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EFFECT OF PLANT DENSITY AND N-FYM COMBINATION FERTILIZER LEVELS ON TWO YELLOW MAIZE CULTIVARS PRODUCITIVY

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ABSTRACT: Two field experiments were conducted during two consecutive summer seasons of 2014 and 2015 in an administrative field at Diarb Negm District, Sharkia Governorate, under Agronomy Department supervision, Faculty of Agriculture, Zagazig University, Egypt. The aim of this study was to investigate the response of two yellow maize hybrids (Single Cross 176 and Three-way Cross 352) to three plant densities (20000, 24000 and 30000 plants/fad.), and nitrogen-farmyard combination fertilizer levels (60, 80 and100 kg N/fad., without addition of farmyard manure (FYM) and 60 kg N/fad.+20 m^3 FYM/fad., 80 kg N/fad.+ 20 m^3 FYM/fad., and 100 kg N/fad.+20 m^3 FYM/ fad.) under clay soils conditions. The obtained results could be summarized as follows: The tried three maize plant densities had different effects on plant height (cm), ear diameter and length (cm), number of rows/ear, number of kernels/row, 100-kernel weight, kernel weight/ear, and biological yield (ton/fad.) during both seasons and their combined analysis, but the differences among the tried three maize plant densities on aforementioned traits did not reach the level of significance. Results of the first season and the combined analysis detected significant differences among the tried plant densities on ear yield/fad. Where, ear yield/fad., and grain yield/fad., in the first season and combined analysis, harvest index and grain: stover ratio in the two seasons and their combined analysis were significantly increased due to increasing maize density from 20000 or 24000 and up to 30000 plants/fad. Maize SC 173 cultivar appeared to produced taller plants, longer ears and larger number of kernels/row than TWC 352 cultivar. The later produced larger ear diameter, number of rows/ear, 100-kernel weight, kernel weight/ear, ear yield/fad., grain and biological yields/fad., than SC 173 one. No significant differences between two maize cultivars regarding harvest index and grain: stover ratio was observed. The first and the second increments in nitrogen levels up to 100 kg N/fad., with or without addition of farmyard manure was accompanied by a significant increase in ear diameter (cm), ear length (cm), number of rows/ear, number of kernels/row, 100-kernel weight (g), kernel weight/ear (g), ear yield/fad., grain and biological yields (ton/fad.) but harvest index and grain: stover ratio were reduced during both seasons and their combined analysis. These results finally recommend sowing maize cultivar TWC 352 with dense planting of 30000 plants/fad., and raising nitrogen level up to 80 kg N/fad., with addition of farmyard manure to maximize grain yield/fad., under the experimental site and other likely environmental condition.

Key words: Maize, N- FYM combinations, planting densities, grain: stover ratio, yield attributes.

INTRODUCTION

Maize (*Zea mays* L.) is the most important crop among cereals after wheat and rice in respect of area and production. Maize grain contains starch (72%), protein (10%), oil (4.8%), fiber (5.8%), sugar (3.0%), and ash (1.7%) (**Chaudhry, 1983**). Plant density plays an important role in crop productivity where, **Nwogboduhu (2016)**, studied the response of three maize cultivars to planting densities (20000, 40000, 60000 and up to 80000 plants/ ha) and found that plant density of 60,000 plant/ ha., produced the highest grain yield and also

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was statistically similar with all other plant densities in ear weight and number of kernels/ ear. **Kandil *et al.* (2017)** investigated the effect of hill spacing (15, 20, 25 and up to 30 cm) on grain yield and its attributes of maize. They found that sown maize plants in hills, 30 cm apart gave the highest values of ear diameter, kernel weight/ear, shelling percentage and 100-kernel weight. However, the longest ears were recorded due to sown maize plants at hill spacing of 25 cm apart. On the other side, sown maize plants at 15 cm apart produced the highest value for each of number of rows/ear, number of kernels/row and grain yield/ha.

