

RESPONSE OF CARAWAY YIELD TO PLANT DISTANCE AND NITROGEN FERTILIZATION TREATMENTS

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ABSTRACT

Two field experiments were carried out at the Agricultural Experiment and Research Station, Faculty of Agriculture, Cairo University, during the 2006-2007 and 2007-2008 seasons to study the effect of plant distance and nitrogen fertilization on the yield of caraway (*Carum carvi* L.). Plant distance treatments were 20, 40 and 60 cm. Nitrogen fertilization treatments were 0, 10, 20, 30, 40 and 45 kg N/feddan. The results indicated that the maximum values for plant height were obtained when the distance was 20 cm between the plants, while for the number of branches/plant, the number of umbels/plant, fruit weight/plant (gm), fruit yield/plot (gm), fruit yield/feddan (kg), 1000 seeds weight (gm), oil% and oil yield/feddan (L) the maximum values were obtained when the distance was 60 cm between the plants. Also, the results indicated that the maximum values for plant height, number of branches/plant, number of umbels/plant, fruit weight/plant (gm), fruit yield/plot (gm), fruit yield/feddan (kg), weight of 1000 seeds (gm), oil% and oil yield/feddan (L) were obtained with applying 40 kg of nitrogen/feddan. Interaction between plant distance and nitrogen fertilization resulted in the maximum values of fruit yield/feddan with the distance of 40 cm between plants and applying 40 kg nitrogen/feddan.

Key words: *caraway, Carum carvi, distance, nitrogen fertilizer.*

1. INTRODUCTION

Medicinal and aromatic plants are very important economic plants. Nowadays, there is a return to the use of natural products in pharmaceuticals and cosmetics. Caraway (*Carum carvi* L.), a member of the Umbelliferae (Apiaceae), is an annual spice crop. It has an erect, branched stem. The plant forms a shallow tap root with minimal branching. White flowers are formed at the terminal buds. The oil content and composition are influenced by crop maturity, cultivar and growing conditions. Fertilizers are chemical compounds applied to promote plant growth and fruit production. This application is either through the soil (for uptake by plant roots) or sprayed on the foliage of the plant. The distance of planting affects the vegetative growth. Radwan (1980) mentioned that there was a significant decrease in caraway plant height with increasing plant spacing. Badran and Hafez (2002) indicated that reducing *Nigella sativa* plant density caused considerable increase in each of branch number, herb dry weight as well as fruit yield/plant, while plant height and fruit yield/feddan were greatly reduced. Planting distance affects the essential oil yield. Radwan (1980) obtained an increase in

caraway oil yield/plot as a result of growing the plants at a distance of 20 cm. Ahmed (1997) found that the volatile and fixed oil percentages in the seeds of *Nigella sativa* were increased with increasing the distance between the plants up to 40 cm. The vegetative growth and herb yield are affected with nitrogen fertilizers. Radwan (1980) found that the plant height, number of branches, umbels/plant and fresh and dry weights of coriander and caraway were increased as the levels of nitrogen increased. As regards to the effect of nitrogenous fertilizers on oil yield, Rahman *et al.* (1990), Barreyro *et al.* (1993) and Hussien (1995) found that increasing nitrogenous fertilization for *Coriandrum sativum* increased essential oil yield. Bhati and Shaktawat (1994) and Tiwari and Banafar (1995) stated that the application of 60 kg nitrogen/ha increased the essential oil yield of coriander plant.

The objective of the present study was to find out the effect of plant distance and nitrogen fertilization treatments on the yield of caraway.

