Effect of Plant Spacing and Nitrogen Fertilizer on Sesame Productivity in Reclaimed Land

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ABSTRACT

Two field experiments were carried out at Nubaria Agric. Res. Station during 2000 and 2001 seasons to study the effect of plant spacing (10, 15 and 20 cm between hills) and three nitrogen levels (45, 60 and 75 kg N/fed.) on yield and yield components of sesame productivity in reclaimed land. A split-plot design with four replications was used. The three plant spacing occupied the main plots and nitrogen fertilizer levels were arranged randomly in sub-plots.The results indicated that plant spacing and nitrogen levels significantly affected plant height, fruiting zone length, number of capsules/plant, seed yield/plant and seed yield/feddan. The highest seed yield/fed. was obtained by growing sesame plant at 10 cm appart between hills under the application of 75 kg N/fed. All interactions did not show any significant effect on all studied characters except seed yield/plant and seed yield/fed. It could be concluded that increasing plant spacing decreased seed yield/fed.

INTRODUCTION

It is well known that nitrogen (N) is the most important nutrient for plant growth and crop productivity. However, response of field crops to N application usually varied from location to another according to levels of soil fertility, water supply, used genotypes, level of crop husbandry, ... etc. Many research workers reported that N application improved sesame growth and its productivity in Egypt (Atta, 1986; El-Wakill, 1986; Basha, 1994; Odeny et al., 1994; El-Sergany et al., 1995; Qayyum et al., 1995 and El-Sharke, 1999).

The optimum plant spacing (and plant population density) that could produce the best seed yield of sesame depend on the used genotype and its growth and yield characters as well as the other factors viz., nutrient, water supply and level of crop husbandry.

The highest seed yield was reported when sesame was grown at plant spacing of 30x15 cm; i.e., 222,222 plants/ha (Mandal et al., 1990; Nirval et al., 1995; Patil et al., 1996; Tiwari and Namdeo, 1997 and Moorth et al., 1997). Meanwhile, Dixit et al.(1997) stated that the sesame yield was not significantly affected when plant population density was increased from 300,000 to 6000,000 plants/ha.

In Egypt, sesame is considered as a food crop rather than oil seed crop because most of its seeds are consumed directly, we use its extracted oil in different purposes such as tehena, halawa, bakery products, ... etc. In spite of increasing the area of sesame from 31,000 to 67,000 fed. (116%), and seed

production from 15,000 to 33,000 tons (120%) during 1986 to 1999 period (Central Administration of Agric. Economy, Ministry of Agric. and Land Reclamation, Egypt), about 35,000 tons of sesame seeds were imported in 1998 to satisfy the national requirements. Therefore, increasing sesame seed production is needed. This could be achieved through improving the productivity of sesame because it is increased the last 15 years by 4% only (from 477 to 497 kg/fed.) and also by increasing the area devoted to sesame. This may be easier when the productivity increased and consequently the net return to the farmer will increase.

Therefore, the present work was conducted to study the effect of plant spacing and nitrogen fertilizer on yield and yield components of sesame productivity, under reclaimed land conditions.

MATERIALS AND METHODS

Two field experiments were carried out at Nubaria Agric. Res. Station during 2000 and 2001 seasons to study the effect of plant spacing and nitrogen levels on yield and yield components of sesame crop in reclaimed land. Mechanical and chemical analyses of the experimental site are presented in Table (1). The preceding crop was field bean in the two seasons.

The experiments were carried out in a split-plot design with four replications. Three plant spacing (10, 15 and 20 cm between hills) were randomly distributed in the main plot. The sub-plots were devoted to three nitrogen levels (45, 60 and 75 kg N/fed.). The sub-plot area was 12 m^2 (4x3 m). Sesame seeds cv. Giza 32 were planted in May 25, 2000 and May 23, 2001. The experimental soil was sprayed by Stom herbicide at the recommended rate (1 litre/fed.) just before sowing irrigation. Thinning was done just before the 2nd irrigation to secure 2 plants/hill. The nitrogen fertilizer in the form of ammonium nitrate (33.5% N) was added before the second irrigation. Hoeing was done twice before the 1st and 2nd irrigation for weed control. Other cultural practices were carried out as recommended.