Kareem *et al.* (2017) studied the effect of two population densities (95,556 and 53,333 plants/ha) on growth and yield of two maize cultivars. They found that increasing plant density from 53,333 to 95,556 plants /ha led to significant increase in grain yield/ha. On the other hand, number of kernels/row, number of kernels/ear, 100-kernel weight and shelling percentage were significantly decreased due to increasing plant density. **Revathi *et al.* (2017)** found that lower planting density of 66,666 plants/ha recorded the maximum ear length and number of kernels/ear than 83,333 and 100,000 plants/ha, while, maximum grain yield/ha was recorded with 83,333 plants/ha and stover yield/ ha was recorded with 100,000 plants/ha. On the other direction, weight of kernels/ear, number of rows/ear and 100-kernel weight were not significantly influenced by planting density.

Regarding cultivar differences, **Nwogboduhu (2016)** found that maize cultivars significantly differed in yield parameters. Where, Sammaz 17 produced the highest value for each of plant height, 100 kernels weight, number of kernels/ ear. Sammaz 17 also was statistically similar with Sammaz 18 in ear diameter and grain yield. **Yasin (2016)** obtained that SC 173 maize cultivar surpassed TWC 352 in grain yield and its attributes except, number of ears/ plant and number of rows/ear. On the other direction, TWC 352 surpassed SC 173 in ear diameter. **El-Shahed *et al.* (2017)** stated that SC 128 maize hybrid surpassed SC 176 in ear length and diameter, number of kernels/row, 100- kernels weight grain yield/plant as well as grain and biological yields/fad., while SC. 176 surpassed SC 128 in plant height. No significant differences among maize hybrid could be detected in number of rows/ear.

Kandil *et al.* (2017) recorded significant difference among four yellow maize hybrids (SC 3084, SC 3062, SC 2055 and SC 2066) on grain yield and its attributes, where, SC 3084 achieved the highest value for each of ear length, ear diameter, weight of kernels/ear, shelling (%), 100- kernel weight and grain yield/ ha. On the other hand, S.C 2055 hybrid recorded the greatest value of number of rows/ear. However, S.C 2066 hybrid recorded the highest number of kernels/row, the lowest value for each of ear length, ear diameter, kernel weight/ ear, shelling percentage and 100 kernel weight. SC 3062 hybrid gave the lowest value of grain yield in both seasons.

Nitrogen plays an important role in crop growth and yield. It is highly associated with dark green colour of stem and leaves, vigorous growth, branching, leaf production and size enlargement. The interaction between manure and N fertilizer enhanced N (58-63%) recovery (**Nyamangara *et al*., 2003**). Keeping in view the key role played by N in crop production a field experiment was conducted to study the effects of organic and inorganic sources of nitrogen on the growth and yield of maize. **Yasin (2016)** studied the response of yellow maize to nitrogen fertilizer levels (0, 45, 90 and 135 kg N/fad.) and reported that ear length, ear diameter, 100-kernel weight, kernel weight/ear and grain yield/ fad., were significantly increased with each increase in nitrogen fertilizer level up to 135 kg N/fad. Whereas, plant height and number of kernels/ row were significantly increased by raising nitrogen fertilizer level up to 90 kg N/fad., **El-Shahed *et al.* (2017)** reported that increasing nitrogen fertilizer rate up to 135 kg N/fad., was accompanied by a significant increase in each of plant height, ear length and diameter, number of rows/ear, number of kernels/row, hundred kernel weight, grain yield/fad.