2. MATERIALS AND METHODS

Two field experiments were carried out at the Agricultural Experiment and Research Station,

Faculty of Agriculture, Cairo University, during the 2006-2007 and 2007-2008 seasons to study the effect of plant distance and nitrogen fertilization on the yield of caraway (*Carum carvi* L.). The experimental design used was a split-plot with three replications. Plant distance treatments were 20, 40 and 60 cm, assigned to the main plots. Nitrogen fertilization treatments were 0, 10, 20, 30, 40 and 45 kg N/feddan, assigned to the sub-plots. The field was prepared for cultivation, by deep ploughing and dividing into 54 plots (2 x 2 m), each plot contained 3 rows of 60 cm width. Caraway seeds were sown on one side of each row on 21st September and 1st October 2006 and 2007 in the two seasons, respectively. Nitrogen fertilization as ammonium sulfate ((NH₄)₂SO₄) was divided into two equal portions. The first portion was added after 30 days from sowing. The other one was added after a month from the first. In the second season, the oil percentage was determined in fruits, which were crushed half an hour before distillation, according to the procedure described by the British Pharmacopoeia (1963). In both season, data were recorded for the following growth characters:

- Plant height (cm)
- Number of branches per plant
- Number of umbels per plant
- Number of umbelet per umbel
- Number of fruits per umbelet
- Weight of fruits (gm/plant)
- Fruit yield per plot (gm/plot)
- Fruit yield per feddan (kg/feddan)
- Fruit index (weight of 1000 fruit)
- Essential oil percentage in the fruits
- Essential oil yield / plant (ml)
- Essential oil yield / feddan (L)

All data were subjected to statistical analysis according to the procedures (ANOVA) reported by Snedecor and Cochran (1980). Combined analysis over the two seasons of experimentation was done after testing the homogeneity of variance between the two seasons. Treatment means were compared by the LSD Test at the 5% level of probability.

3. RESULTS AND DISCUSSION

3.1. Plant distance effect

Data presented in Tables (1, 6 and 7) reveal that plant height, number of branches per plant, number of umbels per plant, fruit yield per plot (gm), fruit yield per feddan (kg), oil percentage and oil yield per feddan (L) traits were significantly affected by changing the distance between plants. In the plant height trait, the maximum value was obtained by using 20 cm

between plants, while in the other traits the maximum values were obtained by using 60 cm. Plants grown at distances of 40 and 60 cm showed significant difference in the number of umbels/plant, fruit yield/plot (gm), fruit yield/feddan (kg), oil % and oil yield/feddan (L). These results are in agreement with those obtained by Radwan (1980) on umbelliferous plants and Ahmed (1997) on *Nigella sativa*.

3.2. Nitrogen fertilizer effect

Data presented in Tables (1, 6 and 7) reveal that plant height, number of branches per plant, number of umbels per plant, weight of fruits per plant (gm), fruit yield per plot (gm), fruit yield per feddan (kg), fruit index (weight of 1000 fruits (gm)), oil percentage and oil yield per feddan (L) were significantly affected by changing the nitrogen fertilization. In the case of plant height and number of umbels per plant, the maximum values were obtained by applying 40 kg N/feddan, while in case of number of branches per plant, weight of fruits per plant (gm), fruit yield per plot (gm), fruit yield per feddan (kg), fruit index (weight of 1000 fruits (gm)) and oil yield per feddan (L) it was found that the maximum values were obtained by applying 40 kg N/feddan. There were no significant differences between applying 30 and 40 kg N/feddan in the number of branches/plant, fruit yield/feddan (kg) and weight of 1000 fruits (gm). Concerning the weight of seeds/plant (gm), there were no significant differences between applying 30, 40 and 45 kg N/feddan. The maximum value of oil percentage was obtained from applying 40 kg nitrogen/feddan and there were no significant differences between the applications 20, 30 and 40 kg nitrogen per feddan. These results are in agreement with those obtained by El-Mansi *et al.* (1970) on coriander and Radwan (1980) on umbelliferous plants.

3.3. Seasonal variation

Data presented in Table (1) reveal that plant height, number of branches per plant, number of umbels per plant, weight of fruits per plant (gm), fruit yield per plot (gm) and fruit yield per feddan (kg) traits were significantly affected by the season. These results may be due to the environmental conditions.

3.4. The interaction between season and plant distance

Data presented in Table (4) reveal that weight of fruits per plant (gm), fruit yield per plot (gm) and fruit yield per feddan (kg) traits were significantly affected by the interaction between seasons and plant distance. No significant differences in weight of fruits/plant (gm) were obtained when using 40 and 60 cm between plants.

