Effect of Plant Density, Nitrogen Fertilization and Foliar Spraying with Iron and Zinc on Peanut in Newly Cultivated Sandy Soils

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Abstract: In the present study, attempts were made to identify the potential of micronutrients, nitrogen fertilizer and planting distance for promoting and improving *peanut* growth and productivity. Two Field experiments were conducted during 2006 and 2007 seasons at the Experimental Farm, Faculty of Agriculture, Suez Canal University at Ismailia on peanut Ismailia 1 variety to achieve this target under sprinkler irrigation system. Every experiment included 36 treatments which were the combinations of three nitrogen fertilizer levels, four foliar spraying with micronutrients and three distances between hills. The split-split plots design with four replications was made in use, where nitrogen fertilizer levels were allocated randomly in the main plots, while treatments of foliar spraying with micronutrients were arranged randomly in the sub plots and distances between hills were distributed randomly in the sub-sub plots. Results of the present study indicated that treatment with microelements and nitrogen fertilizer increased significantly the leaf area index and straw, pods, seeds and oil yields/fad. Decreasing plant spaces between hills from 12.5 cm to 7.5 cm also increased the previous traits significantly while, seed oil percentage was decreased. All the interactions among the three studied factors did not affect significantly on yield characters except, the interaction between N-levels and hill spacing on and seed yield/fad. Close spacing of 7.5 cm with the maximum level of in (70 Kg N/fad) gave significantly higher seed yield/fad (1740.96Kg/fad). While, the lowest seed yield/fad (639.11Kg/fad) was obtained from the minimum level of N (30Kg N/fad) with wide spacing of 12.5 cm.

Keywords: Peanut, N-fertilizer, Microelements, hill spacing and Seed Quality

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is a widespread leguminous crop of great agricultural and economic significance. It is cultivated in the semi-arid tropical and sub-tropical regions of approximately 100 countries on six continents between 40°N and 40°S (Naidu *et al.*, 1999). In developing regions of Asia, Africa and South America, peanut is the principal source of digestible protein, cooking oil and vitamins (Savage and Keenan 1994) and contributes significantly to food security and alleviating poverty (Smartt 1994). It is also considered one of the most important edible oil crops in Egypt. In 2008 season, the acreage of peanut In Egypt was 146173 faddans with an average 19.05 ardabs per faddan. The most suitable areas for growing peanut are located in sandy soils, where, it grows successfully in these soils. Many problems face the production of peanut in sandy soils such as low fertility of theses lands, high loss of nutrients by leaching and the unfilled pods in the yield. However, peanut is considered legume crop, maximum yield of crop can not be obtained with symbiotically fixed nitrogen alone but N supply was required (Leng, 1973) especially in sandy soils.

Plants modify the physico-chemical properties and biological composition of the rhizosphere through a range of mechanisms, which include acidification through proton extrusion and the release of root exudates. Along with changes to soil pH, root exudates directly influence nutrient availability. Therefore, Soil surface nutrient balance is one of the indexes of environmental impact on crop production (OECD 2008) and the sustainability of agroecosystems. A surplus or deficiency of nitrogen (N) and microelements has the potential to affect (among other factors) air, water, and soil through nitrous oxide emission, to cause degrade soil fertility. The content of micronutrients in newly sandy soils is very low which considered limiting factor for plant growth. An adequate supply with nutritionally essential macro- and microelements (e.g. N, K, P, Mg, Ca and Zn, Fe, Cu, Co, Mn, Mo, Cr, Na) are of great importance for high yielding under sandy soils conditions. Determine the optimum plant density is very important for obtain the maximum yield especially with new varieties such as Ismailia 1.

