cl-	3.60	3.50
Organic matter%	1.50	1.70	SO4-	2.38	2.45
----	----	----	Available N(ppm)	27.0	30.1
----	----	----	Available P(ppm)	20.5	22.5

The Following Fertilization Treatments Were Done: Control (untreated plants), Ammonium sulphate at 3 g/pot, Ammonium sulphate at 6 g/pot, Ammonium sulphate at 9 g/pot, Nitrobein at 1 g/pot, Nitrobein at 2 g/pot, Nitrobein at 3 g/pot, Phosphorein at 1 g/pot , Phosphorein at 2 g/pot, Phosphorein at 3 g/pot, Ammonium sulphate 3 g + Nitrobein 1 g + Phosphorein 1 g /pot, Ammonium sulphate 6 g+ Nitrobein 2 g + Phosphorein 2 g /pot and Ammonium sulphate 9 g + Nitrobein 3 g + Phosphorein 3 g /pot.

Data recorded after 4 months from transplanting. Plant height, plant circumference, fresh weight of vegetative growth and dry weight of vegetative growth were recorded.

Contents of total chlorophylls and carotenoids contents were estimated according to Moran [9], total carbohydrates contents according to AOAC [10], Nitrogen contents according to Pregl [11], Phosphorus contents according to King [12] and Potassium contents according to Isaac and Kerber [13]. The vegetative growth data were statistically analyzed using SAS 1995 computer program. Analysis of variance was carried out [14]. Means were compared by Duncan critical range at a probability level of 5% [15]. A randomized complete block design was adopted.

RESULTS AND DISCUSSION

Vegetative Growth

Effect of Fertilization Treatments on Plant Height (cm): The effect of fertilization treatments on plant height was significant in both seasons (Table, 1). The tallest plants in the first season were those treated with Ammonium sulphate at either 3 or 6 g/pot, in addition to those treated with Nitrobein at 1 g/pot (105.67, 104.33 and 104.33 cm, respectively). Height of plants treated with Phosphorein at 1 g/pot (102.33 cm) belonged also to this category. The shortest plants were belonged to the untreated control plants (25.00 and 24.00 cm) in both seasons, respectively, in addition to those treated with Phosphorein at 3 g/pot (85.00 and 36.00 cm) in both seasons, respectively or Phosphorein at 1, 2 or 3 g/pot in the second season (38.33, 37.00 and 36.00 cm, respectively). Generally, plant height in the first season was more than in the second one maybe attributed to some environment factors such as temperature, humidity and sunlight etc.

These results are in agreement with the findings of several researchers who reported that inoculation of flax seed with Nitrobein alone increased stem length significantly, that plant height of lemon grass increased by using some varieties of phosphate solubilizing bacteria, biofertilization with phosphate solubilizing bacteria increased plant growth of sesame and different sources of nitrogen (ammonium nitrate or ammonium sulphate) or bio-fertilizers (Biogein or Nitrobein) increased plant height of guar plants (*Cyamopsis tetragonoloba*) [16-19].

Effect of Fertilization Treatments on Plant Circumference (cm): The effect of fertilization treatments on plant circumference was significant in the two seasons (Table, 1). The widest plants resulted when Nitrobein at either 1 or 2 g/pot (71.33 and 71.67 cm) respectively in the first season. In the second one, corresponding plants were those treated with Nitrobein at 2 g/pot (69.67 cm). The thinnest plants were belonged to the untreated

Table 1: Effect of fertilization treatments on plant height (cm) and plant circumference (cm) of *Kochia scoparia* L. during two seasons 2013 and 2014

