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EFFECT OF SOWING DATE, PLANTING DENSITY AND NITROGEN FERTILIZATION ON FORAGE YIELD AND QUALITY OF FODDER MAIZE

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ABSTRACT: Two field experiments were carried out in an administrative farm in Sefeta village, Zagazig region, Skarkia Governorate, during two successive seasons 2004 and 2005. This investigation aimed to study the effect of three sowing dates (May 15th, June 15th and July 15th), four planting densities (70000, 105000, 140000 and 175000 plants/fad.) and four nitrogen fertilization levels (check, 30, 60, 90 kg N/fad.) on fresh and dry forage yields, leaf/stem ratio, crude protein content in leaves and stems in addition to crude fiber content in leaves and stems. The most important findings could be summarized as follows:

Sowing fodder maize in May 15th, gave the highest fresh and dry forage yields, crude protein in stems and leaf: stem ratio, while delaying sowing date from May 15th, to June 15th or July 15th, led to increasing crude fiber content in leaves and stems.

Planting 140000 plants/fad. gave the highest fresh and dry forage yields, while planting 175000 plants/fad. gave the highest leaf /stem ratio and crude protein content in both leaves and stems compared to the other planting densities.

The application of N-fertilizer up to 90kg N/fad. significantly increased fresh and dry forage yields as well as crude protein content in leaves and stems, but significantly and gradually decreased crude fiber content % in leaves and stems.

The obtained results showed significant interaction effect between planting density and nitrogen fertiiization level on fresh forage yield/fad., leaf/stem ratio and leaves protein content%. Also

significant interaction effect between sowing dates and nitrogen fertilization levels was observed.

Key words: Fodder maize, sowing date, planting density, nitrogen fertilization, forage yield, forage quality.

INTRODUCTION

In Egypt, the limited forage crops cultivated area constitutes the basic constraint to increase animal production because of forage shortage especially during the summer season at which animals suffer from lack in fresh forages. Therefore, farmers are used to increase production of fodder maize (darawa), as far, this crop is highly nutritive, heavy yielding, easy to cut and handle beside it has a short growing season (50-80 days). This could be achieved by vertical expansion, through improving cultural practices. Therefore, a rapid improvement in the yielding capacity of fodder maize could be gained by using a suitable sowing date, planting density and level of nitrogen fertilizer.

In Egypt, delaying planting, from May to August (Soliman *et al.*, 1983), from March to June (Abd El- Shafy, 2002) and from June 1st, to June15th (Zeidan *et al.*, 2003) significantly decreased forage yield and quality of fodder maize.

Planting density is one of the major factors determining the ability of the crop plant to capture resources. Increasing seeding rate up to 50-65 kg/fad. (Eid, 1978 and Geweifel, 1990), 90 kg/fad. (Nour El-Din *et al,* 1975) and 120 kg/ha. (Ayub *et al.*, 2003 in Pakistan) significantly increased fresh and dry forage yields. Mahmoud and Abd El-Shafy (1995) indicated that high planting densities of fodder maize up to 70000 plants/fad. gave the highest green, dry and protein yields. Plant density had little effect on crude fiber percentage. Sarhan and Abd El- Galil (2001) in Egypt, found that fresh and dry forage yields were, increased significantly due to increasing plant population density from 70000 plants/fad. to 93333 plants/fad. in both seasons.

Regarding the effect of nitrogen fertilization, Sawant and Khanvilkar (1987) reported that increasing N level up to 80 N/ha. caused significant increase in fresh fodder maize yield with no further increase with adding 120 kg N/ha. Meantime, Soelaeman *et al.* (1987) found that fresh forage yield

whereas crude protein content responded to nitrogen up to 225 kg N/fad. In Egypt, Nour El-Din *et al.* (1975) recommended 60 kg N/fad. to get maximum fresh and dry forage yields. While, nitrogen fertilizer did not influence the content of crude protein of fodder maize. Also, Eid (1978) found that 45 kg N/fad. in one season and 60 kg N/fad. in the other one are the optimum levels to obtain the maximum green forage yield, 45 kg N/fad. for maximum dry matter yield/fad. and 60 kg N/fad. for maximum protein content in both seasons.Geweifel (1990) in Egypt, found that adding N fertilizer up to 90 kg N/fad. to fodder maize significantly increased green and dry forage yields and crude protein content in both seasons. However, crude fiber content was decreased due to increasing N rates in the second season only. Also, Ayub *et al.* (2003) in Pakistan, stated that "nitrogen application up to 90kg N/ha. significantly increased fresh fodder yield, dry matter, crude protein and crude fiber of fodder maize."