Several studies have addressed different aspects of the N amount issue associated with the changing of plant density and microelements. Barik *et al.* (1998) and Mahmoud and El-Far, (2000) concluded that applying N fertilizer up to 40kgN/ha increased pod and seed yields/ha. Also, El-Seesy and Ashoub (1994) studied the effect of three plant distances namely 10, 20 and 30cm between hills on ridge 60cm apart to give plant densities 70000, 35000 and 23333 plants/fad, respectively and three levels of N fertilizer namely 20.50, 30.75 and 41kg N/fad on peanut crop and concluded that the highest pod yield/fad was received from planting at 10cm and using 41kg N/fad. While, Ash-Shormillesy and Abd El-Hameed (2006) studied the effect of two hill spacing namely 15 and 25cm to give plant population 112000 and 67200 plants/fad and two levels of N fertilization namely 20 and 40kg N/fad on peanut. The results indicated that there were significant interactions between hill spacing x N fertilizer levels on pods, seeds and oil yields/fad of peanut. The highest values of pods and seeds weight/plant were achieved by applying 40kg N/fad and sown in hills 25cm apart (67200 plants/fad), while the lowest values were obtained by adding 20kg N/fad and planted in hills 15cm apart (112000 plants/fad).

The importance of soil microelements and their interactions with plant density in relation to nutrient availability is considered along with their associated mechanisms of plant growth promotion. Rifaat *et al.* (2004) and Hafiz (2007) studied the effect of three hill spacing namely 10, 15 and 20cm in rows 60cm apart which give plant densities of 35000, 46666 and 70000 plants/fad and four micronutrients treatments 0.4% Zn SO4, 0.4% MnSO4, 0.4% ZnSO4 + 0.4% MnSO4 and water (control) on peanut and reported that there was significant interaction between hill spacing x micronutrients on 100-seed weight and pod yield/ fad. The highest 100-seed weight was obtained by spraying peanut plants with Zn + Mn and sown in hills 20cm apart, while the highest pod yield/fad was achieved by spraying with Zn + Mn and planted in hills 10cm apart.

The objective of this study was to evaluate the potential of foliar microelements, nitrogen fertilization and plant density to improve the yield and its quality of peanut under sandy soils conditions.

MATERIALS AND METHODS

Two Field experiments were carried out during 2006 and 2007 seasons at the Experimental Farm, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt. The peanut cultivar Ismailia 1 was used to study the effect of nitrogen fertilization, foliar spraying with zinc and iron and planting density on growth, yield, its components and quality under sprinkler irrigation system.

Each experiment included 36 treatments which were the combinations of three nitrogen fertilization levels, four foliar spraying with micronutrients and three distances between hills.

The three nitrogen levels were (30, 50 and 70 Kg N/fad). While, the four micronutrients treatments were water (control); 625ppm chelated zinc (16% Zn-EDTA); 550ppm chelated iron (8.5% Fe- EDTA); 625ppm chelated zinc + 550ppm chelated iron. Meanwhile, the three planting distances were 7.5 cm between hills (112000 plants/fad.); 10 cm between hills (84000 plants/fad.); 12.5cm between hills (67200 plants/fad). The experimental soil was sandy in texture. Mechanical and chemical analysis of the experimental soil were stated in Table (1).

The split-split plot design with four replications was made in use, where nitrogen fertilization levels were allocated randomly in the main plots, treatments of foliar spraying with micronutrients were arranged randomly in the sub plots and distances between hills were distributed randomly in the sub-sub plots. The experimental plot consists of 7 rows, 4 m in long and 50 cm in width.

All seeds of *Arachis hypogaea* cultivar Ismailia 1 were coated by Arab gum and inoculated with the specific Rhizobium strain immediately before sowing. Seeds were sown on April 19 and 23 in 2006 and 2007 seasons, respectively. After 20 days from sowing, peanut plants were thinned to one plant per hill.

A basal dose of 200 Kg calcium superphosphate (15.5% P2O2) was added at two equal doses before sowing and after 45 days from sowing. Potassium in the form of Potassium sulphate (48% K2O) at the rate of 100Kg/fad was applied at three equal doses, after thinning, 45 and 70 days from sowing. Nitrogen in the form of ammonium sulphate (20.5% N) at the previous rates (30, 50 and 70Kg N/fad) was applied at three equal doses, after 30, 45 and 60 days from sowing. Foliar spraying with micronutrients was done at three doses, after 40, 55 and 70 days from sowing with volume spray of 400 liter/fad.