	Plant height (cm)		Plant circumference (cm)	
Fertilization treatments	1st season	2nd season	1st season	2nd season
Control	25.00 h	24.00 f	16.00 f	16.67 e
Ammonium sulphate 3 g/pot/30 cm	105.67 a	50.00 d	48.67 b-e	21.33 e
Ammonium sulphate 6 g/pot/30 cm	104.33 a	74.00 b	50.00 b-d	52.67 b
Ammonium sulphate 9 g/pot/30 cm	97.33 bc	61.33 c	50.33 b-d	50.33 b
Nitrobein 1 g/pot/30 cm	104.33 a	91.67 a	71.33 a	46.67 b
Nitrobein 2 g/pot/30 cm	94.67 c-e	92.33 a	71.67 a	69.67 a
Nitrobein 3 g/pot/30 cm	88.67 e-g	81.00 b	60.33 ab	47.00 b
Phosphorein 1 g/pot/30 cm	102.33 ab	38.33 e	38.00 de	20.33 e
Phosphorein 2 g/pot/30 cm	90.00 d-g	37.00 e	43.67 c-e	26.33 de
Phosphorein 3 g/pot/30 cm	85.00 g	36.00 e	53.00 bc	34.33 cd
Ammonium sulphate 3 g + Nitrobein 1 g+ Phosphorein 1 g /pot/30 cm	95.33 cd	82.00 ab	36.00 e	46.33 bc
Ammonium sulphate 6 g + Nitrobein 2 g+ Phosphorein 2 g /pot/30 cm	91.33 c-f	80.00 b	42.33 c-e	52.00 b
Ammonium sulphate 9 g + Nitrobein 3 g+ Phosphorein 3 g /pot/30 cm	87.00 fg	72.00 b	47.33 b-e	50.00 b

Means with the same letter in the same column are not significantly different.

Table 2: Effect of fertilization treatments on fresh and dry weight of vegetative growth (g/plant) of *Kochia scoparia* L. during two seasons 2013 and 2014

	Fresh weight (g/plant)		Dry weight (g/plant)	
Fertilization treatments	1st season	2nd season	1st season	2nd season
Control	16.39 h	15.68 f	13.92 h	13.32 f
Ammonium sulphate 3 g/pot/30 cm	43.81 g	38.81 e	37.23 g	32.99 e
Ammonium sulphate 6 g/pot/30 cm	84.37 c-e	90.82 a	71.71 b-e	77.19 a
Ammonium sulphate 9 g/pot/30 cm	78.62 de	75.90 bc	66.82 de	64.51 bc
Nitrobein 1 g/pot/30 cm	55.86 f	54.46 d	44.80 f	46.28 d
Nitrobein 2 g/pot/30 cm	83.41 c-e	54.56 d	49.25 f	46.37 d
Nitrobein 3 g/pot/30 cm	95.45 ab	79.22 bc	68.84 c-e	67.34 bc
Phosphorein 1 g/pot/30 cm	78.52 e	76.42 bc	66.74 e	64.95 bc
Phosphorein 2 g/pot/30 cm	86.30 c-e	84.27 ab	73.35 b-d	71.62 ab
Phosphorein 3 g/pot/30 cm	88.75 bc	83.60 ab	75.43 b	71.06 ab
Ammonium sulphate 3 g + Nitrobein 1 g+ Phosphorein 1 g /pot/30 cm	90.28 bc	71.95 c	76.73 b	61.16 c
Ammonium sulphate 6 g + Nitrobein 2 g+ Phosphorein 2 g /pot/30 cm	102.53 a	88.56 a	87.15 a	75.27 a
Ammonium sulphate 9 g + Nitrobein 3 g+ Phosphorein 3 g /pot/30 cm	86.61 cd	72.50 c	73.61 bc	61.62 c

Means with the same letter in the same column are not significantly different.

control plants (16.00 and 16.67 cm) respectively in both seasons and those treated with Ammonium sulphate at 3 g/pot + Nitrobein at 1 g/pot + Phosphorein at 1 g/pot (36.00 cm) in the first season, in addition to those treated with Ammonium sulphate at 3 g/pot or Phosphorein at 1 g/pot (21.33 and 20.33 cm, respectively) in the second one. These results are in agreement with the findings of several researchers who reported that Nitrobein application caused a positive effect on growth characters in a number of plants including *Vicia faba*, periwinkle and dill [20-23].

Effect of Fertilization Treatments on Fresh Weight of Vegetative Growth (g/plant): The effect of fertilization treatments on fresh weight (g/plant) of vegetative growth was found to be significant in both seasons of this experiment (Table, 2). The heaviest fresh weight belonged to plants treated with Ammonium sulphate at 6 g/pot + Nitrobein at 2 g/pot + Phosphorein at 2 g/pot (102.53 and 88.56 g/plant) in the first and second seasons, respectively, in addition to plants treated with Ammonium sulphate at 6 g/pot (90.82 g/plant) in the second one. Plants treaded with Nitrobein at 3 g/pot in the first season (95.45 g/plant) or with Phosphorein at either 2 or 3 g/pot (84.27 and 83.60 g/plant) respectively in the second one, were not significantly different from the previous group. The lightest fresh vegetative growth weight belonged to the untreated control plants (16.39 and 15.68 g/plant) in the first and second seasons, respectively. These results are in agreement with the findings of several researchers who reported that bio and NPK fertilizer treatments significantly increase leaf fresh and dry weights in olive leaves, the highest values of all growth characters of quinoa plants were recorded at treatment of ammonium nitrate in combination with Nitrobein and calcium superphosphate in combination with Phosphorein [24, 25].

