RESPONSE OF *KOCHIA SCOPARIA TRICHOPHILA* PLANTS TO DIFFERENT PLANT SPACING AND CHEMICAL FERTILIZATION TREATMENTS

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ABSTRACT

The experiment was caried out during two years 2003 and 2004 at Ornamental Horticulture Departments, Faculty of Agriculture, Cario University to study the effect of some agricultural practices such as plant spacing (20, 40 or 60 cm between the plant and some chemical fertilization treatments such as (ammonium nitrate, or ammonium sulphate at the rate of 2, 4 or 8 gm/plant or NPK at the levels of (1:1:1; 2:1:1; 3:1:1; 1:2:2; 2:2:1; 3:2:2; 1:3:2 and 3:3:1) at the rate of 5/gm/plant on growth and chemical composition of *Kochia scoparia trichophila* plants in order to recommend the best plant spacing as well as the suitable fertilization treatments which can be used for production of Kochia plants.

The results can be summerized as follows:-

I-Plant spacing:-

- Plant spacing (20, 40 or 60 cm between the plants) had a highly significant effect on plant growth and chemical composition. The closer plant spacing (20 cm) produced significantly the tallest plants.
- The wider plant spacing (60 cm) significantly increased the following characteristics: number of branches/plant; plant circumference; fresh and dry weights of the herb; and the percentages of carbohydrates, nitrogen, protein, phosphorus and potassium in the plant.

II- Chemical fertilization:-

- The applicate of chemical fertilization treatments had a highly significant effect on plant growth and chemical composition which were used in this study. NPK treatment at the rate of 1:3:2 was the most effective treatment in producing the tallest plants, the largest plant circumferences and the heaviest fresh and dry weight/plant in both seasons.
- NPK treatment at the rate of (1:3:2) significantly increased carbohydrates, nitrogen and protein perentages.
- NPK treatment at the rate of (2:2:1) was the most effective treatment in increasing the percentages of phosphorus and potassium in the plant.

Key words: *Kochia scoparia,* agricultural practices, plant spacing, chemical fertilization

INTRODUCTION

Kochia scoparia " summer cypress or fire bush" is a summer annual plants belongs to family Chenopodiaceae. The plants has formal globe or cobumner shape resembling cupressus; half to one meter height, a subshrub with numerous narrow, partly almost threadike like leaves 5 cm large, fresh green flower small greenish inconspicuous. The tiny green axillary flowers are insignificant, the plants needs warm temperature. The plants produce a big and

attractive foliage growth. The plants grow easily by seeds which normaly sown in April or May and produce vegetative growth during the summer months.

Some agriculture practices such as plant spacing as well as chemical fertilization play a great role in the production of many plants. Many investigators studied the effect of plant spacing in many plant species but not in *Kochia scoparia* plants such as **Sukhadia *et al.*, (1986)** on coriander plants they found that wider spacing increased vegetative growth/ plant. **El-Shaer (1989)** on fennel plant reported that there was a reduction in plant height with increasing spacing between plants. **Verzalova *et al.*, (1990)** on fennel observed that the closest distance between plants and using one plant /hill gave significantly the tallest plants. **Kandeel *et al.*, (2001)** reported that decreasing plant spacing to 30 cm and using one plant/hill led to an increase height of fennel plants. Also **Nofal *et al.*, (2001)** on *Ammi visnaga* found the same result.

Ahmed (1997) spaced *Nigella sativa* plants at 20, 30 and 40 cm and found that stem diameter was increased with increasing the distance between plants up to 40 cm, **Salah El-Deen (2005)** reported that in fennel plants the gradual increase in plant number from 40 and up to 156/10 m^2 plot caused a gradual increase in plant height, but a gradual reduction in stem diameter, number of primary and secondary branches/ plant and branches and leaves fresh and dry weight/plant. Chlorophyll a,b and carotenoids contents were considerable decreased by the gradual increase in planting density. Nitrogen, phosphorus and potassium percentage in plant tissue were markedly increased as the plant density was gradually decreased.