The sprinkler irrigation system was used. Total amount of water consumed throughout the growing season attained 4588 and 4937m3/fad in the first and second seasons, respectively. The normal cultural practices for growing peanut crop at Ismailia Governorate were followed.

At 75, 90 and 105 days from sowing, five guarded plants were taken randomly from 2nd and 6th row in each plot to measure leaf area index (LAI) which was calculated by dividing leaf area/plant by land area of one plant.

While, at harvest, after 138 days from sowing, yield and yield attributes (Number of seeds/pod and Pod, seed and fodder yields Kg/Fad) were determined from the central three rows (3, 4 and 5) in each plot.

Seed quality was determined from the seed yield which obtained from the central three rows (3rd, 4th and 5th) in each plot at harvested. Also seed oil content (%) was determined by using the Soxhelt continuous extraction apparatus with petroleum ether (60–80C°) as an organic solvent for a period of 12 hours according to A.O.A.C. (1975) and oil yield (Kg/fad) was calculated by multiplying seed oil content (%) and seed yield/fad.

Table (1): Some mechanical and chemical properties of the experimental soil in the two seasons.

Seasons	Sand	Silt%	Clay%	Texture class	PH	E.C. m.mohs/cm at 25°C
2006	93.00	3.45	3.55	Sandy	7.85	0.18
2007	92.50	3.70	3.80	Sandy	7.60	0.16

Seasons	Soluble anions meq/L				Soluble cations meq/L			Available			Available trace nutrients		
	CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	N PPm.	P PPm.	K PPm.	Fe PPm.	Zn PPm.	Mn PPm.
2006	-	0.48	0.66	0.29	0.31	0.35	0.38	9.22	3.60	20.11	6.80	0.70	2.00
2007	-	0.41	0.58	0.17	0.26	0.28	0.31	9.95	3.85	22.40	7.50	0.78	2.60

The analysis of variance of split-split plots design was used according to Snedecor and Cochran (1982). The combined analysis of variance was applied after using Bartelet Test to find the homogeneity of error. Means followed by the same alphabetical letters are not statistically different according to Duncan's Multiple Range Test at the 5% level of significance (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of N levels, micronutrients and planting distances on leaf area index:

Peanut leaf area index is the principal mean for light intercepting and an important photosynthesis parameter for the plant as will as it is considered the best measure for photosynthesis capacity of plant regarding to the occupied area.

It is evident from Table (2) that increasing N- levels from 30 to 70 kg N/fad produced gradually and significantly increases in leaf area index at 75 and 90 days after sowing in both seasons and their combined data. Meanwhile, at 105 days after sowing the leaf area index was significantly increased by increasing N-levels from 30 to 50 kg N/fad in both seasons and their combined data. These results indicate that using 70 kg N/fad did not differ significantly from 50 kg N/fad in this respect. The combined data showed that the relative increases percentage of leaf area index due to application 70 kg N/fad were 55.97%, 42.05% and 16.18% compared with 30 kg N/fad at 75, 90 and 105 days after sowing respectively. These findings are in harmony with those obtained by Nour (1977).

From the combined data in the same Table, it could be concluded that the maximum values of leaf area index were obtained from spraying with zinc+ iron at 75 and 90 days from sowing without significant difference with those obtained from sowing with iron only. At 150 days from planting, the treatment of zinc and iron gave significantly the highest values of leaf area index. Meanwhile, the results obtained from the combined data showed that the minimum values of leaf area index were significantly obtained from spraying with water at 75 and 90 days after sowing and from spraying with water or zinc at 105 days after sowing. Compared with zinc, the relative increase percentages due to application of zinc and iron were 21.51%, 20.60% and 33.03% at 75, 90 and 105 days after sowing with combined data, respectively. The beneficial effects of iron and zinc on the growth characters of peanut plants might be attributed to its important roles in cell division, raising root nodules efficiency in nitrogen fixation, root extension, N metabolism, chloroplast structure and enzymes activation (Austin *et al.,* 2008). These results are in agreement with those obtained by Tripathy *et al.* (1999) and Mohamed (2001).