The studied characters were days to 50% flowering and to maturity measured on whole sub-plots basis. At harvest, a random sample of 10 guarded plants was taken from each sub-plot to estimate the plant height, height to first capsule on the main stem, fruiting zone length on the main stem, number of capsules/plant, 1000-seed weight and seed yield/plant. Seed yield/fed. was determined from the whole sub-plot.

Oil content in sesame seeds was determined by Soxhlet apparatus on dry weight basis as described by Sorenson (1947).

The collected data were statistically analyzed according to Snedecor and Cochran (1967).

Table 1. Mechanical and chemical analyses of the experimental soil in 2000 and 2001 seasons.

Soil properties	Season	
	2000	2001
Soil particles (%)		
Sand	52.9	53.3
Silt	21.8	20.8
Clay	25.3	25.9
Soil texture	sandy clay loam	sandy clay loam
Chemical properties		
Total N (%)	0.046	0.051
Available N (ppm)	26.30	28.60
Available P (ppm)	9.68	8.40
Available K (ppm)	425.0	403.0
pH	8.2	8.1
E.C. (mmhos/cm)	2.21	1.95
O.M. (%)	0.95	0.98
$CaCO_3$ (%)	22.9	22.5

RESULTS AND DISCUSSION

1. Effect of hill spacing

Days to maturity, stem height to first capsule, 1000-seed weight and seed oil percentage were not significantly affected by hill spacing in the two seasons. Data presented in Tables (2 and 3) indicated that plant height was significantly increased as hill spacing increased. Also, increasing hill spacing significantly increased fruiting zone length, number of capsules/plant and seed yield/plant. Increasing plant spacing may cause an increase in yield per plant, this may be due to more spacing between hills which leads to less competition between plants on light, nutrients and water.

Data presented in Tables (2 and 3) indicated that increasing plant spacing significantly decreased seed yield/fed. of sesame plants in the two seasons. These results are in agreement with those obtained by Sharma et al.(1996) and Dixit et al.(1997)

Table 2. Average values of days to maturity, plant height, height to 1st capsule and fruiting zone length of sesame plants as affected by plant spacing and N levels in 2000 and 2001 seasons.

Treatments	Days to maturity		Plant height (cm)		Height to 1st capsule (cm)		Fruiting zone length (cm)	
	2000	2001	2000	2001	2000	2001	2000	2001
Plant spacing								
10	119.2	122.8	166.2	173.7	80.3	79.4	92.4	95.3
15	119.8	123.8	170.5	176.1	79.4	77.9	95.3	96.6
20	120.8	124.2	174.1	175.9	76.9	78.6	98.1	102.4
$L.S.D_{0.05}$	N.S	N.S	3.9	1.1	N.S	N.S	2.3	1.2
Nitrogen levels								
45	119.5	122.6	167.5	173.6	78.8	79.2	93.5	96.4
60	119.8	123.8	170.5	175.0	78.8	78.7	95.0	97.8
75	120.7	124.5	174.4	177.4	78.5	78.3	97.6	100.2
$L.S.D_{0.05}$	N.S	N.S	4.2	1.7	N.S	N.S	3.5	2.9

Table 3. Average values of number of capsules/plant, 1000-seed weight, seed yield/plant, seed yield/fed. and seed oil content (%) of sesame plants as affected by plant spacing and N levels in 2000 and 2001 seasons.