MATERIALS AND METHODS

Two field experiments were carried out in an administrative field in Sefeta village, Zagazig region, Sharkia Governorate, during two successive seasons 2004 and 2005. Soil mechanical analysis of the experimental field showed that the soil texture was clay (1.60% coarse sand, 18.64% find sand%, silt 26.90% and 52.86% clay). Each experiment included 48 treatments which were the combinations of three sowing dates, four planting densities and four nitrogen fertilization levels. The three sowing dates were May 15th, June 15th and July 15th. The used planting densities were as follows:

1. 70000 plants/fad. using planting distance of 20cm on both sides of the ridge.
2. 105000 plants/fad. using planting distance of 13.3cm on both sides of the ridge.
3. 140000 plants/fad. using planting distance of 10cm on both sides of the ridge.
4. 175000 plants/fad. using planting distance of 8cm on both sides of the ridge.

The four nitrogen fertilizer levels were: zero, 30, 60 and 90kg N/fad.

The experiments were laid out in a split split plot design with three replications, where sowing dates were assigned to the main

plots and the planting density occupied the sub plots. However, nitrogen fertilizer levels were allocated to the second order sub-plots. The sub-plot area was 14.4 m^2 (3.6x4m) i-e. 6 ridges of 60cm width and 4m long. The preceding crop was wheat in both seasons. Basal dose of phosphorus fertilizer in form of superphosphate (15.5% P_2O_5) was added at time of seedbed preparation, whereas, N fertilization was added in the form of ammonium nitrate (33.5% N) as two equal doses, the first dose was applied at the 1st irrigation, where as the second dose was added at the 2nd irrigation. Maize cultivar used in both seasons was hybrid 310(three way cross hybrid). All cultural practices were kept the same as usually practiced in farmers fields.

The following yield and quality parameters were determined at cutting (60 days after sowing) throughout the two growing seasons:

1. Fresh forage yield (ton/fad.): at time of cutting an area of 4.8 m^2 (two ridges of 4m long x 1.2 m width), was cut where weighed and forage yield was calculated.

2. The forage plants were dissected to leaves and stems. Samples of 250gm fresh forage were taken from each two parts of plants oven dried at 70C° up to constant. Weight where dry forage yield/fad. was calculated

3. Leaf/stem ratio: was determined using the following formulae:

$$\frac{dry\ \ weight\ \ of\ \ leaves\ \ /\ plant}{dry\ \ weight\ \ of\ \ stems\ \ /\ plant} \times 100$$

4. Crude protein content: total nitrogen was determined using the modified kjeldahl method and multiplied it by 6.25.

5. Crude fiber content: was determined according to A. O. A. C. (1970).

Data were statistically analyzed using "MSTAT-C V.2.10, 1988" computer program. In the interaction, capital and small letters were used to compare rows and columns means, respectively.

RESULTS AND DISCUSSION

Forage Yield

Data related to fresh and dry forage yields (ton/fad.) as influenced by sowing date, planting density and nitrogen levels during 2004 and 2005 growth seasons and their combined are presented in Table 1.

The statistical analysis for dry forage yield showed significant differences among the three sowing dates (May15th, June15th and July15th) in both seasons and their combined analysis, while the results of the first and second seasons did not show any difference among sowing dates in fresh forage yield. But in the combined analysis fresh forage yield was significantly affected by sowing date. It is apparent from the data of the combined analysis that, planting in May15th increased fresh and dry forage yields over planting in June15th and July15th. The reduction in fresh and dry forage yields due to delaying planting date from May15th to June 15th and June15th to July15th reached 23.23% and 4.46% in fresh forage yield while, 27.12% and 6.87% in dry forage yield, respectively (combined data). The differences observed between sowing dates may be due to the different climatic conditions such as day length and heat prevailing during growth. This reflect the role impact, of planting date as one of the most cultural practices for determining the productivity of summer forage crops. The same trend was shown from the results of Soliman *et al.* (1983), Abd El-Shafy and Ahmed (2002), Zeidan *et al.* (2003).