Generally, data in Table (2) clearly indicate that leaf area index was significantly increased with increasing plant density from 67200 to 112000 plants/fad. This was true throughout the first season and combined data at 75 and 90 days after sowing and in both seasons and their combined data at 105 days after sowing. This increasing of leaf area index is seemed to be affected by the increments of the plant population and well utilization of the environmental factors. Meanwhile, at 75 and 90 days after sowing the results of the second season indicate that the influence of plant distance on leaf area index was not significant. These results are in harmony with those obtained by Mohamed (2001) and El-Sayed (2003).

Table (2): Effect of N levels, foliar spraying with zinc and iron and distances between hills on leaf area index of peanut at 75, 90 and 105 days from sowing.

	At 75 days from sowing			At 90days from sowing			At 105days from sowing		
	2006	2007	Comb.	2006	2007	Comb.	2006	2007	Comb.
N levels (Kg/fad)									
N 30	4.47 c	1.88 c	3.18 C	5.47 c	3.33 c	4.40 C	7.72 b	6.12 b	6.92 B
N 50	5.14 b	2.48 b	3.81 B	6.41 b	3.94 b	5.18 B	8.66 a	6.46 a	7.56 A
N70	5.63 a	4.28 a	4.96 A	7.31 a	5.19 a	6.25 A	8.79 a	7.28 a	8.04 A
RI%			55.97%			42.05%			16.18%
Micronutrients									
Water	4.67 b	2.13 c	3.40 C	5.49 d	3.39 c	4.44 C	7.36 c	5.36 d	6.36 C
Zinc	4.80 b	2.64 c	3.72 B	6.18 c	3.82 b	5.00 B	7.39 c	6.22 c	6.81 C
Iron	5.34 a	3.21 b	4.28 A	6.65 b	4.59 a	5.62 A	8.63 b	6.96 b	7.80 B
Zinc + Iron	5.49 a	3.55 a	4.52 A	7.27 a	4.78 a	6.03 A	10.17 a	7.95 a	9.06 A
RI*%			21.51%			20.60%			33.03%
Plant distance									
7.5 cm.	5.56 a	3.01 a	4.29 A	7.32 a	4.24 a	5.78 A	10.30 a	8.03 a	9.17 A
10 cm.	5.18 b	2.93 a	4.06 A	6.07 b	4.00 a	5.04 B	8.18 b	6.38 b	7.28 B
12.5 cm.	4.51 c	2.71 a	3.61 B	5.81 b	4.21 a	5.01 B	7.70 b	5.44 c	6.57 C
Interactions									
N * M	NS	NS	NS	NS	NS	NS	NS	NS	NS
N * D	NS	*	NS	NS	NS	NS	NS	NS	NS
M * D	NS	NS	NS	NS	NS	NS	NS	NS	NS
N * M * D	NS	NS	NS	NS	NS	NS	NS	NS	NS

RI%: - Relative increasing percentage due to application of N70 compared with N30

RI*%: - Relative increasing percentage due to application of zinc and iron compared with zinc

The results in the same Table indicate that the interactions effect among the three studied factors did not affect significantly on leaf area index throughout all growth stages in both seasons and their combined data, which means that these factors act independently.

Effect of N levels, micronutrients and planting distances on yield and yield attributes:

Data illustrated in Table (3) show the effect of the three studied factors on number of seeds/pod and pod and seed yields (Kg/fad) in the two seasons and their combined data.