Manures check soil erosion, leaching of nutrients, evaporation losses and have a residual effect for succeeding crops. The good effects of manures remain longer in soil as the nutrients of manures slowly become available to the plants (**Malival, 2001**). Nevertheless, imbalanced use of fertilizer without application of farmyard manure (FYM) and without knowing the requirements of crops and fertility status of soil causes the problem such as deterioration of soil structure, environmental and ground water pollution *etc*. Similarly continuous use of chemical fertilizer without FYM causes the depletion of soil fertility. **El-Sobky (2014)** showed that organic manuring treatments (without manuring, 20 m^3 FYM/fad. and 5 tons compost/ fad.) was without significant effect on plant height, ear length, ear diameter, number of rows/ ear, number of kernels/row, and kernel weight/ ear. However ear length, ear, grain and biological yields/fad., were significantly increased due to addition of 20 m^3 FYM/fad., compared with check or compost treatments. **Omar (2014)** indicated that number of kernels/row, hundred kernel weight and grain yield/ha responded to the increase in FYM rates up to 80 m^3/ha. **El-Kholy *et al.* (2015)** studied the effect of three organic manure rates (check, 2.5 and 5 tons/fad.) on yield and its attributes of yellow maize (single cross 173). They revealed that application of organic manure up to 5 tons/fad., significantly increased ear length, number of rows/ear, number of kernels/row, hundred kernel weight, ear and kernel yields/plant, ear, grain and biological yields/fad., as compared to the other rates (combined data). **Kareem *et al.* (2017)** revealed that application of poultry manure at rate of 2.5 or 5.0 ton/ha caused significant increase in number of rows/ear, number of kernels/ear, 100-kernel weight and grain yield/ ha of maize comparing to without poultry manure application. Thus, the aim of this study was to investigate the response of two yellow maize hybrids (Single Cross 176 and Three-way Cross 352) to plant density and nitrogen-farmyard combinations fertilization levels under clay soils conditions.

MATERIALS AND METHODS

This field experiments work was performed for two consecutive summer seasons of 2014 and 2015 in an administrative field at Diarb Negm District, Sharkia Governorate, under Agronomy Department supervision, Faculty of Agriculture, Zagazig University, Egypt.

Factors Under Study

Plant density (D)

Three plant densities were studied as follows: 20000, 24000 and 30000 plants/fad.

To achieve the tested plant densities, maize was manually planted on one side of the ridge with hill spacing of 30, 25 and 20 cm for plant densities of 20000, 24000 and 30000 plants/fad., respectively.

Maize cultivars

Single Cross 176 and three ways Cross 352.

N-farmyard combinations

The examined 6 N-farmyard combination levels were: 60, 80 and100 kg N/fad., without addition of FYM and 60 kg N/fad. + 20 m^3 farmyard manure/fad., 80 kg N/fad.+ 20 m^3 farmyard manure/fad., and 100 kg N/fad.+20 m^3 farmyard manure/fad.

Nitrogen fertilizer, in form of urea (46.5% N) with the chosen levels, was soil added in two equal doses, the first one after thinning and the second dose was added 30 days after sowing. Organic manure was incorporated before planting at rate of 20 m^3/fad. Soil samples were collected from the experimental sites at the depth of 0 – 30 cm before planting to determine soil physical and chemical properties. The experiment was conducted on clay loam soil with 1.1% organic matter, 11.25 mg kg^{-1}soil phosphorus, 207 mg kg^{-1}soil potash, 54.4 mg kg^{-1} soil nitrogen and FYM contains 32.45% organic matter, 0.68% phosphorus, 1.1% potash and 1.32% nitrogen as average during both seasons.

A spilt-spilt plot design with three replicates was used, where the plant densities were assigned to the main plots, and the sub-plots were occupied by maize hybrids. Whereas, the N-farmyard combination fertilization levels were randomly distributed in the sub- sub plots.

Planting was done after Egyptian clover (*Trifolium alexandrinum* L.), wheat (*Triticum aestivum* L.) as a proceeding crop in the first and second seasons, respectively. In both seasons, two yellow maize cultivars (Single Cross 176, Three- Way Cross 352) were planted on 20th may. Each 2nd order sub plot (3.5 m × 4 m) included 5 ridges. Plants were thinned to one plant per hill after 15 days from planting. Phosphorus at level of 31 kg P_2O_5/fad., as ordinary superphosphate (15.5% P_2O_5) was band placed at the time of planting. Weeds were controlled manually. Harvesting was practiced on 18th and 14th September in the two seasons, respectively.