Table (1): Effect of plant distance, nitrogen fertilization and seasonal variation on growth and productivity of caraway (*Carum carvi* L.)

Studied Factors		Plant height (cm)	Number of branches / plant	Number of umbels / plant	Number of umbelet / umbel	Number of fruits / umbelet	Weight of fruits/plant (gm)	Yield /plot (gm)	Yield /feddan (kg)	Weight of 1000 fruits (gm)
Seasons	2006/2007	113.30	12.09	68.65	15.48	8.02	25.23	301.48	316.55	4.44
	2007/2008	94.10	9.37	43.85	14.16	7.61	8.12	163.04	171.19	4.00
F test		*	*	*	-	-	*	*	*	-
LSD at 0.05		8.17	0.84	14.23	NS	NS	16.83	50.18	71.25	NS
Plant Distance	20 cm	110.44	9.50	38.66	14.46	8.03	12.18	185.836	195.12	3.71
	40 cm	104.22	10.75	59.40	15.22	7.98	18.01	236.417	248.23	4.30
	60 cm	96.58	11.90	70.69	14.78	7.43	19.83	274.530	288.25	4.66
F test		*	*	*	-	-	-	*	*	-
LSD at 0.05		9.97	1.113	15.07	NS	NS	NS	69.360	47.98	NS
Nitrogen Fertilization	0 kg N/feddan	93.60	8.33	38.22	14.88	7.46	9.74	150.00	157.50	3.789
	10 kg N/feddan	101.30	9.66	48.96	14.51	7.43	14.60	185.34	194.61	4.158
	20 kg N/feddan	105.30	10.88	57.88	14.82	7.90	16.84	237.56	249.44	4.330
	30 kg N/feddan	108.70	12.16	62.08	14.89	7.53	18.53	277.72	291.60	4.538
	40 kg N/feddan	113.10	13.38	72.41	14.77	7.90	22.45	337.66	354.54	4.629
	45 kg N/feddan	100.20	9.944	57.95	15.04	8.66	17.88	205.25	215.52	3.917
F test		*	*	*	-	-	*	*	*	*
LSD at 0.05		3.34	1.24	8.91	NS	NS	6.93	61.83	69.43	0.180

Table (2): Effect of the interaction between plant distance, nitrogen fertilization and seasonal variation on growth and productivity of caraway (*Carum carvi* L.)