Concerning the effect of N-levels on number of seeds/pod, insignificant differences could be detected during both seasons and their combined data in this respect. These results are in good line with Abd El-Mottaleb (1983). He reported that number of seeds/pod was not affected by applying N fertilizer. On contrary, Ash-Shormillesy and Abd El-Hameed (2006) found that increasing N-level from 20 to 40 Kg N/fad increased number of seeds/pod. Also, the results indicate that increasing N-levels from 30Kg to 70 Kg N/fad increased gradually and significantly pod and seed yields (Kg/fad) in both seasons and over them. The results of the combined data in Table (3) showed that the relative percentages of increasing due to applying 70 Kg N/fad were 58.70% for pod yield and 90.37% for seed yield compared with 30 Kg N/fad. The obtained results are in agreement with those reported by Migawer and Soliman (2001), El-Habbasha (2005) and Ash-Shormillesy and Abd El-Hameed (2006).

The results in the same Table (3) revealed that pod and seed yields/fad were significantly affected by foliar application of micronutrients. While, micronutrients had insignificant influence on number of seeds/pod. The highest pod and seed yields/fad were obtained from foliar application with mixture of zinc and iron followed by the treatments of iron, zinc and water (control) with significant differences between them, respectively. In comparison with foliar application with water, the treatments of zinc and iron increased pod and seed yields/fad by 42.51% and 66.32% in combined data, respectively.

The beneficial effect of micronutrients on pod and seed yields/fad of peanut might be due to their favorable effects on growth and dry matter accumulation in peanut plants as a result of raising root nodules efficiency in nitrogen fixation as well as increasing the uptake of nitrogen by plant roots (Hallsworth *et al.*, 1964 and Leigh, 1971). Also, micronutrients increase photosynthetic pigments content (Saad *et al.,* 1980) and enzymes activity in turn enhance plant metabolism (Peyve, 1969 and Boardman, 1975) which reflected favorably on yield attributes such as number and weight of pods and seeds/plant as well as 100-seed weight and finally increased pod and seed yields/fad of peanut. These results are in harmony with those reported by Ali (2002), Ali and Mowafy (2003), Attia (2004), Rifaat *et al.* (2004) and Hafiz (2007).

Regarding the effect of planting distance on number of seeds/pod, pod yield/fad and seed yield/fad, the results in Table (3) revealed highly significant differences on pod and seed yields/fad during the two seasons and their combined data, while the effect of planting distance on number of seeds/pod was insignificant throughout the two seasons and their combined data. The results also, revealed that the maximum pod and seed yields/fad were obtained by sowing at 7.5 cm between hills in both seasons and their combined data. These results of the combined data also, showed that with increasing the distance between hills from 7.5 to 12.5 cm, pod yield/fad and seed yield/fad were decreased by 34.83% and 29.31% respectively. Also, El-Far and Ramadan (2000) and Hussein *et al.* (2000) stated that the highest pod yield/fad was achieved from closer spacing. Moreover, Mohamed (2001) found that increasing plant population from 42000 to 84000 plants/fad increased seed yield/fad. In addition, the obtained results are in accordance with those reported by El-Sayed (2003), Saleh *et al.* (2003), Ali *et al.* (2004) and Ash-Shormillesy and Abd El-Hameed (2006).

Also, the results in Table (3) indicate that the interactions between the three studied factors did not affect significantly on number of seed/pod and pod and seed yields/fad in both seasons and their combined data, except NxD which affected significantly on seed yield/fad (Table 3a). Close spacing of 7.5 cm with the maximum level of N (70 Kg N/fad) gave significantly higher seed yield/fad (1740.96 Kg/fad), followed by 1402.01 Kg seed/fad and 1295.89 Kg seed/fad which were obtained from the interaction between 70 Kg N/fad with hill spacing of 10 cm and the interaction between 50 Kg N/fad with hill spacing of 7.5 cm and with significant differences between them, respectively. The lowest seed yield/fad (639.11 Kg/fad) followed by 816.81 Kg/fad were obtained from the minimum level of N (30 Kg N/fad) with wide and mid spaces of 12.5 and 10cm with significant differences between them, respectively.

Effect of N levels, micronutrients and planting distances on straw yield and seed quality:

Table (4) indicates the straw yield (Kg/fad), seed oil % and oil yield (Kg/fad) of peanut at harvest as affected by N fertilization treatments, micronutrients treatments and plant spacing and their interaction in both seasons and over them.