Table 3: Effect of fertilization treatments on total chlorophylls contents (mg/g/F.W.) and carotenoids contents (mg/g/F.W.) of *Kochia scoparia* L. during two seasons 2013 and 2014

	Total chlorophylls contents (mg/g/F.W.)		Carotenoids contents (mg/g/F.W.)	
Fertilization treatments	1st season	2nd season	1st season	2nd season
Control	1.17	1.18	0.48	0.48
Ammonium sulphate 3 g/pot/30 cm	1.03	0.91	0.47	0.57
Ammonium sulphate 6 g/pot/30 cm	1.49	1.79	0.48	0.47
Ammonium sulphate 9 g/pot/30 cm	1.32	0.98	0.47	0.45
Nitrobein 1 g/pot/30 cm	0.64	0.74	0.48	0.42
Nitrobein 2 g/pot/30 cm	0.79	0.85	0.39	0.39
Nitrobein 3 g/pot/30 cm	1.37	0.72	0.37	0.38
Phosphorein 1 g/pot/30 cm	0.93	0.87	0.40	0.43
Phosphorein 2 g/pot/30 cm	1.11	1.12	0.48	0.48
Phosphorein 3 g/pot/30 cm	0.94	0.94	0.46	0.46
Ammonium sulphate 3 g + Nitrobein 1 g+ Phosphorein 1 g /pot/30 cm	0.99	1.04	0.46	0.47
Ammonium sulphate 6 g + Nitrobein 2 g+ Phosphorein 2 g /pot/30 cm	2.01	1.47	0.49	0.47
Ammonium sulphate 9 g + Nitrobein 3 g+ Phosphorein 3 g /pot/30 cm	0.93	1.09	0.46	0.47

Effect of Fertilization Treatments on Dry Weight of Vegetative Growth (g/plant): The effect of fertilization treatments on dry weight (g/plant) of vegetative growth was significant in the two seasons of this experiment (Table, 2). The heaviest dry vegetative growth weight was a result of applying Ammonium sulphate at 6 g/pot + Nitrobein at 2 g/pot + Phosphorein at 2 g/pot treatment (87.15 and 75.27 g/plant) in the first and second seasons, respectively, in addition to those treated with Ammonium sulphate at 6 g/pot (77.19 g/plant) in the second season. Plants treated with Phosphorein at either 2 or 3 g/pot in the second season had significant effect on their dry weight of vegetative growth in the same first category (71.62 and 71.06 g/plant, respectively). The lightest dry vegetative growth weight belonged to the untreated control plants (13.92 and 13.32 g/plant) in the first and second seasons, respectively. These results are in agreement with the findings of several researchers who reported that application of biofertilizer (a mixture of *Azotobacter chroococcum, Azospirillum liboferum* and *Bacillus megaterium*) to fennel plants with 50% of the recommended dosage of chemical NPK increased plant fresh and dry weight compared to chemical fertilizer treatments only, supplying *Epipremnum aureum* plants with nitrogen using 2 g ammonium sulphate, 8 g compost and 4 ml Nitrobien biofertilizer per plant was very effective in stimulating foliage dry weight and different sources of nitrogen (ammonium sulphate) or bio fertilizers (Biogein or Nitrobein) increased dry weight of aerial part of guar plants (*Cyamopsis tetragonoloba*) [26, 27, 19].

Chemical Composition

Effect of Fertilization Treatments on Total Chlorophylls Contents (mg/g/F.W.): The effect of fertilization treatments on total chlorophylls contents (Table, 3). The highest contents in the first season were a result of applying Ammonium sulphate at 6 g/pot + Nitrobein at 2 g/pot + Phosphorein at 2 g/pot in addition to treatments of Ammonium sulphate at 6 g/pot or Nitrobein at 3 g/pot (2.01, 1.49 and 1.37 mg/g/F.W., respectively). In the second season, the corresponding value (1.79 mg/g/F.W.) was a result of using Ammonium sulphate at 6 g/pot. The lowest content of total chlorophylls belonged to plants treated with Nitrobein at 1 g/pot (0.64 and 0.74 mg/g/F.W.) in the first and second seasons, respectively, in addition to those treated with Nitrobein at 3 g/pot (0.72 mg/g/F.W.) in the second one. In another study on *Epipremnum aureum* plants that were treated with nitrogen using 2 g ammonium sulphate, 8 g compost and 4 ml Nitrobien biofertilizer per plant was very effective in stimulating plant pigments [27].