Al- Badawy *et al.*, (1994) found that NPK fertilization increased plant height, branches number, stem diameter and herb fresh and dry weights of *Nigella sativa* L. plants. However, **Aly (1999)** applied NPK (3:2:1) to *Nigella sativa* plants at different rates (100, 200, 300 Kg/fed) and observed that 300Kg/fed caused a significant increased in vegetative growth. **Khattab and Helmy (2003)** recorded that maximum values of fennel plant height, number of branches/plant and fresh and dry weights of leaves and branches/plant were obtained from using NPK (200Kg ammonium sulphate 100 Kg superphosphate and 50 Kg potassium sulphate.

Ibrahim (2000), **Nofal *et al.*, (2001)** and **Salah El-Deen (2005)** on fennel they reported that NPK fertilization increased N, P and K percentages in the leaves.

Since Kochia plants can be used as annual summer plants in the garden and also for animal feed as a summer green feeds. In fact no study have been carried out in Egypt on this plant concerning plant spacing and chemical fertilization.

Therefore, this study includes two experiments the first Exp. aimed to study the effect of different plant spacing on growth and chemical composition of *Kochia scoparia* plants. The second Exp. aimed to study the response of *Kochia scopaia* plants to different chemical fertilization treatments in order to recommend the best plant spacing as well as the suitable fertilizer treatments to be used for production of Kochia plants.

MATERIALS AND METHODS

This study was carried out at the Ornamental Horticulture Department, Faculty of Agriculture, Cairo University during two years 2003 and 2004. the objective of the current experiment was to study the effect of some agricultural practices such as plant spacing and chemical fertilization on growth and chemical composition of *Kochia scoparia* plants.

The current work can be divided into two experiments:-

First experiment: Effect of plant spacing:-

The aim of this experiment was to study the effect of planting *Kochia scoparia* in different plant spacing such as 20, 40 or 60 cm between each plant and the distance between the rows was 50 cm. Therefore in each plant spacing 9, 5 or 3 plants were planted in each $1m^2$ respectively.

Seeds of *Kochia scoparia* were sown on 1st of April in both seasons in the nursery area. After one 1st of May the seedlings were transplanted in small pots (10 cm diameter) filled with agricultural soil and placed in a shaded area in the nursery. After two weeks from transplanting the seedlings were planted in a sunny area in plots 1.5x1.5 m in rows 50 cm distance and 20, 40 and 60 cm between each plant. After two weeks from planting, the plants were fertilized with 5g/ammonium nitrate (33.5%)2g superphosphate (15.5% and 1g sul [hate potassium (48/k 20%)/plant. After one month from the first application the second application was done. In this experiment three treatments replicated 3 times were done.

The physical and chemical properties of the used soil can be shown in the following table:-

Texture	**Coarse sand (%)**	**Fine sand (%)**	**Silt (%)**	**Clay (%)**	**Organic matter (%)**
Clay	2.1	16.4	25.2	55.3	1.0

Chemical properties									
				Soluble Cations meq/L			**Soluble amions meq/L**		
S.P.%	**PH**	**E.C.**	**$CaCO_3$%**	**Ca^{+2}**	**Na^{+}**	**K^{+}**	**HCO_3**	**Cl**	**SO_4**
62	8.6	1.20	3.9	0.8	1	0.25	1.3	0.45	0.3
	Nppm	**Pppm**	**Kppm**	**FCppm**	**Znppm**	**Mnppm**			
	1.7	38	564	1.8	1.3	0.3			

Saturation percentage: S.P.

Electrical condectivity mmohs/cm^3 : E.C.

Second experiment: Effect of chemical fertilization:

The aim of this study was to investigate the effect of using ammonium nitrate ($NO_3(NH_4)_2$ (33.5% N), ammonium sulphate ($SO_4(NH_4)_2$ (20.5% N); at different rates 2,4 or 8 gm/plant. Also NPK at different levels (1:1:1; 2:1:1; 3:1:1; 1:2:2; 2:2:1; 3:2:2; 1:3:2 and 3:3:1) at the rate of 5g/plant. The mixture of NPK was formed from ammonium sulphate 20.5% N, calcium superphosphate 15.5 % P_2O_5 and potassium sulphate 48.5 % K_2O were used as a sources of N, P and K respectively. The fertilizer treatments were done at three weeks intervals from 1st of June till 1st of Sept. (five times during the each season).

On 15th of May in each season the seedlings were transplanted in clay pots 30cm and one plants were planted in each pot. The pots were filled with the same agricultural soil which were used in the first experiment, the pots

were placed in a sunny area. Therefore, in this experiment 15 treatments, replicated three times and in each replicate 5 plants were used.