At harvest (110 days after sowing), random sample of five guarded plants were taken from each plot to estimate: 1. Plant height (cm), 2. Ear diameter (cm), 3. Ear length (cm), 4. Number of rows/ear, 5. Number of kernels/row. 6. Hundred kernel weight (g), 8. Ear kernel weight (g).Therefore, in order to determine the final yield, the following characters were recorded from the two central ridges, and then transformed to the final yield/fad. 9. Ear yield (ton/fad.), 10. Grain yield (ton/fad.), 12. Biological yield (ton/fad.), 13. Harvest index, HI: it was calculated as follows: HI = grain yield per fad./Biological yield per fad. x 100 14. Grain: stover ratio: it was estimated as coming: grain yield per fad./straw yield per fad.

Data was statistically analyzed according to **Gomez and Gomez (1984)** by using **MSTAT-C (1989)** where statistical program Version 2.1 was used for analysis of variance (ANOVA). A combined analysis was undertaken for the data of the two seasons after testing the homogeneity of the experimental errors by Bartellet,^{s} test **(Steel *et al*., 1997)**. Treatment means were compared using least significant range (LSR) test at 0.05 level of probability**.** Means followed by the same alphabetical letters are not statistically significant according to Duncans multiple range test.

RESULTS AND DISCUSSION

Plant Density Effect

Regarding the influence of the tried three maize plant densities had different effects on plant height, ear diameter (cm), ear length (cm) (Table 1), number of rows/ear, number of kernels/row, 100-kernel weight (Table 2), kernel weight/ear (Table 3), biological yield (ton/fad.) (Table 4) during both seasons and their combined analysis, but the differences among the tried three maize plant densities on aforementioned traits did not reach the level of significance. The obtained results of the first season promoted with those of the combined analysis detected significant differences between the tried plant densities on ear yield/fad., (Table 3), while the differences did not amounted to the level of significance during the second season. Where, ear yield/fad., grain yield/fad. (Table 3), harvest index and grain : stover ratio (Table 4) in the two seasons and their combined analysis were significantly increased due to increasing maize density from 20000 or 24000 and up to 30000 plants/fad. The obtained results are in harmony with those recorded by **El-Hendawy *et al.* (2008), Asif *et al.* (2010), Abdou (2012), El-Shahed *et al.* (2013), Kandil *et al.* (2017)** and **Kareem *et al.* (2017)** who recorded significant increase in grain yield per unit area due to raising planting density. On the other direction, **El-Kholy *et al.* (2015)** studied the effect of three plant densities (24000, 28000 and 32000 plants/ fad.) on yield and its attributes of yellow maize and reported that the low and moderate densities significantly increased kernel yield/ fad.

Cultivar Differences

Maize S.C. 173 cultivar appeared to produce taller plants and longer ears (Table 1), larger number of kernels/row (Table 2) than TWC 352 cultivar. The later produce larger ear diameter (Table 1), number of rows/ear, 100-kernel weight (Table 2), kernel weight/ear, ear yield/fad., grain yield/fad., (Table 3) and biological yields/fad., (Table 4), than S.C. 173 one. Several workers explained that maize cultivars differed significantly in grain yield and its attributes, such like **Attia *et al.* (2009), Abdou *et al*. (2012), El-Shahed *et al.* (2013),** Ibrahim ***et al.* (2014), Nassr *et al.* (2015), Faheed *et al.* (2016), El-Shahed *et al.* (2017)** and **Kandil *et al.* (2017)**.