Effect of Fertilization Treatments on Carotenoids Contents (mg/g of fresh weight): The effect of fertilization treatments on carotenoids contents (Table 3). Irrespective of this, the highest content of carotenoids was detected in plants supplied with Ammonium sulphate at 6 g/pot + Nitrobein at 2 g/pot + Phosphorein at 2 g/pot in the first season and those treated with Ammonium sulphate at 3 g/pot in the second season (0.49 and 0.57 mg/g/F.W., respectively). The lowest recorded in the same regard

Table 4: Effect of fertilization treatments on total carbohydrates contents (% D.W.) and Nitrogen (% D.W.) of *Kochia scoparia* L. during two seasons 2013 and 2014

Fertilization treatments	Total carbohydrates contents (% D.W.)		Nitrogen (% D.W.)	
	1st season	2nd season	1st season	2nd season
Control	68.90	67.24	1.07	0.85
Ammonium sulphate 3 g/pot/30 cm	68.93	70.12	1.79	1.82
Ammonium sulphate 6 g/pot/30 cm	73.88	75.55	2.05	2.04
Ammonium sulphate 9 g/pot/30 cm	69.54	69.19	2.04	2.02
Nitrobein 1 g/pot/30 cm	67.70	68.87	0.67	0.70
Nitrobein 2 g/pot/30 cm	68.94	68.89	1.17	1.15
Nitrobein 3 g/pot/30 cm	79.21	79.34	0.90	0.98
Phosphorein 1 g/pot/30 cm	69.50	70.42	0.74	0.78
Phosphorein 2 g/pot/30 cm	75.38	79.00	0.72	0.93
Phosphorein 3 g/pot/30 cm	80.88	70.78	0.67	0.74
Ammonium sulphate 3 g + Nitrobein 1 g+ Phosphorein 1 g /pot/30 cm	70.23	72.60	2.02	2.03
Ammonium sulphate 6 g + Nitrobein 2 g+ Phosphorein 2 g /pot/30 cm	74.73	72.08	1.90	2.07
Ammonium sulphate 9 g + Nitrobein 3 g+ Phosphorein 3 g /pot/30 cm	66.52	67.38	2.15	2.17

belonged to plants treated with Nitrobein at 3 g/pot (0.37 and 0.38 mg/g /F.W.) in the first and second seasons, respectively.

Effect of Fertilization Treatments on Total Carbohydrates Contents (% D.W.): The effect of fertilization treatments on total carbohydrates contents (Table, 4). The highest percentage in the first season was produced by plants treated with Phosphorein at 3 g/pot or with Nitrobein at 3 g/pot (80.88 and 79.21 % D.W., respectively). In the second one, corresponding values were a result of using Nitrobein at 3 g/pot or with Phosphorein at 2 g/pot (79.34 and 79.00 % D.W., respectively). The lowest values belonged to plants supplied with Ammonium sulphate at 9 g/pot + Nitrobein at 3 g/pot + Phosphorein at 3 g/pot (66.52 % D.W.) in the first season and the untreated control plants in addition to those treated with Ammonium sulphate at 9 g/pot + Nitrobein at 3 g/pot + Phosphorein at 3 g/pot in the second one (67.24 and 67.38 % D.W., respectively). In another study on guar plants (*Cyamopsis tetragonoloba*) that were treated with different sources of nitrogen biofertilizers increased total carbohydrates contents [19].