At the end of the experiments in October in both seasons the following data were recorded: plant height (cm), number of branches/plant, plant circumference (cm); fresh and dry weights (gm) plant of the vegetative growth. The percentage of total carbohydrates was determined using the method described by **Dubois *et al.*, (1956)**. Whereas, the nitrogen percentage was determined by the usual Kjeldahl method **A.O.A.C., (1955**) as follows: the dried sample from leaves and stems were digested with concentrated sulphuric acid in the presence of digestion catalysts (a mixture of copper sulphate and anhydrous sodium sulphate (1:10), the crud protein percentage was calculated by multiplying the total nitrogen percentage by 6.25. Phosphorus percentage was determined according to the method adapted by **Hucker and Catroux (1980)**. However, potassium percentage was determined by using flame photometer according to the method described by **Cottenie *et al.*, (1982).**

The layout of the experiment was a randomized complete block design. The difference between the means of the different treatments were compred by using New L.S.D. test at 0.5% probability according to **Snedecor and Cochran (1980).**

RESULTS AND DISCUSSION

I-Effect of plant spacing:-

Plant height (cm) Table (1):-

The data showed that plant height of Kochia plants was gradually increased by decreasing plant spacing (from 60 to 20 cm) with significant differences being obtained in the two seasons. It is also noticed that the closer plant spacing (20 cm) gave the taller plants and significantly taller than the other plant spacing 40 or 60 cm.

In the meantime the shortest plants were due to the wider plant spacing. The trend of increasing plant height by decreasing plant spacing was indicated by different authors such as **Ibrahium (2000)** and **Kandeel *et al.*, (2001)** on fennel**, Badran *et al.*, (2003)** on anise and **Salah El-Deen (2005)** on fennel plants. They observed a gradual increase in plant height due to the closer plant spacing. In fact decreasing plant spacing results usually, in more competition between plants for water, nutrients, soil and light in comparison. Therefore, plant grown in closer spacing received low amount of light compared to the wider spacing and the low light intensity caused an increase in plant height.

Number of branches/plant:-

Table (1) clearly showed that the number of branches/ plant was significantly and gradual decreased in both seasons parallel to the gradual decrease in plant spacing (from 60 to 20 cm). Therefore, the greatest number of branches/plant (77.22 and 44.81) for the two seasons respectively, were obtained due to the wider spacing (60 cm). The percentage of reduction in the number of branches/plant due to the closer plant spacing (20cm) reached (70 and 55 %) in the both seasons respectively, compared to the wider plant spacing (60 cm).

This result can be explanted by the fact that using a wider plant spacing allow the plants to grown in more room for root system growth and adequate nutrients water and light, there by produces more branches/plant. These results are in harmony with the fending of **Amer *et al.*, (2001)** on pea and **Salah El-Deen (2005)** on fennel plants.

Plant circumference (cm):

The data on plant circumference (Table 1) revealed that the wider plant spacing significantly increased this character in both seasons. The highest plant circumference 117.78 and 89.26 cm were observed in plants which were planted at 60 cm spacing in both seasons respectively.

This is the case, however, the closer plant spacing (20 cm) significantly decreased this character (95.30 and 61.22 cm) in both seasons. The percentages of reduction due to the closer plant spacing (20 cm) compared to the wider plant spacing (60 cm) in both seasons respectively reached (35% and 44%). The same results as it was observed in the number of branches/plant.

Table (1): Effect of plant spacing on plant height (cm), number of branches/plant and circumference (cm) of *Kochia scoparia trichophila* plants(during two years 2003 and 2004).