The combined data presented in Table (4) show clearly that the highest straw yield (12018.08 Kg/fad) and oil yield (690.28 Kg/fad) resulted significantly with applying 70 Kg N/fad. While the highest seed oil percentage (52.65% and 51.46%) were recorded from the other studied levels (30 and 50 Kg N/fad) without significant difference between them, respectively.

Over the two seasons, data in the same Table (3) indicate that increasing N-levels from 30 Kg to 70 Kg N/fad increased straw and oil yields by 60.21% and 67.80%, respectively while the seed oil percentage was decreased. In this respect, favorable effects of fertilization with N on these traits were mentioned by El-Habbasha (2005) and Ash-Shormillesy and Abd El-Hameed (2006).

The foliar application of micronutrients affected these traits significantly in the two seasons and over them. In comparison with the foliar application by tap water, the highest straw and oil yields/fad (11568.84

and 725.1 Kg/fad, respectively) were obtained from the treatment of zinc and iron with significant differences with the other studied treatments in the combined data of the two seasons. Meanwhile, the maximum seed oil percentages were obtained from the treatment of zinc and iron, the treatment of iron and finally the treatment of zinc without significant differences among them.

The positive effect of micronutrients on seed oil content (%), might be due to the important role of micronutrients in enhancing enzymes activity and metabolism of lipids. The increase in oil yield/fad could be due to the increase in seed yield/fad and seed oil content (%).

The foliar application with micronutrients was found to enhance straw and oil yields by Attia (2004), Rifaat *et al.* (2004) and Hafiz (2007).Moreover, several investigators reported favorable effects of micronutrients on seed oil percentage, from them Ramamoorthy and Mohamed (2001), Ali (2002), Ali and Mowafy (2003), Rifaat *et al.* (2004) and Hafiz (2007).

Data presented in Table (4) show clearly that the cultivation of peanut plants at 7.5 cm between hills increased the straw and oil yields than those cultivated at 10 cm and 12.5 cm. In General, these results were true for both seasons and over them. In the combined data of the seasons, the relative increase percentages due to using 7.5 cm between hills were 61.89% for straw yield and 27.69% for oil yield compared with 12.5 cm between hills.

Opposite results were obtained from seed oil percentage, the highest values were significantly recorded under the middle and wide spaces (10 cm and 12.5 cm) without significant difference between them in both seasons and over them. By contrast, oil yield was significantly increased with narrowing plant spaces. This may be due to the high yields of pods and seeds under narrow spacing (Table 3). Similar results were obtained by Hanna *et al.* (1994), El-Far and Ramadan (2000), Mohamed (2001), El-Sayed (2003), Saleh *et al.* (2003) and Ash-Shormillesy and Abd El-Hameed (20).06.

Table (3): Effect of N levels, foliar spraying with zinc and iron and distances between hills on number of seeds/pod, pod yield (Kg/fad) and seed yield (Kg/fad) of peanut at harvest.