N-FYM Combinations Effect

Any increment in nitrogen level up to 100 kg N/fad., with or without addition of farmyard manure was accompanied by a significant increase in ear diameter, ear length (Table 1), number of rows/ear, number of kernels/row, 100-kernel weight (Table 2), kernel weight/ear, ear yield/fad., grain yield/fad., (Table 3) and biological yields/fad. (Table 4), but harvest index and grain: stover ratio (Table 4) was reduced

Table 1. Plant height, ear diameter and length (cm) of the two yellow maize cultivars as affected by planting density and N-farmyard combination fertilization levels during two successive summer seasons (2014 and 2015) as well as their combined analysis

Main effects and interactions	Plant height (cm)			Ear diameter (cm)			Ear length (cm)		
	2014	2015	Comb.	2014	2015	Comb.	2014	2015	Comb.
Planting density (D)									
20000 plants/faddan	2.55	2.35	2.45	4.89	4.58	4.74	18.43	16.59	17.51
24000 plants/faddan	2.54	2.13	2.34	4.86	4.58	4.72	18.06	16.68	17.37
30000 plants/faddan	2.53	2.41	2.47	4.85	4.65	4.75	17.92	16.88	17.40
F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cultivars (C)									
SC 173	2.78	2.42	2.60	4.73	4.61	4.67	18.93	16.69	17.81
TWC 352	2.30	2.18	2.24	5.00	4.60	4.80	17.34	16.75	17.04
F-test	**	*	**	**	NS	**	**	NS	**
N-farmyard combinations (F)									
60 kg N/faddan	2.51	2.30	2.40	4.74 e	4.18 c	4.46 e	16.93 d	15.05 c	15.99 e
80 kg N/faddan	2.53	2.34	2.43	4.85cd	4.35 c	4.60 d	17.76 c	15.77 c	16.76 d
100 kg N/faddan	2.52	2.13	2.33	4.90bc	4.73 b	4.81bc	18.81 b	17.17 b	17.99 b
60 kg N + 20 m^3 FYM/ faddan	2.53	2.38	2.46	4.77de	4.67 b	4.72 c	17.27 d	16.95 b	17.11 c
80 kg N + 20 m^3 FYM/ faddan	2.59	2.34	2.47	5.01 a	4.69 b	4.85 b	18.63 b	17.14 b	17.89 b
100 kg N + 20 m^3 FYM/ faddan	2.55	2.30	2.43	4.94ab	5.00 a	4.97 a	19.42 a	18.22 a	18.82 a
F-test	NS	NS	NS	**	**	**	**	**	**
Interactions									
D x C	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x F	NS	*	*	NS	NS	NS	NS	NS	NS
C x F	NS	NS	NS	NS	NS	*	NS	NS	NS
D x C x F	NS	NS	NS	NS	NS	NS	NS	NS	NS

*, ** and NS indicate significant at 0.05, 0.01 and not significant, respectively.

Table 2. Number of rows/ear, number of kernels/row and 100-kernel weight (g) of the two yellow maize cultivars as affected by planting density and N-farmyard combination fertilization levels during two successive summer seasons (2014 and 2015) as well as their combined analysis