Regarding the effect of planting density, it is apparent from the data in Table 1, that fresh and dry forage yields/fad. were highly significantly affected by planting density in both seasons. The plant density of 140000 plant/fad. gave the highest fresh and dry forage yields, which yielded 19.279 and 2.964 tons/fad., respectively (combined data). The highest forage yield/fad. at plant density 140000 plant/fad. was mainly attributed to increasing number of plants per unit area; the increase in the amount of solar energy intercepted by leaves and the well development of roots within the soil volume might account much for the better utilization of the environmental factors. On the other hand, the statistical significant depression in the fresh and dry forage yields with increasing planting densities from 140000 to 175000 plants/fad. might be attributed to the intensive competition between plants for light and this might in turn resulted in acceleration of leaf towards senescence stage and finally to a depression in fresh and dry forage yields. These results agreed with those reported by other authors such as Nour El- Din *et al.* (1975), Eid (1978), Geweifel (1990) and Ayub *et al.* (2003).

Concerning the effect of nitrogen fertilization on fresh and dry forage yields, the results in Table 1 show highly significant differences in fresh and dry forage yields in both seasons. The results indicated that the forage yield/fad. proportionally increased with the increase in nitrogen level. The corresponding increase in forage yield with each increment of applied nitrogen from zero to 90kg/fad. was significant. The addition of 90kg N gave the highest forage yield in both seasons. In general, several investigators obtained similar results; among them are Ayub *et al.* (2003) and Eltelib *et al.* (2006).

Table1. Fresh and dry forage yields (ton/fad) of fodder maize as influenced by sowing date, planting density and nitrogen level in both seasons and their combined

Main effects and interactions	Fresh forage yield (ton/fad.)			Dry forage yield (ton/fad.)		
	First season 2004	Second season 2005	Combined	First season 2004	Second season 2005	Combined
Sowing date (S):						
May 15th	19.610	18.104	18.857 a	3.107 a	2.890 a	2.998 a
June 15th	14.407	14.546	14.476 b	1.967 b	2.402 b	2.185 b
July 15th	14.797	12.863	13.830 b	2.060 b	2.011 c	2.035 b
F-test	N.S	N.S	*	*	**	**
L.S.D	-	-	3.497	0.961	0.378	0.429
Planting density (D):						
70000 plants/fad.	11.876 c	11.354 d	11.615 c	1.706 d	1.689 d	1.697 c
105000 plants/fad.	16.316 b	14.906 c	15.611 b	2.296 c	2.440 c	2.368 b
140000 plants/fad.	19.931 a	18.626 a	19.279 a	2.919 a	3.009 a	2.964 a
175000 plants/fad.	16.961 ab	15.798 b	16.380 b	2.592 b	2.600 b	2.596 b
F- test	**	**	**	**	**	**
L.S.D	3.355	0.674	1.652	0.464	0.150	0.236
Nitrogen levels (N):						
0 kgN/fad.	12.151 d	11.107 d	11.629 d	1.743 d	1.646 d	1.695 d
30 kg N/ fad.	15.519 c	14.663 c	15.091 c	2.250 c	2.329 c	2.289 c
60 kg N/ fad.	17.615 b	16.249 b	16.932 b	2.590 b	2.630 b	2.610 b
90 kg N/ fad.	19.799 a	18.666 a	19.232 a	2.929 a	3.132 a	3.031 a
F- test	**	**	**	**	**	**
L.S.D	0.802	0.548	0.482	0.146	0.123	0.094
Interactions						
SXD	N.S	N.S	N.S	N.S	N.S	N.S
SXN	*	N.S	*	**	N.S	**
DXN	**	**	**	*	**	**
SXDXN	N.S	N.S	N.S	N.S	N.S	N.S