	Number of seeds/pod			Pod yield(Kg/fad)			Seed yield(Kg/fad)		
	2006	2007	Comb.	2006	2007	Comb.	2006	2007	Comb.
N levels (Kg/fad)									
N 30	1.480 a	1.436 a	1.458 A	1785.00 c	1467.75 c	1626.38 C	898.32 c	623.88 c	761.10 C
N 50	1.505 a	1.440 a	1.473 A	1944.75 b	2041.50 b	1993.13 B	1186.82 b	965.84 b	1076.33 B
N70	1.521 a	1.496 a	1.509 A	2432.25 a	2730.75 a	2581.50 A	1512.39 a	1385.36 a	1448.88 A
RI%			3.50%			58.73%			90.37%
Micronutrients									
Water	1.474 a	1.440 a	1.457 A	1825.50 c	1625.25 d	1725.38 D	976.02 d	689.75 d	832.89 D
Zinc	1.513 a	1.450 a	1.482 A	1992.00 b	1938.00 c	1965.00 C	1130.41 c	901.37 c	1015.89 C
Iron	1.457 a	1.460 a	1.459 A	2061.00 b	2175.75 b	2118.38 B	1233.32 b	1062.1 b	1147.71 B
Zinc+Iron	1.564 a	1.478 a	1.521 A	2338.50 a	2579.25 a	2458.88 A	1456.95 a	1313.55 a	1385.25 A
RI*%			4.39%			42.51%			66.32%
Plant distance									
7.5 cm.	1.451 a	1.450 a	1.451 A	2481.75 a	2606.25 a	2544.00 A	1434.60 a	1141.55 a	1288.07 A
10 cm.	1.542 a	1.429 a	1.486 A	1971.00 b	2026.50 b	1998.75 B	1200.87 b	974.46 b	1087.66 B
12.5 cm.	1.513 a	1.491 a	1.502 A	1710.75 c	1605.75 c	1658.25 C	962.07 c	859.06 c	910.56 C
RD%			3.40%			34.83%			29.31%
Interactions									
N * M	NS	NS	NS	NS	NS	NS	NS	NS	NS
N * D	NS	NS	NS	NS	NS	NS	*	*	*
M * D	NS	NS	NS	NS	NS	NS	NS	NS	NS
N * M * D	NS	NS	NS	NS	NS	NS	NS	NS	NS

RI%: - Relative increasing percentage due to application of N70 compared with N30
RI*%: - Relative increasing percentage due to application of zinc and iron compared with water
RD%: - Relative decreasing percentage due to using 12.5cm between hills compared with 7.5cm

Table (3a): Seed yield (Kg/fad) as affected by the interaction between N levels and hill spaces at harvest (the combined data).

hill spaces (cm)	N levels (Kg/fad)		
	30	50	70
7.5 cm	827.37	1295.89	1740.96
10 cm	816.81	1044.16	1402.01
12.5 cm	639.11	888.94	1203.62
L.S.D. 0.05		169.41	

Table (4): Effect of N levels, foliar spraying with zinc and iron and distances between hills on fodder yield (Kg/fad.), seed oil percentage and oil yield (Kg/fad.) of peanut at harvest.

	Straw yield (Kg/fad.)			Seed oil percentage			Oil yield (Kg/fad.)		
	2006	2007	Comb.	2006	2007	Comb.	2006	2007	Comb.
N levels (KG/fad)									
N 30	8241.17 ^{c}	6762.48 ^{c}	7501.64 ^{C}	54.38 ^{a}	50.92 ^{a}	52.65 ^{A}	491.64 ^{c}	331.12 ^{c}	411.38 ^{C}
N 50	10093.41 ^{b}	9304.45 ^{b}	9698.93 ^{B}	53.09 ^{a}	49.83 ^{a}	51.46 ^{A}	630.74 ^{b}	492.12 ^{b}	561.43 ^{B}
N70	12728.75 ^{a}	11307.41 ^{a}	12018.08 ^{A}	49.26 ^{b}	45.49 ^{b}	47.38 ^{B}	742.64 ^{a}	637.92 ^{a}	690.28 ^{A}
RI%			60.21%						67.80%
Micronutrients									
Water	8595.81 ^{d}	8151.93 ^{d}	8373.87 ^{D}	49.01 ^{b}	45.85 ^{b}	47.43 ^{B}	620.67 ^{d}	316.3 ^{d}	397.4 ^{D}
Zinc	9540.19 ^{c}	8548.90 ^{c}	9044.55 ^{C}	52.73 ^{a}	49.16 a	50.95 ^{A}	538.37 ^{c}	443.1 ^{c}	519.6 ^{C}
Iron	10686.63 ^{b}	9255.71 ^{b}	9971.17 ^{B}	53.24 ^{a}	49.44 ^{a}	51.34 ^{A}	598.87 ^{b}	525.1 ^{b}	590.8 ^{B}
Zinc+Iron	12595.11 ^{a}	10542.56 ^{a}	11568.84 ^{A}	53.98 ^{a}	50.53 ^{a}	52.26 ^{A}	728.77 ^{a}	663.7 ^{a}	725.1 ^{A}
R*I%			38.15%			10.18%			82.46%
Plant distance									
7.5 cm.	12443.47 ^{a}	11855.44 ^{a}	12149.46 ^{A}	49.25 ^{b}	45.15 ^{b}	47.02 ^{B}	705.1 ^{a}	521.69 ^{a}	613.40 ^{A}
10 cm.	10326.09 ^{b}	8803.47 ^{b}	9564.78 ^{B}	53.62 ^{a}	50.23 ^{a}	51.93 ^{A}	642.7 ^{b}	495.90 ^{a}	569.30 ^{B}
12.5 cm.	8293.76 ^{c}	6715.42 ^{c}	7504.59 ^{C}	53.86 ^{a}	50.87 ^{a}	52.37 ^{A}	517.2 ^{c}	443.56 ^{b}	480.38 ^{C}
RI**%			61.89%						27.69%
Interactions									
N * M	NS	NS	NS	NS	NS	NS	NS	NS	NS
N * D	NS	NS	NS	NS	NS	NS	NS	NS	NS
M * D	NS	NS	NS	NS	NS	NS	NS	NS	NS
N * M * D	NS	NS	NS	NS	NS	NS	NS	NS	NS