Treatments plant spacing	Plant height (cm)		N.of branches/plant		Circumference(cm)	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
60 cm	89.67	74.23	77.22	44.81	117.78	89.26
40 cm	94.89	79.95	70.56	43.68	95.89	86.22
20 cm	99.89	83.08	45.39	29.48	95.30	61.22
LSD at 5%	2.86	3.11	4.83	2.75	2.72	4.69

Fresh and dry weight of the vegetative growth/plant:

The data on the fresh weight of the vegetative growth/plant revealed that plant spacing had a highly significant effect on this character. Increasing plant spacing from 20 to 60 cm caused a significant increase in the fresh weight. The heaviest fresh weight/plant (809.33 and 414.56 gm/plant) was obtained due to the wider spacing (60 cm) in both seasons respectively. Whereas, the closer spacing (20 cm)produced the smallest fresh weight/plants in both seasons (415.06 and 243.89 gm)respectively. The percentage of reductive due to the closer spacing reached (94 %and 70 %) in both seasons respectively, compared with the wider spacing (60cm). The reduction in fresh weight in the present study was emphasized on differed plant species such as (**Badran *et al.*, 2003** on anise **and Salah El-Deen, 2005,** on fennel. The data on the dry weight of the vegetative plant showed the same trend as in the fresh weight. In conclusion one can say that the wider plant spacing significantly increased both fresh and dry weights compared to the closer plant spacing.

Table (2): Effect of plant spacing on fresh and dry weight/plantof *Kochia scoparia trichophila* plants(during two years 2003 and 2004).

Treatments spacing plant	Fresh weight g/plant		Dry weight g/plant	
	F.S.	S.S.	F.S.	S.S.
60 cm	809.33	414.66	259.70	138.20
40 cm	739.50	394.40	236.50	131.50
20 cm	415.06	243.89	128.40	81.30
LSD at 5%	7.25	2.69	3.93	5.21

Total carbohydrates percentage:-

Table (3) showed that the total carbohydrates percentage in the dried herb increased as a result of increasing plant spacing. In both seasons, plants which were planted at 60 cm spacing significantly produced the highest percentage of carbohydrate (37.63 and 41.55 %) in the first and second seasons, respectively as compared to the closer plant spacing 20 cm. The increment in total carbohydrates may be due to the increase in photosynthesis as a result of grow the plants in more room for root system growth and adequate light intensity as compared to the closer spacing.

Nitrogen and protein percentage:-

Nitrogen percentage was significantly and gradual increased by increasing plant spacing as shown in Table (3) in both seasons.

The percentage of increases in nitrogen % due to the wider plant spacing (60 cm) reached 43 and 31 % in the first and second seasons, respectively in comparison with the closer plant spacing (20 cm). the results were in agreement with the results which were obtained by **Ibrahim (2000) and Salah El-Deen (2005)** on fennel plants.

The data on the total protein percentages in the plants showed the same trend as in the nitrogen %. However, the highest percentages in protein (17.06and 16.34 %) was obtained from plants which were planted in wider spacing (60 cm) in both seasons respectively. In general Kochia plants had a high value of protein. The percentages of protein in the vegetative parts varied from 11.87 to 17.06 % in the first season. However, in the second season these percentage were 12.81 and 16.34 %. In fact these percentages can be concluded that Kochia plants is a rich plant in protein and can be used as a crop to feed animals during the summer.

Table (3): Effect of plant spacing on carbohydrate (%), nitrogen (%) and protein (%) of *Kochia scoparia trichophila* plants (during two years 2003 and 2004).

Treatments plant spacing	Carbohydrates (%)		Nitrogen (%)		Protein (%)	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
60 cm	37.63	41.55	2.73	2.68	17.06	16.34
40 cm	34.00	36.61	2.25	2.49	14.06	15.56
20 cm	29.77	32.32	1.90	2.05	11.87	12.81
LSD at 5%	4.72	4.53	0.36	0.17	0.17	0.39

Phosphorus percentage:-

Data in Table (4) showed that the phosphorus percentage in the vegetative parts were significant decreased by the gradual decrease in plant spacing (from 60 to 20 cm)in both seasons. Phosphorus percentage in the leaves was significantly affected by different plant spacing only in the first season. The highest values of P % being obtained from planting at 60 cm spacing. Whereas, the lowest values were obtained from the closer spacing. It is interesting to note that P% was increased by 65 and 24 % in the first and second seasons due to the used of wider plant spacing 60 cm compared with closer plant spacing 20 cm. The above mentioned results were in harmony with those obtained by **Ibrahim (2000)** on fennel and **Badran *et al.*, (2003)** on anise.

Potassium percentage:-

Potassium percentage showed the same trend as phosphorus and nitrogen percentage. In general the wider spacing produced the highest percentages of potassium in both seasons respectively (1.75 and 2.00%). Whereas, the closer plant spacing gave the smallest values 1.55 and 1.70% in both seasons, respectively (Table 4).