The interaction between each two fact ors under study proved to affect fresh and dry forage yields. The most important of these interactions are shown in Tables 1a and 1b as well as Fig. 1 and 2. It is evident from the data that fresh forage yield was significantly decreased due to delaying sowing under the different nitrogen levels Table 1a and Fig1. May 15th planting gave the highest forage yield when 90kg/fad. was applied on the other hand , under the different densities used ;fresh forage yield was increased by adding nitrogen. Increasing planting density up to 140000 plants/fad. significantly increased this trait where the highest fresh forage yield (23.482 ton/fad.)was obtained when fodder maize was sown with 140000 plants/fad. and fertilized with 90kgN/fad.(Table 1b and Fig 2).

Table 1a. Fresh forage yield (ton/fad) of fodder maize as influenced by the interaction between sowing date and nitrogen fertilization (combined data)

Sowing date	Nitrogen fertilization level			
	0kgN/fad.	30kgN/fad.	60kgN/fad.	90kgN/fad.
May 15th	D 14.488 a	C 18.551 a	B 20.149 a	A 22.240 a
June 15th	D 10.999 b	C 13.858 b	B 15.436 b	A 17.613b
July 15th	D 9.401 c	C 13.858 c	B 15.212 b	A 17.844 b

Table 1b. Fresh forage yield (ton/fad) of fodder maize as influenced by the interaction between planting density and nitrogen fertilization (combined data)

Planting density	Nitrogen fertilization level			
	0 kgN/fad.	30kgN/fad.	60kgN/fad.	90kgN/fad.
70000 plants /fad.	D 9.180 c	C 11.042 c	B 12.174 d	A 14.064 d
105000plants/fad.	D 11.508 b	C 15.199 b	B 16.698 c	A 19.039 c
140000plants/fad.	D 13.796 a	C 18.649 a	B 21.189 a	A 23.482 a
175000plants/fad.	D 12.033 b	C 15.473 b	B 17.669 b	A 20.344 b

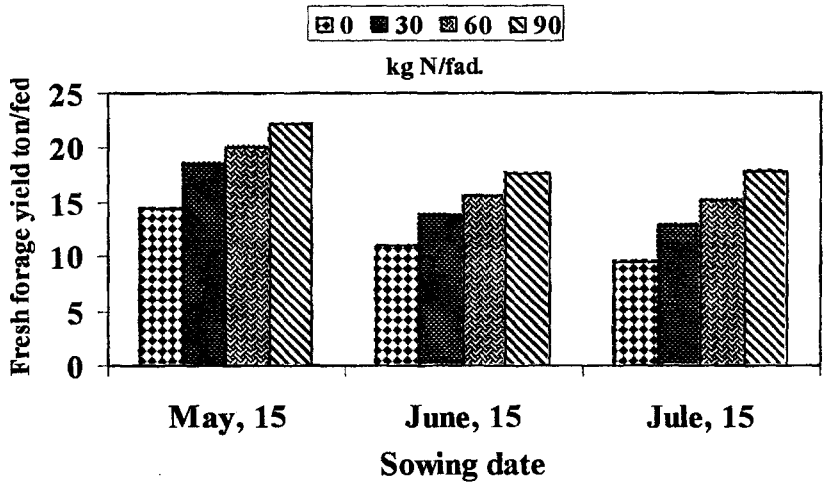

Fig. 1. Fresh forage yield (ton/fad.) as affected by the interaction between sowing date and N level.