Plant distance	Nitrogen Fertilization	Plant height (cm)		Number of branches /plant		Number of umbels /plant		Number of umbellet /umbel		Number of fruits/ umbellet		Weight of fruits /plant (gm)		Yield /plot (gm)		Yield /feddan (kg)		Weight of 1000 Fruits (gm)	
		2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008
20 cm	0 kg N/feddan	111.6	92.6	9.33	4.66	38.20	15.40	14.66	14.26	8.20	7.60	11.90	2.65	183.33	88.33	192.50	92.75	3.365	2.623
	10 kg N/feddan	118.6	97.6	9.66	7.00	42.93	21.33	15.86	13.30	7.40	6.80	13.30	4.31	182.33	120.70	191.45	126.73	3.983	3.280
	20 kg N/feddan	122.6	102.6	11.00	8.66	43.46	33.13	15.33	14.00	9.40	7.00	16.32	5.28	276.33	133.33	290.15	140.00	4.055	3.653
	30 kg N/feddan	128.0	105.0	12.00	10.00	44.33	34.20	14.40	13.86	6.80	7.00	17.18	7.44	284.33	140.00	298.55	147.00	4.125	3.813
	40 kg N/feddan	132.3	107.6	13.66	10.00	65.53	36.80	15.00	13.10	8.60	8.40	24.39	10.02	340.66	179.66	357.70	188.65	4.325	4.160
	45 kg N/feddan	116.6	89.6	10.33	7.66	59.26	29.33	14.86	14.86	9.60	9.60	24.25	9.16	223.66	77.33	234.85	81.20	3.776	3.413
40 cm	0 kg N/feddan	107.6	88.0	10.33	6.33	52.80	26.20	15.13	16.20	7.60	8.40	17.11	3.35	188.33	92.00	197.75	96.60	3.995	3.980
	10 kg N/feddan	112.0	93.6	11.00	8.66	58.86	34.66	15.13	14.66	8.00	8.40	25.79	6.22	222.00	121.60	233.10	127.68	4.603	4.067
	20 kg N/feddan	116.0	93.0	11.66	9.66	76.46	50.80	15.40	14.00	7.20	7.60	29.41	8.53	278.00	180.07	291.90	189.08	4.751	4.140
	30 kg N/feddan	120.0	96.0	13.33	10.66	77.73	53.50	17.26	15.10	7.60	7.00	30.83	10.2	378.66	226.66	397.60	238.00	5.041	4.353
	40 kg N/feddan	121.6	103.0	15.00	12.33	92.53	65.86	15.33	14.86	8.80	7.60	36.93	11.3	471.33	258.66	494.90	271.59	4.724	4.450
	45 kg N/feddan	105.3	94.3	11.00	9.00	67.93	55.53	14.93	14.66	8.00	9.60	26.50	9.81	266.00	153.66	279.30	161.35	4.012	3.553
60 cm	0 kg N/feddan	95.3	66.6	11.33	8.00	56.46	40.30	15.73	13.33	6.80	6.20	18.98	4.45	232.66	115.36	244.30	121.12	4.639	4.133
	10 kg N/feddan	100.0	86.0	12.00	9.66	85.06	50.90	15.53	12.60	7.60	6.40	29.32	8.64	309.00	156.44	324.45	164.26	4.799	4.220
	20 kg N/feddan	104.0	93.6	13.33	11.00	87.60	55.86	15.80	14.40	9.60	6.60	32.23	9.28	364.33	193.33	382.55	203.00	4.859	4.520
	30 kg N/feddan	108.3	95.3	14.66	12.33	101.5	61.20	15.66	13.06	8.00	8.80	33.45	12.05	390.00	246.66	409.50	259.00	5.127	4.767
	40 kg N/feddan	112.3	102.0	16.00	13.33	106.3	67.40	16.73	13.60	7.20	6.80	39.13	12.89	512.33	263.33	537.95	276.50	5.466	4.650
	45 kg N/feddan	107.0	88.3	12.00	9.66	78.80	56.86	15.86	15.06	8.00	7.20	27.19	10.38	323.33	187.55	339.50	196.93	4.363	4.387
F-test		*		-		-		-		-		-		-		-		-	
LSD at 0.05		5.96		NS		NS		NS		NS		NS		NS		NS		NS	

Table (3): Effect of the interaction between nitrogen fertilization and seasonal variation on growth and productivity of caraway (*Carum carvi* L.)

Nitrogen Fertilization	Plant height (cm)		Number of branches /plant		Number of umbels /plant		Number of umbelet /umbel		Number of Fruits / umbelet		Weight of Fruits /plant (gm)		Yield /plot (gm)		Yield /feddan (kg)		Weight of 1000 Fruits (gm)	
	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008
0 kg N/feddan	104.8	82.4	10.33	6.33	49.15	27.30	15.17	14.60	7.53	7.40	16.00	3.48	201.44	98.564	211.51	103.49	4.000	3.579
10 kg N/feddan	110.2	92.4	10.88	8.44	62.28	35.63	15.51	13.52	7.66	7.20	22.81	6.39	237.77	132.91	249.66	139.56	4.461	3.856
20 kg N/feddan	114.2	96.4	12.00	9.77	69.17	46.60	15.51	14.13	8.73	7.06	25.98	7.70	306.22	168.91	321.53	177.36	4.555	4.104
30 kg N/feddan	118.7	98.7	13.33	11.00	74.53	49.63	15.77	14.01	7.46	7.60	27.15	9.91	351.00	204.44	368.55	214.66	4.765	4.311
40 kg N/feddan	122.1	104.2	14.88	11.88	88.13	56.68	15.68	13.85	8.20	7.60	33.48	11.42	441.44	233.88	463.51	245.58	4.839	4.420
45 kg N/feddan	109.6	90.7	11.11	8.77	68.66	47.24	15.22	14.86	8.53	8.80	25.98	9.79	271.00	139.51	284.55	146.49	4.050	3.784
F-test	-		*		-		-		-		*		*		*		-	
LSD at 0.05	NS		0.488		NS		NS		NS		3.98		33.89		34.79		NS	

Table (4): Effect of the interaction between plant distance and seasonal variation on growth and productivity of caraway (*Carum carvi* L.)