The percentage of increase due to use of wider spacing (60 cm) reached 13 and 18% in the first and second seasons respectively as compared to the (20 cm) plant spacing.

Table (4): Effect of plant spacing on phosphorus (%) and potassium (%) of *Kochia scoparia trichophila* plants(during two years 2003 and 2004).

Treatments plant spacing	Phosphorus (%)		Potassium (%)	
	F.S.	S.S.	F.S.	S.S.
60 cm	0.66	0.57	1.75	2.00
40 cm	0.47	0.63	1.65	1.90
20 cm	0.40	0.46	1.55	1.70
LSD at 5%	0.17	0.12	0.07	0.10

Second experiment: Effect of chemical fertilization:-

Plant height (cm):

The data in Table (5) showed that all treatments led to increase in plant height compared with control plants in both seasons. In fact the application of chemical fertilization significantly increased plant height. This may be due to the increase in N in the root zone and its effect on the physiological and metabolic activities of the plants. This enhancing effect may induce exudate of same hormonal substances like cytokinins and auxins, which encourage plant height. **Rajput and Singh (1996)** claimed that the nutrients available in the soil increased with increasing nitrogen application. The increase in nitrogen uptake enhanced physiological activities of plants and thereby increased the growth **(Rajput *et al.*, 1995). Abd-El-Fattah and Sorial (2000)** on summer squash plants ensured that increasing nitrogen levels increased of cytokinins and gibberellins which enhanced cell division and cell elongation and this increased vegetative growth. In general both ammonium nitrate and ammonium sulphate treatments significantly increased plant height as compared to the control. In the first season ammonium sulphate treatments were significantly better than ammonium nitrate in increasing plant height and 2/g/plant was the most effective treatment in producing plants with 68.78 cm height. The same trend was also observed in the second season. This means that in case of fertilizing Kochia plants one can recommend to use ammonium sulphate at the rate of 2/g/plant. In case of using NPK the most effective treatment was to use NPK at the rate of (1: 3: 2), this treatment was significantly better than all other treatments in both seasons. These fendings were in agreement with those of **Said Al-Ahl (2005)** on *Anethum graveolens* and **Youssef *et al.*, (2004)** on *Salvia officinalis*. In conclusion NPK at the rate of (1:3:2) was the most effective treatment in producing the tallest plants in both seasons.

Plant circumference (cm):

The data in Table (5) indicated that all treatments significantly increased plant circumference as compared to the control plants in both seasons. In addition, using ammonium sulphate at the rates of 2,4 or 8 gm/plant gave a better results than using ammonium nitrate with the different rates. In general one can say that ammonium nitrate at the rate of 8g/plant gave 49.22 cm circumference, whereas, using ammonium sulphate at the rate of 2 g/m gave nearly the same value (48.22), in the first season. However, in the second season another trend was observed i.e., ammonium nitrate at the rate of 2 or 4 gm/plant was the most effective treatment in producing the largest value (80.83 and 81.33 cm) respectively. In case of applying NPK treatments the data revealed that all treatments significantly increased the circumference of the plants as compared to the controls in both seasons. Also using NPK at the rate of (1:3:2) was the most effective treatment in increasing the circumference of the plants and produced the largest values 54.78 and 82.33 cm in the first and second seasons, respectively. Thus, it can be concluded that fertilizating Kochia plants with chemical fertilization increased the formation of branches. The increase in number of branches may be due to the increase in nitrogen content in the soil. Also the increase in the level of nitrogen was responsible for increase number of branches, causing higher photosynthesis and assimilation rates, metabolic activity and cell division which were responsible for increase in the growth characters (**Chauhan *et al.*, (1996)** on *Brassica juncea*. Similar results were obtained by (**Said Al-Ahl (2005)** on dill plants.