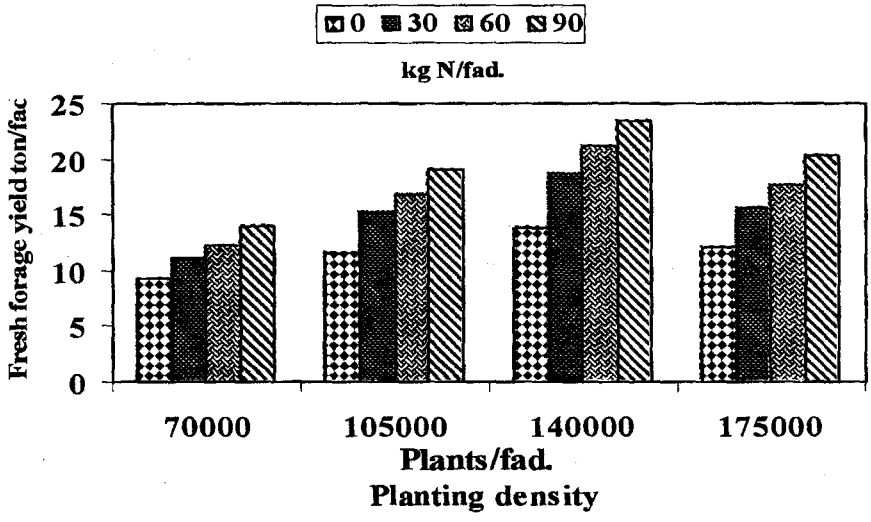

Fig. 2. Fresh forage yield (ton/fad.) as affected by the interaction between planting density and N level.

Leaf/ Stem Ratio

Means of leaf/stem ratio as affected by sowing date, planting density and nitrogen levels in 2004 and 2005 seasons and their combined are presented in Table 2.

The statistical analysis of variance showed highly significant differences among the three sowing dates. This was true in the second season and the combined analysis. Seeding on May 15th (early planting) gave higher value of this ratio compared to those of June 15th and July 15th (late planting). These results are in general agreement with those obtained by Hassan (2003) and Abd El- Raouf *et al.* (1988).

Increasing planting density from 70000 to 175000 plants/fad. showed highly significant increase in leaf/stem ratio in both seasons and their combined analysis. These results are in harmony with those reported by Hassanein *et al.* (1983) and Yakout *et al.* (1986)

Concerning the effect of nitrogen fertilization on leaf/stem ratio, the statistical analysis of the data of the combined analysis showed significant differences in leaf/stem ratio between treatments. The highest leaf/stem ratio was obtained from the application of 30kg N/fad. These results are in harmony with those reported by Abd El- Gawad (1993) and Geweifel (1997).

The interaction between each two factors under study proved to affect leaf/stem ratio. The most important interactions are shown in Tables 2a and 2b. It is clear to note that under different planting densities; delaying sowing from May15th to July15th significantly decreased leaf/stem ratio Table 2a.Under different planting density increasing nitrogen levels increased leaf/stem ratio. The highest leaf/stem ratio was obtained by using nitrogen level of 30kg N/fad. and planting density of 175000 plants/fad. (Table 2b).

Crude Protein Content

The averages of crude protein content in leaves and stems of fodder maize plants as influenced by sowing date, planting density and nitrogen levels in both seasons and their combined are presented in Table 3. Protein content of stems varied with sowing at various planting dates in both seasons and combined analysis. It could be noticed that crude protein content in stems was decreased with delay in sowing date, crude protein percentages were 5.209, 4.938 and 4.739% with sowing on

Table 2. Leaf / stem ratio of fodder maize as influenced by sowing date, planting density and nitrogen level in both seasons and their combined

Main effects and interactions	First season 2004	Second season 2005	Combined
Sowing date (S):			
May 15th	80.578 a	79.665 a	80.122 a
June 15th	66.543 b	80.261 a	73.402 b
July 15th	60.723 b	69.054 b	64.889 c
F-test	*	**	**
L.S.D	1.195	5.231	5.415
Planting density (D):			
70000 plants /fad.	60.632 c	69.353 b	64.992 c
105000 plants/fad.	64.221 bc	78.576 a	71.399 b
140000 plants/fad.	69.961 b	80.092 a	75.027 b
175000 plants/fad.	82.312 a	77.286 a	79.799 a
F- test	**	**	**
L.S.D	6.043	3.163	3.439
Nitrogen levels (N):			
0 kgN/fad.	67.692	74.785	71.238 b
30 kg N/ fad.	71.841	76.921	74.381 a
60 kg N/ fad.	69.331	76.468	72.899 ab
90 kg N/ fad.	68.263	77.133	72.698 ab
F- test	N.S	N.S	*
L.S.D	-	-	2.270
Interactions			
S.XD	N.S	**	**
SXN	N.S	N.S	N.S
DXN	N.S	**	**
SXDXN	N.S	N.S	N.S