Main effects and interactions	Number of rows/ear			Number of kernels/row			100-kernel weight (g)		
	2014	2015	Comb.	2014	2015	Comb.	2014	2015	Comb.
Planting density (D)									
20000 plants/faddan	14.92	14.73	14.83	40.60	35.81	38.20	33.53	31.19	32.36
24000 plants/ faddan	14.72	14.83	14.78	40.81	36.42	38.61	33.22	30.03	31.63
30000 plants/ faddan	14.76	15.18	14.97	40.02	35.90	37.96	33.11	29.97	31.54
F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cultivars (C):									
S.C. 173	14.09	14.21	14.15	42.79	36.11	39.45	32.56	29.50	31.03
T.W.C. 352	15.51	15.63	15.57	38.16	35.97	37.06	34.02	31.30	32.66
F-test	**	**	**	**	NS	**	**	**	**
N-farmyard combinations (F)									
60 kg N/ faddan	14.47 c	14.82	14.64 b	37.97 d	32.01 d	34.99 d	30.39 e	28.33 c	29.36 e
80 kg N/ faddan	14.68 abc	14.64	14.66 b	39.81 c	34.34 c	37.07 c	33.44 e	29.44 bc	31.44 cd
100 kg N/ faddan	15.03 ab	14.89	14.96 ab	42.12 ab	37.42 b	39.77 b	34.61 ab	30.00 bc	32.31 bc
60 kg N + 20 m^3 FYM/ faddan	14.62 bc	15.02	14.82 ab	38.69 d	36.47 b	37.58 c	31.72 d	30.89 b	31.31 d
80 kg N + 20 m^3 FYM/ faddan	14.90 ab	15.03	14.97 ab	41.66 b	36.94 b	39.30 b	33.94 bc	31.06 ab	32.50 b
100 kg N + 20 m^3 FYM/ faddan	15.09 a	15.09	15.09 a	42.61 a	39.06 a	40.83 a	35.61 a	32.67 a	34.14 a
F-test	*	NS	*	**	**	**	**	**	**
Interactions									
D x C	NS	NS	*	NS	NS	NS	NS	NS	NS
D x F	NS	NS	NS	**	NS	NS	NS	NS	NS
C x F	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x C x F	NS	NS	NS	NS	NS	NS	NS	NS	NS

*, ** and N.S indicate significant at 0.05, 0.01 and not significant, respectively.

Table 3. Kernel weight/ear (g), ear yield (ton/faddan) and grain yield (ton/faddan) of the two yellow maize cultivars as affected by planting density and N-farmyard combination fertilization levels during two successive summer seasons (2014 and 2015) as well as their combined analysis

Main effects and interactions	Kernel weight/ear (g)			Ear yield (ton/faddan)			Grain yield (ton/faddan)		
	2014	2015	Comb.	2014	2015	Comb.	2014	2015	Comb.
Planting density (D)									
20000 plants/faddan	178.40	141.82	160.11	3.90 b	3.07	3.48 b	3.20 b	2.54	2.87 b
24000 plants/ faddan	174.39	139.96	157.17	4.06 b	3.35	3.71 b	3.31 b	2.77	3.04 b
30000 plants/ faddan	173.47	142.87	158.17	4.54 a	3.80	4.17 a	3.65 a	3.08	3.36 a
F-test	NS	NS	NS	**	NS	**	**	NS	*
Cultivars (C):									
S.C. 173	171.37	129.81	150.59	4.03	3.16	3.60	3.32	2.61	2.96
T.W.C. 352	179.47	153.29	166.38	4.30	3.65	3.97	3.46	2.98	3.22
F-test	NS	**	**	**	**	**	*	**	**
N-farmyard combinations (F)									
60 kg N/ faddan	152.02 d	120.39 c	136.20d	3.65 d	2.79 d	3.22 e	2.97 d	2.31 d	2.64 e
80 kg N/ faddan	172.93 c	129.34 c	151.14c	4.03 c	3.15 cd	3.59 d	3.26 c	2.61 c	2.93 d
100 kg N/ faddan	189.06 b	142.75 b	165.90b	4.39 b	3.40 bc	3.90 bc	3.60 b	2.79 bc	3.19 bc
60 kg N + 20 m^3 FYM/ faddan	157.54 d	145.60 b	151.57c	3.93 c	3.47 bc	3.70 cd	3.21 c	2.86 bc	3.04 cd
80 kg N + 20 m^3 FYM/ faddan	182.10 b	146.96 b	164.53b	4.32 b	3.61 b	3.96 b	3.51 b	2.93 b	3.22 b
100 kg N + 20 m^3 FYM/ faddan	198.86 a	164.26 a	181.56a	4.67 a	4.00 a	4.34 a	3.78 a	3.28 a	3.53 a
F-test	**	**	**	**	**	**	**	**	**
Interactions									
D x C	NS	NS	NS	*	NS	*	*	NS	*
D x F	*	NS	NS	**	NS	NS	**	NS	NS
C x F	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x C x F	NS	NS	NS	*	NS	NS	*	NS	NS

*, ** and NS indicate significant at 0.05, 0.01 and not significant, respectively.