Fresh and dry weight (gm)/plant:-

Table (5) show that both fresh and dry weights/plant were significantly increased by the chemical fertilizers treatments in both seasons. Using ammonium nitrate at the rate of 8 gm/plants significantly increased both fresh and dry weight compared with the other treatments in both seasons. In case of fresh weight this treatments produced 507.5gm and 265.0 gm/ plant in the first and the second seasons respectively. Also using ammonium sulphate significantly increased both fresh and dry weight of the plants as compared to control plants but this effect was less in general than in case of using ammonium nitrate. In case of using NPK treatments the data showed that all treatments significantly increased both fresh and dry weight/plant as compared to control. The most effective treatment was NPK at the ratio of (1:3:2). This treatment produced in case of fresh weight 518.3 and 276.7 gm/plant in the first and second season respectively. The percentage of increase over control due to NPK treatment at the rate of (1:3:2) reached 111.5 and 44 % in the first and second seasons, respectively. The increase in plant fresh weight may be due to the increase of N in the root zone as a result of nitrogen application. The stimulation effects of applying nitrogen on vegetative growth characters may be attributed to the well known functions of nitrogen in plant life, being a part of protein, it is an important constituent of protoplasm. Moreover, nitrogen involves in many organic compounds of plant system. A sufficient supply of various nitrogenous compounds is therefore, required in each plant cell for its proposed functioning. **(Mengel and Kirkby, 1987).** Generally the enhancing effect of N- fertilization on plant growth may be due to the positive effects of N element on activation of photosynthesis and metabolic processes

of organic compounds in plants which in turn, encourage the plant vegetative growth **(Gardener *et al.*, 1985).**

Table (5): Effect of chemical fertilization treatments on growth of *Kochia scoparia trichophila* plants (during two years 2003 and 2004).

Treatments	Plant height(cm)		Circumference (cm)		F.weightg/plant		D.weightg/plant	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
Control	41.05	55.50	24.56	57.67	245.0	191.7	80.3	63.60
A.N.2 g/plant	57.11	76.33	33.11	80.83	280.8	273.3	92.3	90.10
A.N.4 g/plant	60.67	80.17	35.44	81.33	426.7	221.7	142.2	73.90
A.N. 8 g/plant	61.99	78.67	49.22	70.33	507.5	265.0	180.8	98.33
A.S. 2 g/plant	68.78	77.00	48.22	75.00	486.7	200.7	161.2	66.90
A.S. 4 g/plant	64.45	73.67	45.67	67.33	366.7	245.0	120.3	81.70
A.S. 8 g/plant	67.78	72.17	41.89	69.17	321.7	221.7	105.7	73.90
NPK1:1:1	70.11	76.13	37.89	60.50	343.3	242.3	111.4	80.80
NPK2:1:1	68.78	74.17	41.67	75.17	415.0	225.0	136.3	75.00
NPK3:1:1	65.44	76.33	45.33	69.67	431.7	233.3	143.9	77.80
NPK1:2:2	72.33	65.50	41.44	62.50	365.8	205.3	121.9	68.43
NPK2:2:1	70.55	77.33	43.33	75.53	357.8	205.0	119.3	68.30
NPK3:2:2	70.89	73.17	46.67	69.50	433.3	215.0	144.4	71.70
NPK1:3:2	76.78	76.87	54.78	82.33	518.3	276.7	170.8	92.20
NPK3:3:1	66.45	74.33	43.00	65.33	388.9	155.0	129.6	51.70
LSDat 5%	2.78	2.94	3.36	3.41	14.1	11.3	6.9	2.40

Ammonium nitrate : A.N. Ammonium sulphate : A.S.

Total carbohydrates percentage:-

Table (6) show that the total carbohydrates percentage in the dried herb increased as a result of using NPK treatment in comparison to the control plants in both seasons. The treatments (NPK at the rate of 1:1:1 or 2:2:1 or 1:3:2 were the most effective treatments in producing significantly the highest percentage of carbohydrate (43.90, 46.33 and 44.25 %, respectively in the first season, respectively. The second season showed the same trend. NPK treatments, in general produced more carbohydrate percentage compared to using ammonium nitrate or ammonium sulphate. The increment in total carbohydrate may be due to the increase of photosynthesis. Similar results are in homorny with those obtained by **Youssef *et al.*, (2004)** on *Salvia officinalis* and **Said Al-Ahl (2005)** on *Anethum graveolens* plants.

Nitrogen percentage:-

From Table (6) it was noticed that all fertilization treatments caused a positive effect on the nitrogen percentage at both seasons.