Table 2a. Leaf/stem ratio of fodder maize as influenced by the interaction between sowing date and planting density (combined data)

Sowing date	Planting density			
	70000 plants /fad.	105000 plants /fad.	140000 plants /fad.	175000 plants /fad.
May 15th	B 76.610 a	AB 79.228 a	A 82.800 a	AB 81.910 a
June 15th	C 67.207 b	BC 72.707 b	B 73.801 b	A 79.893 a
July 15th	C 51.220 c	B 62.262 c	B 68.480 c	A 77.594 a

Table 2b. Leaf/stem ratio of fodder maize as influenced by the interaction between planting density and nitrogen fertilization (combined data)

Planting density	Nitrogen fertilization level			
	0 kgN/fad.	30kgN/fad.	60kgN/fad.	90kgN/fad.
70000plants/fad.	B 61.045	B 63.590	B 64.938	A 70.396
105000plants/fad.	A 72.185	A 71.965	A 71.074	A 70.370
140000plants/fad.	B 72.057	A 78.577	AB 75.627	B 73.846
175000plants/fad.	B 79.666	A 83.391	AB 79.958	B 76.181

May15th, June15th and July15th, respectively, while delaying in sowing date insignificantly affected the crude protein in leaves for two seasons and their combined. Also the data showed that higher protein content was obtained from the leaves than from stems in both seasons and combined analysis. El-Hattab and Harb (1991), Khinizy *et al.* (1997) and Abd El- Shafy and Ahmed (2002) came to similar results.

Generally, protein content in leaves and stems were increased significantly by increasing plant density from 70000 to 175000 plants/fad. the higher plant density gave the highest protein percentage in leaves i.e. 7.928, 7.792 and 7.860% in both seasons and their combined, respectively. Also plant density of 175000 plants/fad. gave the highest protein percentage in stems. i.e. 5.332, 5.460 and 5.396% in both seasons and their combined. While, the lowest protein percentage in leaves was obtained from planting density of 70000 plants/fad.

Protein content in leaves and stems were increased significantly as N- application was raised from 0 to 90kg N/fad. in both seasons and their combined. These results are in harmony with those reported by Soelaeman *et al.* (1987), Geweifel (1990), Mikhiel (1997) and Ayub *et al.* (2003).

The interaction effect of planting density and nitrogen fertilizer levels on crude protein content in leaves in both seasons and their combined is shown in Table 3a. The results clearly indicate that, under the different planting densities used; crude protein content in leaves was increased by adding nitrogen. Also, increasing planting density up to 175000 plants/fad. significantly increased this trait where the highest crude protein content in leaves (9.523%) was obtained when fodder maize was sown with 175000 plants/fad. and fertilized with 90kg N/fad.

Crude Fiber Content

The means of crude fiber content as affected by sowing date, planting density and nitrogen levels in both seasons and their combined are given in Table 4. The effect of sowing dates on crude fiber content in leaves was significant in second season and combined data. While, crude fiber content in stems was significant only in combined data.

Table 3. Crude protein content (%) in leaves and stems of fodder maize as influenced by sowing date, planting density and nitrogen level in both seasons and their combined