Effect of Fertilization Treatments on Nitrogen Contents (% D.W.): The effect of fertilization treatments on nitrogen contents (Table, 4). The highest percentages of nitrogen in the first season were detected in plants that received Ammonium sulphate at 9 g/pot + Nitrobein at 3 g/pot + Phosphorein at 3 g/pot, followed by those fertilized with Ammonium sulphate at 6 g/pot (2.15 and 2.05% nitrogen). The heighest values in the second season were a result of applying Ammonium sulphate at 6 g/pot + Nitrobein at 2 g/pot + Phosphorein at 2 g/pot and Ammonium sulphate at 9 g/pot + Nitrobein at 3 g/pot + Phosphorein at 3 g/pot (2.07 and 2.17% nitrogen). The lowest percentages of the same element were obtained by Phosphorein at 1, 2 or 3 g/pot in addition to Nitrobein at 1 or 3 g/pot (0.74, 0.72, 0.67, 0.67 and 0.90% nitrogen, respectively) in the first season and Nitrobein at 1 g/pot (0.70 % nitrogen) in the second one. These results are in agreement with the findings of several researchers who reported that 750 mineral nitrogen plus 200-300g Nitrobein showed an increase in leaf nitrogen and different sources of nitrogen (ammonium nitrate or ammonium sulphate) increased nitrogen of guar plants (*Cyamopsis tetragonoloba*) [28, 19].

Effect of Fertilization Treatments on Phosphorus Contents (% D.W.): The effect of fertilization treatments on phosphorus contents (Table, 5). The highest percentages in the first season belonged to plants supplied with Phosphorein at 3 g/pot or Nitrobein at 2 g/pot (0.35 and 0.36%, respectively). The Plants treated with Nitrobein at 3 g/pot in the second season achieved the highest position in this concern (0.39% phosphorus). The lowest values were found in the plants treated with Ammonium sulphate at 3 or 9 g/pot (0.10 and 0.11%, respectively) in the first season, or those treated with Ammonium sulphate at 3, 6 and 9 g/pot (0.12, 0.17 and 0.10%, respectively) in the second one. In another study on lablab beans (Lablab purpureus) that were treated with *Rhizobium* and BMP (phosphobacterin and Phosphorein) inoculation individually increased phosphorus contents of the shoots [29].

Table 5: Effect of fertilization treatments on Phosphorus (% D.W.) and Potassium (% D.W.) of *Kochia scoparia* L. during two seasons 2013 and 2014

	Phosphorus (% D.W.)		Potassium (% D.W.)	
Fertilization treatments	1st season	2nd season	1st season	2nd season
Control	0.29	0.30	1.53	1.23
Ammonium sulphate 3 g/pot/30 cm	0.10	0.12	1.50	1.58
Ammonium sulphate 6 g/pot/30 cm	0.17	0.17	1.80	1.78
Ammonium sulphate 9 g/pot/30 cm	0.11	0.10	1.78	1.98
Nitrobein 1 g/pot/30 cm	0.30	0.32	1.68	1.77
Nitrobein 2 g/pot/30 cm	0.36	0.33	1.77	1.98
Nitrobein 3 g/pot/30 cm	0.26	0.39	1.78	1.72
Phosphorein 1 g/pot/30 cm	0.30	0.29	1.65	1.68
Phosphorein 2 g/pot/30 cm	0.31	0.35	1.72	1.88
Phosphorein 3 g/pot/30 cm	0.35	0.36	1.65	1.78
Ammonium sulphate 3 g + Nitrobein 1 g+ Phosphorein 1 g /pot/30 cm	0.22	0.29	1.50	1.57
Ammonium sulphate 6 g + Nitrobein 2 g+ Phosphorein 2 g /pot/30 cm	0.22	0.26	1.55	1.70
Ammonium sulphate 9 g + Nitrobein 3 g+ Phosphorein 3 g /pot/30 cm	0.28	0.25	1.52	1.40

Effect of Fertilization Treatments on Potassium Contents (% D.W.): The effect of fertilization treatments on Potassium contents (Table, 5). The highest percentage were found in the plants treated with Ammonium sulphate at 6 g/pot (1.80% Potassium) in the first season, or plants treated with Ammonium sulphate at 9 g/pot or Nitrobein at 2 g/pot (1.98% Potassium for both treatments) in the second one. The lowest values were found in the untreated plants and those treated with Ammonium sulphate at 9 g/pot + Nitrobein at 3 g/pot + Phosphorein at 3 g/pot (1.23 and 1.40%, respectively) in the second one. These results are in agreement with the findings of several researchers who reported that all treatments including biofertilizers used increased percentage of potassium in the leaves of Le-Conte pear trees as compared to the control [30]. Bio and NPK fertilizer treatments increase potassium contents in olive leaves and different sources of nitrogen (Ammonium nitrate or Ammonium sulphate) or bio-fertilizers (Biogein or Nitrobein) increased nitrogen, phosphorus and Potassium of guar plants (*Cyamopsis tetragonoloba*) [24, 19].

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