In the meantime results on the two seasons showed a significant increase in the nitrogen percentage of herb as a result of nitrogen fertilizer. The largest values of nitrogen percentage was resulted from NPK treatments at the rate of 1:3:2 (2.87 and 3.03 %) in the first and second seasons, respectively. This mean that this treatment was the most effective treatment in producing the highest percentage of nitrogen in the herb. The least values of nitrogen percentage in both seasons were determined in the untreated plants. The increment in nitrogen percentage in both seasons may be due to fertilized plants with nitrogen. The application of nitrogen increased the concentration

of N in plant tissue and also the total fresh herbage yield, which ultimately led to the increase in uptake of N **Said Al-Ahl (2005)** on dill plants.

Total protein percentage:-

The data Table (6) indicated that all fertilizer treatments caused a significant increase in the protein percentage in the herb. The most effective treatment in this respect was NPK at the rate of 1:3:2. This treatment produced the highest values (17.87 and 18.94 %) in the first and second seasons, respectively.

Table (6): Effect of chemical fertilization treatments on carbohydrates (%), nitrogen (%) and protein (%) of *Kochia scoparia trichophila* plants (during two years 2003 and 2004).

Treatments	Carbohydrates(%)		Nitrogen (%)		Protein (%)	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
Control	33.10	30.17	1.98	1.67	12.38	10.44
A.N.2 g/plant	34.33	35.67	2.60	2.27	16.15	14.19
A.N.4 g/plant	32.17	36.19	2.73	2.85	17.06	17.81
A.N. 8 g/plant	35.25	37.88	2.85	2.98	17.81	18.62
A.S. 2 g/plant	26.96	28.49	2.23	2.34	13.94	14.63
A.S. 4 g/plant	28.14	30.55	2.45	2.69	15.31	16.81
A.S. 8 g/plant	32.44	35.10	2.67	2.78	16.69	17.38
NPK1:1:1	43.90	36.23	2.23	2.83	13.94	17.69
NPK2:1:1	37.10	36.02	2.67	1.99	16.69	12.44
NPK3:1:1	42.60	37.10	2.54	2.71	15.88	16.94
NPK1:2:2	30.40	34.54	2.08	2.59	13.00	16.19
NPK2:2:1	46.33	40.86	2.18	2.38	13.63	14.88
NPK3:2:2	42.60	37.10	2.20	2.63	13.75	16.44
NPK1:3:2	44.25	41.90	2.87	3.03	17.87	18.94
NPK3:3:1	39.12	36.44	2.51	2.67	15.69	16.69
LSD at 5%	1.81	0.40	0.28	0.38	0.86	1.53

Ammonium nitrate : A.N. Ammonium sulphate : A.S.

Phosphorus percentage:-

The effect of fertilizations on phosphorus percentage is shown in Table (7). In both seasons all fertilizer treatments which were used in this study significantly increased phosphorus percentage in the herb. In both seasons, the most effective treatment was NPK at the rate of 2:2:1 this treatment produced the highest percentage (0.73 % and 0.66 %) in the first and second seasons, respectively. The role of ammonium nitrate, ammonium sulphate and NPK treatments in promoting phosphorus percentage which was observed in this study was also observed by number of authors such as **Badran *et al.*, (2003)** on anise, and **Salah El-Deen (2005)** on fennel plants.

Potassium percentage:-

Data in Table (7) indicated that supplying the plants with ammonium nitrate at different rates (2,4 or 8 gm/plant) significantly increased potassium percentage and this increase gradually increased ammonium nitrate concentration increaded. The data showed that 8g/plant from ammonium nitrate was the most effective treatment since it produced the highest value 1.94 and 1.97% in the first and second seasons respectively. The percentage of increase due to this treatment over the control reached 37.7 and 21.6% in the

first and second seasons, respectively. Using ammonium sulphate had a significant effect on increasing potassium percentage only when it used at the rate of 4 or 8 gm/ plant comparing to the control plants. Whereas, using NPK treatments at the rate of 2:2:1 was the most effective treatments in producing the highest percentages (2.00 and 2.05% in both seasons, respectively). The percentage of increase in potassium percentage due to these two treatments reached (41.8 and 26.5%) over the control plants.

Table (7): Effect of chemical fertilization treatments on phosphorus (%) and potassium (%) of *Kochia scoparia trichophila* plants (during two years 2003 and 2004).