Main effects and interactions	Crude protein in leaves %			Crude protein in stems %		
	First season 2004	Second season 2005	Combined	First season 2004	Second season 2005	Combined
Sowing date (S):						
May 15th	6.995	7.199	7.097	5.175 a	5.243 a	5.209 a
June 15th	6.846	6.887	6.866	4.971 b	4.905 b	4.938 b
July 15th	6.567	6.634	6.601	4.782 b	4.696 b	4.739 c
F-test	N.S	N.S	N.S	*	*	**
L.S.D	-	-	-	0.198	0.304	0.117
Planting density (D):						
70000plants /fad.	5.850 d	6.087 d	5.969 d	4.676 c	4.544 c	4.610 d
105000plants/fad.	6.440 c	6.588 c	6.514 c	4.848 c	4.691 c	4.769 c
140000plants/fad.	6.993 b	7.160 b	7.076 b	5.048 b	5.096 b	5.072 b
175000plants/fad.	7.928 a	7.792 a	7.860 a	5.332 a	5.460 a	5.396 a
F- test	**	**	**	**	**	**
L.S.D	0.299	0.203	0.168	0.193	0.194	0.127
Nitroen levels (N):						
0 kgN/fad.	6.023 d	6.043 d	6.033 d	4.560 d	4.520 d	4.540 d
30 kg N/ fad.	6.588 c	6.618 c	6.603 c	4.826 c	4.853 c	4.840 c
60 kg N/ fad.	7.072 b	7.079 b	7.075 b	5.118 b	5.087 b	5.103 b
90 kg N/ fad.	7.529 a	7.888 a	7.708 a	5.398 a	5.330 a	5.364 a
F- test	**	**	**	**	**	**
L.S.D	0.164	0.176	0.118	0.111	0.116	0.078
Interactions						
SXD	N.S	N.S	N.S	N.S	N.S	N.S
SXN	N.S	N.S	N.S	N.S	N.S	N.S
DXN	**	**	**	N.S	N.S	N.S
SXDXN	N.S	*	N.S	N.S	N.S	N.S

Table 3a. Crude protein content (%) in leaves of fodder maize as influenced by the interaction between planting density and nitrogen fertilization (combined data)

Planting density	Nitrogen fertilization level			
	0 kgN/fad.	30kgN/fad.	60kgN/fad.	90kgN/fad.
70000plants/fad.	C 5.662 c	B 5.888 d	B 6.020 d	A 6.304 d
105000plants/fad.	D 5.886 b	C 6.334 c	B 6.757 c	A 7.080 c
140000plants/fad.	D 6.208 a	C 6.784 b	B 7.387 b	A 7.926 b
175000plants/fad.	D 6.375 a	C 7.404 a	B 8.138 a	A 9.523 a

Table 4. Crude fiber content (%) in leaves and stems of fodder maize as influenced by sowing date, planting density and nitrogen level in both seasons and their combined

Main effects and interaction	Crude fiber in leaves %			Crude fiber in stems %		
	First season 2004	Second season 2005	Combined	First season 2004	Second season 2005	Combined
Sowing date (S):						
May 15th	26.381	27.063 b	26.722 b	28.027	29.328	28.677 b
June 15th	27.444	27.780 ab	27.612 b	29.264	29.745	29.505 ab
July 15th	29.477	28.958 a	29.217 a	30.923	30.728	30.826 a
F-test	N.S	*	*	N.S	N.S	*
L.S.D	-	1.50	1.525	-	-	1.517
Planting density (D):						
70000plants/fad.	29.146 a	29.138 a	29.142 a	31.337 a	31.788 a	31.562 a
105000plants/fad.	27.932 b	28.531 a	28.231 b	29.085 b	30.323 b	29.704 b
140000plants/fad.	27.036 c	27.458 b	27.247 c	28.535 b	29.227 c	28.881 c
175000plants/fad.	26.955 c	26.606 c	26.781 d	28.660 b	28.398 c	28.529 c
F- test	**	**	**	**	**	**
L.S.D	0.785	0.619	0.464	1.60	0.957	0.698
Nitrogen levels (N):						
0 kgN/fad.	29.794 a	29.685 a	29.740 a	32.304 a	31.848 a	32.076 a
30 kg N/ fad.	27.996 b	28.135 b	28.066 b	30.100 b	30.361 b	30.230 b
60 kg N/ fad.	27.201 c	27.346 c	27.273 c	28.240 c	29.337 c	28.789 c
90 kg N/ fad.	26.078 d	26.567 d	26.322 d	26.975 d	28.190 d	27.582 d
F- test	**	**	**	**	**	**
L.S.D	0.561	0.324	0.319	0.818	0.407	0.449
Interactions						
SXD	N.S	N.S	N.S	N.S	N.S	N.S
SXN	N.S	N.S	N.S	N.S	N.S	N.S
DXN	N.S	N.S	N.S	N.S	N.S	N.S
SXDXN	N.S	N.S	N.S	N.S	N.S	N.S

The crude fiber content in leaves and stems were increased significantly with delaying sowing dates. The crude fiber content in leaves ranged between 26.722 and 29.217% due to delaying sowing from May 15th to July 15th. While, the crude fiber content in stems ranged from 28.677 to 30.826% for the sowing dates of May15th to July15th, respectively. Similar results were obtained by Deinum and Struik (1986).