Plant distance	Plant height (cm)		Number of branches /plant		Number of umbels /plant		Number of umbelet /umbel		Number of fruits / umbelet		Weight of fruits /plant (gm)		Yield /plot (gm)		Yield /feddan (kg)		Weight of 1000 fruits (gm)	
	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008
20 cm	121.6	99.2	11.00	8.00	48.95	28.36	15.02	13.90	8.33	7.73	17.89	6.48	248.44	123.22	260.86	129.38	3.938	3.491
40 cm	113.7	94.6	12.05	9.44	71.05	47.76	15.53	14.91	7.86	8.10	27.76	8.25	300.72	172.11	315.75	180.71	4.521	4.091
60 cm	104.5	88.6	13.22	10.66	85.96	55.42	15.88	13.67	7.86	7.00	30.05	9.62	355.27	193.78	373.04	203.47	4.876	4.446
F-test	-		-		-		-		-		*		*		*		-	
LSD at 0.05	NS		NS		NS		NS		NS		3.16		23.97		27.66		NS	

Table (5): Effect of the interaction between plant distance and nitrogen fertilization on growth and productivity of caraway (*Carum carvi* L.)

Plant distance	Nitrogen Fertilization	Plant height (cm)	Number of branches / plant	Number of umbels / plant	Number of umbel / umbel	Number of Fruits / umbel	Weight of Fruits /plant (gm)	Yield / plot (gm)	Yield / feddan (kg)	Weight of 1000 Fruits (gm)
		20 cm	0 kg N/feddan	102.16	7.00	26.800	14.467	7.90	7.280	135.833
	10 kg N/feddan	108.16	8.33	32.133	14.583	7.10	8.813	151.517	159.09	3.631
	20 kg N/feddan	112.66	9.833	38.300	14.667	8.20	10.803	204.833	215.07	3.854
	30 kg N/feddan	116.50	11.00	39.267	14.133	6.90	12.317	212.167	222.77	3.969
	40 kg N/feddan	120.00	11.833	51.167	14.850	8.50	17.212	260.167	273.17	4.243
	45 kg N/feddan	103.16	9.00	44.300	14.867	9.60	16.709	150.500	158.02	3.595
40 cm	0 kg N/feddan	97.83	8.333	39.500	15.667	8.00	10.235	140.167	147.17	3.988
	10 kg N/feddan	102.83	9.833	46.767	14.900	8.20	16.013	171.803	180.39	4.335
	20 kg N/feddan	104.50	10.667	63.633	14.700	7.40	18.974	225.038	240.49	4.445
	30 kg N/feddan	108.00	12.00	65.617	16.183	7.30	20.541	302.667	317.80	4.697
	40 kg N/feddan	112.33	13.667	79.200	15.100	8.20	24.144	364.997	383.24	4.587
	45 kg N/feddan	99.83	10.00	61.733	14.800	8.80	18.160	209.833	220.32	3.782
60 cm	0 kg N/feddan	81.00	9.667	48.303	14.533	6.50	11.721	174.013	182.71	4.386
	10 kg N/feddan	93.00	10.833	67.983	14.067	7.00	18.985	232.723	244.36	4.509
	20 kg N/feddan	98.83	12.167	71.733	15.100	8.10	20.756	278.833	292.77	4.690
	30 kg N/feddan	101.83	13.50	81.367	14.367	8.40	22.754	318.330	334.25	4.947
	40 kg N/feddan	107.16	14.667	86.867	15.167	7.00	26.017	387.833	407.22	5.058
	45 kg N/feddan	97.667	10.833	67.833	15.467	7.60	18.786	255.445	268.21	4.375
F-test		-	-	-	-	-	*	*	*	-
LSD at 0.05		NS	NS	NS	NS	NS	4.70	41.52	41.05	NS

Table (6): Effect of plant distance and nitrogen fertilization on oil (%) in crushed fruits of caraway.