RI%: - Relative increasing percentage due to application of N70 compared with N30
RI**%: - Relative increasing percentage due to application of zinc and iron compared with water
RI**%: - Relative increasing percentage due to using 7.5cm between hills compared with 12.5cm

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تاثير الكثافة النباتية والتسميد الازوتى والرش بالحديد والزنك على الفول السودانى فى الاراضى الرملية حديثة الاستزراع

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فى هذة الدراسة اجريت عدة محاولات للتعرف على تاثير العناصر الصغرى والتسميد النيتروجينى ومسافات الزراعة لتشجيع وتحسين نمو وانتاجية الفول السودانى .

اجريت تجربتين حقليتين خلال موسمى ٢٠٠٦،٢٠٠٧ بمزرعة كلية الزراعة جامعة قناة السويس بالاسماعيلية على صنف الفول السودانى اسماعيلية ١ تحت نظام الرى بالرش. تضمنت كل تجربة ٣٦ معاملة والتى كانت عبارة عن توليفات بين ثلاث مستويات من التسميد النيتروجينى و ٤ مستويات من الرش الورقى للعناصر الصغرى وثلاث مسافات زراعة . اجريت التجربة فى تصميم القطع المنشقة مرتين فى ٤ مكررات حيث احتل التسميد النيتروجينى القطع الرئيسية والرش الورقى للعناصر الصغرى القطع المنشقة مرة واحدة ومسافات الزراعة القطع المنشقة مرتين.اوضحت النتائج ان المعاملة بالعناصر الصغرى والتسميد النيتروجينى زاد معنويا من كلا من دليل مساحة الاوراق ومحصول العرش و القرون والبذور و الزيت/ الفدان.اشارت النتائج ان نقص مسافة الزراعة بين الجور من ١٢,٥سم الى ٧,٥ سم زاد معنويا جميع الصفات السابقة ولكن حدث نقص فى محتوى البذور من الزيت. ولم يكن هناك تفاعل معنوى بين الثلاث عوامل تحت الدراسة على جميع صفات المحصول ماعدا التفاعل ما بين النيتروجين ومسافات الزراعة لصفة محصول البذور للفدان. حيث وجد ان استخدام مسافة الزراعة الضيقة (٧,٥سم) مع اعلى معدلات من التسميد النيتروجينى (٧٠ كجم/الفدان) اعطى اعلى محصول بذور /فدان (١٧٤٠,٩٦كجم/فدان) بينما اقل محصول بذور (٦٣٩,١٢١ كجم/فدان) قد تحصل علية من اقل معدل تسميد نيتروجينى مع مسافة الزراعة الواسعة (١٢,٥ سم).