Regarding the effect of planting density on crude fiber content in leaves and stems, it is observed from the data in Table 4 that, crude fiber content in leaves and stems was significantly decreased with the increase in the planting density. These of results are in harmony with those obtained by Yakout *et al.* (1986), Sanderson *et al.* (1995) and Mahmoud (1997).

Concerning the effect of nitrogen fertilizer levels on crude fiber content in leaves and stems, the results in Table 4 showed highly significant differences in crude fiber content in leaves and stems in both seasons and their combined. Crude fiber content in leaves and stems was decreased with each increase in the nitrogen level. These results agreed with those reported by other investigators such as Patel *et al.* (1976), Mikhiel (1997) and Raju *et al.* (1997).

The interaction effect between different studied factors on crude fiber content in leaves or stems was insignificant.

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تأثير ميعاد وكثافة الزراعة والتسميد النيتروجينى على محصول وجودة العلف في الذرة الشامية (دراوه)

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أقيمت تجربتان حقليتان بحقل إرشادي بقرية صفيطه مركز الزقازيق بمحافظة الشـــرقية خلال الموسمين الزراعيين ٢٠٠٤ و٢٠٠٥، وذلك بهدف دراســـة تـــأثير ثلاثـــة مواعيـــد للزراعة (منتصف مايو، منتصف يونيه، منتصف يوليه) وأربع كثافات زراعيـــة(٧٠٠٠٠، ١٠٥٠٠٠، ١٤٠٠٠٠، ١٧٥٠٠٠ نبات/فدان) وأربع معدلات للتسميد النيتروجينى (صفر، ٣٠ ، ٦٠ ، ٩٠ كجم ن/فدان)، على محصول العلف الأخضر والجاف ونسبة الأوراق إلـــى السيقان ونسبة البروتين والألياف في كل من الأوراق والسيقان، ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :

١. أدى تأخير الزراعة من منتصف مايو إلى منتصف يونيه أو يوليه إلى انخفاض كـــل من محصول العلف الأخضـــر والجـــاف، نســـبة البـــروتين فـــي الســـيقان، نســـبة الأوراق/السيقان بينما زادت نسبة الألياف الخام في كل من الأوراق والسيقان.

٢. أعطت الكثافة الزراعية ١٤٠٠٠٠ نبات/فدان أعلى القيم لمحصول العلـــف الأخضـــر والجاف/فدان، بينما أعطت الكثافة الزراعية ١٧٥٠٠٠ نبات/فدان أعلى القيم لكل من نسبة الأوراق/ السيقان ونسبة البروتين الخام في الأوراق والسيقان وأقل القيم فـــي نسبة الألياف الخام في الأوراق والسيقان.

٣. أدى زيادة مستوى التسميد النيتروجينى حتى ٩٠ كجم ن/فدان إلـــى حـــدوث زيـــادة معنوية في محصول العلف الأخضر، محصول العلف الجاف، نســـبة البـــروتين فـــي الأوراق والسيقان بينما انخفض محتوى الألياف في كل من الأوراق والسيقان بزيادة معدل التسميد النيتروجينى.

٤. أوضحت النتائج وجود تداخل فعل مؤكد إحصائيا بين كثافـــة الزراعـــة ومســـتويات النيتروجين على محصول العلف الأخضر للفدان ونسبة الأوراق إلى السيقان والنسبة المئوية للبروتين في الأوراق. وكان هناك تداخل فعل مؤكد إحصـــائيا بـــين مواعيـــد الزراعة ومستويات التسميد النيتروجينى على المحصول الغض. حيث تـــم تســـجيل أعلى المتوسطات بتبكير الزراعة وزيادة معدل التسميد النيتروجينى حتى ٩٠كجم ن/ فدان أو إتباع كثافة زراعه١٤٠٠٠٠ نبات/فدان.