Fertilizer	Distance	20 cm	40 cm	60 cm	Mean
	0 kg nitrogen/feddan		1.833	2.573	2.733
10 kg nitrogen/feddan		2.867	3.333	3.467	3.222
20 kg nitrogen/feddan		3.200	3.500	3.533	3.411
30 kg nitrogen/feddan		3.200	4.400	4.200	3.933
40 kg nitrogen/feddan		3.333	4.067	4.433	3.944
45 kg nitrogen/feddan		2.733	3.533	3.267	3.178
Mean		2.861	3.568	3.606	
LSD at 0.05	Plant Distance	0.349			
	Nitrogen Fertilizer	0.712			
	Distance X Fertilizer	NS			

Response of caraway yield to plant distance and.....

3.5. The interaction between season and nitrogen fertilization

Data presented in Table (3) reveal that plant height, weight of seeds per plant (gm), fruit yield per plot (gm) and fruit yield per feddan (kg) were significantly affected by the interaction between seasons and nitrogen fertilization. These results may be due to the environmental conditions.

with 40 kg nitrogen/plant). In the case of weight of fruits per plant (gm) no significant differences were obtained when the distance was 40 cm distance between plants and plants received 40 kg nitrogen/plant) or at 60 cm distance between plants and plants received 30 kg nitrogen/plant, and also at 60 cm distance between plants and

Table (7): Effect of plant distance and nitrogen fertilization on oil yield/feddan (L) in crushed fruits of caraway .

Distance Fertilizer	20 cm	40 cm	60 cm	Mean
0 kg nitrogen/feddan	1.677	2.521	3.357	2.518
10 kg nitrogen/feddan	3.579	4.203	5.838	4.540
20 kg nitrogen/feddan	4.340	6.741	7.287	6.123
30 kg nitrogen/feddan	4.550	10.472	10.920	8.647
40 kg nitrogen/feddan	6.426	11.136	12.145	9.902
45 kg nitrogen/feddan	2.108	5.960	6.486	4.852
Mean	3.780	6.839	7.672	
LSD at 0.05	Distance	2.047		
	Fertilizer	2.606		
	Distance X Fertilizer	NS		

3.6. The interaction between plant distance and nitrogen fertilization

Data presented in Tables (5, 6 and 7) reveal that weight of seeds per plant (gm), fruit yield per plot (gm) and fruit yield per feddan (kg) were significantly affected by the interaction between plant distance and nitrogen fertilization. The maximum values were obtained from planting at 60 cm between the plants and applying 40 kg nitrogen per feddan. No significant differences were obtained between the planting distance of 40 cm with fertilization at 40 kg nitrogen/plant and the distance of 60 cm distance between plants

plants received 40 kg nitrogen/plant).

Fig. (1) shows a curve estimating the interaction between plant distance and nitrogen fertilization for yield/feddan of caraway. The response rate of the first stage was positive over all treatments. The increments per one fertilizer kg were 6.763, 10.28 and 10.00 kg with planting distances of 20, 40 and 60 cm, respectively. The response rate of second stage was negative over all the treatments. The reduction per one fertilizer kg was equal 0.114, 0.147 and 0.148 kg in 20, 40 and 60 cm, respectively.

We can determine the best level of nitrogen (40 kg nitrogen/feddan) that gives the maximum yield