Treatments	No. of capsules /plant		1000-seed weight (g)		Seed yield/plant (g)		Seed yield/fed. (kg)		Oil seed (%)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Plant spacing										
10	66.5	68.6	3.73	3.74	10.9	12.1	763.5	776.7	47.36	48.93
15	72.3	76.8	3.85	3.73	13.3	14.1	750.9	765.3	48.34	48.09
20	76.2	80.7	3.84	3.81	16.2	16.5	749.4	750.9	47.90	48.35
$L.S.D_{0.05}$	2.7	1.3	N.S	N.S	0.6	0.8	5.5	4.7	N.S	N.S
Nitrogen levels										
45	69.6	72.9	3.80	3.74	12.6	13.2	747.5	755.4	47.53	48.42
60	71.3	75.2	3.82	3.71	13.5	14.4	756.5	766.3	48.36	48.24
75	74.1	78.1	3.79	3.82	14.3	15.1	760.8	771.2	47.72	48.72
$L.S.D_{0.05}$	3.2	2.6	N.S	N.S	1.1	0.9	6.2	5.9	N.S	N.S

2. Effect of N levels

All studied characters, except days to maturity, height to first capsule, 1000-seed weight and seed oil percentage, were significantly affected by nitrogen levels in the two seasons, as shown in Tables (2 and 3). Increasing N levels from 45 to 75 kg N/fed. increased seed yield/fed. However, increasing N levels also increased fruiting zone length, number of capsules/plant and seed yield/plant. Such increase in seed yield of sesame may be due to the stimulation effect of nitrogen fertilizer to vegetative growth of sesame plant which lead to significant increase in plant height (Tables 2 and 3), which increased fruiting zone length and consequently the number of capsules/plant. Atta (1986), El-Wakil (1986), Basha (1994), El-Emam et al.(1998), El-Sergany et al.(1999) and El-Sharke (1999) reported similar results in Egypt. The same trend was also noticed in India by some researchers (Bennett et al., 1996; Dutta et al., 1996 and Singh et al., 1997), who stated that highest seed yield of sesame was obtained at N level of 90-120 kg/ha.

3. N levels x hill spacing interaction

Data presented in Tables (4 and 5) indicated that the interaction between plant spacing and nitrogen levels had significant effect on seed yield/plant and seed yield/fed. during both seasons of the study. The highest value of seed yield/fed. was obtained by growing sesame plant at 10 cm between plants and under the application of 60 kg N/fed. Ghosh and Patra (1994) found significant effect of hill spacing x N levels interaction on seed yield/fed. of sesame. It is clear from Table (3) that the rate of seed yield increased due to increasing nitrogen levels from 45 to 75 kg N/fed.

Table 4. Average values of days to maturity, plant height, height to 1st capsule and fruiting zone length of sesame plants as affected by plant spacing and N levels interaction in 2000 and 2001 seasons.

Plant spacing (S)	N fertilizer (N)	Days to maturity		Plant height (cm)		Height to 1st capsule (cm)		Fruiting zone length (cm)	
		2000	2001	2000	2001	2000	2001	2000	2001
10	45	118.7	122.1	166.3	172.3	80.1	79.3	90.3	93.7
	60	118.9	122.9	165.9	173.1	81.3	78.9	92.4	95.4
	75	120.1	123.4	171.3	175.6	79.5	80.1	95.7	96.8
Mean		119.2	122.8	166.2	173.7	80.3	79.4	92.8	95.3
15	45	119.3	123.1	165.7	173.4	78.9	78.4	93.4	95.1
	60	120.2	123..9	170.4	175.5	78.3	77.9	95.6	96.3
	75	120.2	124.5	175.3	179.4	80.9	77.3	96.7	98.4
Mean		119.8	123.8	170.5	176.1	79.4	77.9	95.2	96.6
20	45	120.7	122.5	170.4	175.1	77.3	80.0	96.7	100.3
	60	120.3	124.6	175.3	176.4	76.9	79.3	97.1	101.7
	75	121.4	125.7	176.7	177.3	76.5	77.5	100.4	105.3
Mean		120.8	124.2	174.12	175.9	76.9	78.6	98.1	102.4
$L.S.D_{0.05}$									
S		N.S	N.S	3.9	1.1	N.S	N.S	2.3	1.2
N		N.S	N.S	4.2	1.7	N.S	N.S	3.5	2.9
S x N		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 5. Average values of number of capsules/plant, 1000-seed weight, seed yield/plant, seed yield/fed. and seed oil content (%) of sesamo plants as affected by plant spacing and N levels interaction in 2000 and 2001 seasons.