Treatments	Phosphorus (%)		Potassium (%)	
	F.S.	S.S.	F.S.	S.S.
Control	0.28	0.32	1.41	1.62
A.N.2 g/plant	0.36	0.38	1.48	1.68
A.N.4 g/plant	0.40	0.45	1.81	1.90
A.N. 8 g/plant	0.56	0.64	1.94	1.97
A.S. 2 g/plant	0.30	0.35	1.41	1.52
A.S. 4 g/plant	0.38	0.41	1.62	1.67
A.S. 8 g/plant	0.44	0.52	1.72	1.88
NPK1:1:1	0.34	0.38	1.16	1.25
NPK2:1:1	0.49	0.37	1.46	1.75
NPK3:1:1	0.38	0.45	1.60	1.65
NPK1:2:2	0.43	0.43	1.94	1.95
NPK2:2:1	0.73	0.66	2.00	2.05
NPK3:2:2	0.48	0.52	1.17	1.70
NPK1:3:2	0.39	0.35	1.65	1.87
NPK3:3:1	0.46	0.51	1.58	1.95
LSD at 5%	0.09	0.11	0.12	0.15

Ammonium nitrate : A.N. Ammonium sulphate : A.S.

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استجابة نباتات الكوكيا لمعاملات مختلفة من مسافات الزراعة والتسميد الكيماوى

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أجرى هذا البحث خلال الأعوام ٢٠٠٣/٢٠٠٤ وذلك فى قسم بساتين الزينة بكلية الزراعة جامعة القاهرة. ويهدف البحث إلى دراسة تأثير بعض المعاملات الزراعية مثل مسافات الزراعة (٢٠،٤٠،٦٠سم بين النبات والأخر) وكذلك المعاملات السمادية مثل استعمال نترات أو سلفات الأمونيوم بمعدل ٢، ٤، ٨ جرام من السماد لكل نبات أو استعمال سماد NPK بمستويات مختلفة مثل ١:١:١، ١:١:٢، ١:١:٣، ١:٢:١ ، ٢:٢:١ ، ١:٢:٢ ، ٢:٢:٣ ، ٢:٣:١ ، ١:٣:٣) وذلك بمعدل ٥ جرام/ من السماد/ نبات على النمو والمحتوى الكيماوى لنبات الكوكيا وذلك لغرض معرفة أفضل مسافة زراعة وكذلك أنسب معاملة سمادية ينصح باستعمالها عند زراعة وانتاج نباتات الكوكيا.

<u>ويمكن تلخيص أهم النتائج التى أمكن التوصل إليها فى الآتى:-</u>

<u>أولا: مسافات الزراعة:-</u>

مسافات الزراعة (٢٠ ، ٤٠ ، ٦٠ سم بين النبات والآخر) كان لها تأثير معنوى على النمو والمحتوى الكيماوى للنبات. حيث أن الزراعة الضيقة ٢٠ سم بين النبات والآخر أعطت أعلى زيادة معنوية فى ارتفاع النباتات. بينما الزراعة على مسافات واسعة ٦٠ سم بين النبات والآخر أعطت زيادة معنوية فى الصفات التالية: عدد الأفرع على النبات، محيط النمو للنبات، الوزن الطازج والجاف للمجموع الخضرى، النسبة المئوية لكل من الكربوهيدرات الكلية، النتروجين، البروتين، الفوسفور والبوتاسيوم فى النبات.

<u>ثانيا: التسميد الكيماوى:</u>

إضافة الأسمدة الكيماوية المستعملة كان لها تأثير معنوى على النمو والمحتوى الكيماوى للنبات حيث أن التسميد باستعمال سماد NPK بنسبة (٢:٣:١) كانت أفضل المعاملات السمادية حيث إنها أعطت أطول النباتات واكبر محيط نمو للنبات، وأثقل وزن طازج وجاف للمجموع الخضرى. وكذلك أدت إلى زيادة معنوية فى كل من نسبة الكربوهيدرات الكلية، النتروجين والبروتين فى النبات. بينما استعمال NPK بنسبة (٢:٢:١) كانت أفضل المعاملات السمادية حيث إنها أدت إلى زيادة معنوية فى نسبة الفوسفور والبوتاسيوم فى النبات.

لذلك ينصح بزراعة نباتات الكوكيا على مسافات ٦٠ سم بين النبات والآخر واستعمال التسميد NPK بنسب (٢:٣:١) كأفضل معاملة سمادية.