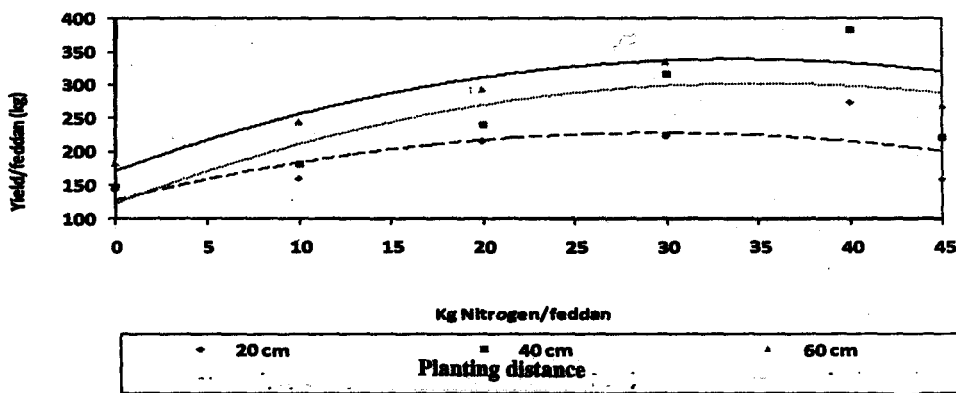


Fig. (1): Effect of interaction between plant distance and nitrogen fertilization on yield/ feddan (kg) of caraway plant.

value from the point of maximum curvature, and we can predict from the graph directly the yield values at any level of nitrogen fertilization within the range.

The predicted equations:

$$Y (20 \text{ cm}) = 127.4 + 6.763x - 0.114x^2$$

$$Y (40 \text{ cm}) = 122.8 + 10.28x - 0.147x^2$$

$$Y (60 \text{ cm}) = 170.6 + 10.00x - 0.148x^2$$

3.7. The interaction between season, plant distance and nitrogen fertilization

Data presented in Table (2) reveal that plant height was significantly affected by the interaction between plant distance, nitrogen fertilization and seasons. The maximum values were obtained by using a planting distance of 20 cm and fertilization with 40 kg nitrogen/feddan. No significant differences were obtained when using (20 cm between plants and 30 kg nitrogen/plant) and (20 cm between plants and 40 kg nitrogen/plant). These results may be due to the nature of plant growth and environmental conditions.

According to the above mentioned results, it could be stated that a plant spacing of 40 cm and 40 kg nitrogen/feddan produced the maximum yield.

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استجابة محصول نبات الكراوية لمعاملات مسافات الزراعة والتسميد النيتروجيني

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ملخص

أقيمت تجربتان حقليتان في مزرعة كلية الزراعة - جامعة القاهرة خلال موسمي الزراعة ٢٠٠٦-٢٠٠٧ و ٢٠٠٧-٢٠٠٨ لدراسة اثر مسافات الزراعة و التسميد النيتروجيني على نبات الكراوية. كانت معاملات مسافات الزراعة ٢٠، ٤٠، ٦٠ سم بين النباتات. أمامعاملات التسميد النيتروجيني فكانت ٠، ١٠، ٢٠، ٣٠، ٤٠ و ٤٥ كجم نيتروجين للفدان. أظهرت النتائج ان اعلى طول للنباتات تم الحصول عليه عند استخدام المسافة ٢٠ سم بين النباتات بينما حققت صفات عدد الفروع الرئيسية للنبات، عدد النورات على النبات، وزن الثمار للنبات بالجرام، محصول الثمار للقطعة التجريبية

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بالجرام، ومحصول الثمار للفدان بالكيلوجرام، وزن ١٠٠٠ بذره بالجرام، النسبة المئوية للزيت و محصول الزيت للفدان باللتر حقت اعلى نتائج عند استخدام ٦٠ سم بين النباتات. تتضمن النتائج كذلك ان صفات طول النبات، عدد الفروع الرئيسية للنبات، عدد النورات على النبات، وزن الثمار للنبات بالجرام، محصول الثمار للقطعة التجريبية بالجرام، ومحصول الثمار للفدان بالكيلوجرام، وزن ١٠٠٠ بذره بالجرام، النسبة المئوية للزيت و محصول الزيت للفدان باللتر كانت اعلى نتائج عند اضافة ٤٠ كجم نيتروجين للفدان. التفاعل بين مسافات الزراعة والتسميد النيتروجيني على محصول البذور للفدان كانت اعلى نتائج عند استخدام ٤٠ سم بين النباتات و اضافة ٤٠ كجم نيتروجين للفدان.

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