Plant spacing (S)	N fertilizer (N)	No. of capsules /plant		1000-seed weight (g)		Seed yield/plant (g)		Seed yield/fed. (kg)		Oil seed (%)	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
10	45	65.3	66.1	3.61	3.75	10.3	11.2	759.2	770.4	47.21	48.25
	60	66.4	68.9	3.82	3.66	10.9	11.9	766.2	780.4	47.95	48.73
	75	67.9	70.8	3.75	3.81	11.5	13.2	765.1	779.3	46.93	49.82
Mean		66.5	68.6	3.73	3.74	10.9	12.1	763.5	776.7	47.36	48.93
15	45	70.3	75.2	3.89	3.71	12.3	12.8	739.4	760.3	48.22	48.51
	60	71.2	77.4	3.75	3.73	13.7	14.6	750.2	770.4	48.90	47.36
	75	75.4	77.9	3.91	3.75	13.9	14.9	763.1	765.2	47.90	48.41
Mean		72.3	76.8	3.85	3.73	13.3	14.1	750.9	765.3	48.34	48.09
20	45	73.2	77.4	3.91	3.76	15.3	15.7	740.8	735.4	47.15	48.51
	60	76.4	79.2	3.89	3.75	15.9	16.8	753.2	748.2	48.23	48.63
	75	78.9	85.7	3.71	3.91	17.4	17.1	754.2	769.2	48.33	47.93
Mean		76.2	80.7	3.84	3.81	16.2	16.5	749.4	750.9	47.90	48.35
$L.S.D_{0.05}$											
S		2.7	1.3	N.S	N.S	0.6	0.7	5.5	4.7	N.S	N.S
N		3.2	2.6	N.S	N.S	1.1	0.9	6.2	5.9	N.S	N.S
S x N		N.S	N.S	N.S	N.S	3.6	2.2	10.8	8.3	N.S	N.S

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الملخص العربى

تأثير مسافات الزراعة والتسميد النتروجينى على إنتاجية السمسم فى الأراضى الجديدة

فتحى رجب رمضان نوار ، سيد عبدالعزيز صالح

قسم بحوث التكثيف المحصولى بمحطة البحوث الزراعية بالنوبارية

أجريت هذه الدراسة فى محطة البحوث الزراعية بالنوبارية خلال موسمى ٢٠٠٠، ٢٠٠١ وذلك لدراسة تأثير ثلاث مسافات للزراعة هى (١٠، ١٥، ٢٠ سم بين الجور على ريشة واحدة للخطوط بعرض ٦٠ سم) وثلاثة معدلات من التسميد الآزوتى (٤٥ ، ٦٠، ٧٥كجم نتروجين/فدان) على المحصول ومكوناته ولقد تم تنفيذ

الـــتجارب فى تصميم القطع المنشفة مرة واحدة ووزعت مسافات الزراعة عشوائياً فى القطع الرئيسية ووزعت معدلات التسميد الأزوتى فى القطع الشقية عشوائياً.

وقد أوضحت النتائج مايلى:

١- أدت نـــتائج مسافات الزراعة ومعدلات التسميد الأزوتى تأثيراً معنوياً على إرتفاع النبات وطول المنطقة الثمرية وعدد الكبسولات/نبات ومحصول النبات وكذلك محصول الفدان فى الموسمين وكان أعلى محصول للفدان بالزراعة على مسافة ١٠سم بين الجور وإضافة ٧٥كجم نتروجين/فدان.

٢- كان هناك تأثير معنوى للتفاعل بين مسافات الزراعة بين الجور ومعدلات التسميد الأزوتى على محصول البذور/نبات وكذلك محصول البذور للفدان.

٣- أدت زيادة مسافة الزراعة إلى نقص المحصول معنوياً.