Table 4. Biological yield (ton/faddan), harvest index and grain : stover ratio of the two yellow maize cultivars as affected by planting density and N-farmyard combination fertilization levels during two successive summer seasons (2014 and 2015) as well as their combined analysis

Main effects and interactions	Biological yield(ton/faddan)			Harvest index			Grain : stover ratio		
	2014	2015	Comb.	2014	2015	Comb.	2014	2015	Comb.
Planting density (D):									
20000 plants/faddan	7.89	6.72	7.30	40.74 b	37.81 b	39.27 b	81.35 b	70.01 b	75.68 b
24000 plants/ faddan	7.93	7.22	7.58	41.95 ab	38.60 b	40.27 b	86.73ab	72.79 b	79.76 b
30000 plants/ faddan	8.42	7.66	8.04	43.37 a	40.50 a	41.93 a	94.21 a	81.73 a	87.97 a
F-test	NS	NS	NS	*	*	**	*	*	**
Cultivars (C):									
S.C. 173	7.83	6.73	7.28	42.48	38.90	40.69	88.34	74.00	81.17
T.W.C. 352	8.33	7.67	8.00	41.55	39.04	40.29	86.53	75.68	81.11
F-test	*	*	**	NS	NS	NS	NS	NS	NS
N-farmyard combinations (F)									
60 kg N/ faddan	6.96 e	5.72 d	6.34 d	42.64 ab	40.40 a	41.52 a	89.92 a	79.94 a	84.93 a
80 kg N/ faddan	7.72 d	6.72 c	7.22 c	42.21 b	38.93 b	40.57 b	88.68 a	74.02 bc	81.35 b
100 kg N/ faddan	8.85 b	7.48 bc	8.17 b	40.75 c	37.22 c	38.98 d	81.95 b	68.78 d	75.37 d
60 kg N + 20 m^3 FYM/ faddan	7.50 d	7.15 bc	7.33 c	42.91 a	40.06 a	41.48 a	90.60 a	78.51 a	84.56 a
80 kg N + 20 m^3 FYM/ faddan	8.24 c	7.49 b	7.86 b	42.55 ab	39.27 b	40.91 b	89.76 a	76.75 ab	83.26 ab
100 kg N + 20 m^3 FYM/ faddan	9.20 a	8.64 a	8.92 a	41.04 c	37.95 c	39.49 c	83.68 b	71.04 cd	77.36 c
F-test	**	**	**	**	**	**	**	**	**
Interactions									
D x C	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x F	**	NS	NS	NS	**	NS	NS	*	NS
C x F	NS	NS	NS	**	NS	**	NS	NS	*
D x C x F	NS	NS	NS	NS	*	**	NS	NS	NS

*, ** and NS indicate significant at 0.05, 0.01 and not significant, respectively.

during both seasons and the combined analysis. Emphatically increase in grain yield could be obtained by raising nitrogen level supplied over 60 kg N/fad., with or without addition of FYM as ascertained from the results of both seasons and their combined analysis. Several investigators found that chemical nitrogen fertilization increased maize grain yield such as **Akmal *et al.* (2010), El-Naggar (2012), Darwich (2013), El-Sobky (2014), El-Kholy *et al.* (2015), Yasin (2016) and El-Shahed *et al.* (2017)**. Also, the obtained results are in agreement with those reported by **Udom and Bello (2009), Adejumo *et al*. (2010), Zayed *et al.* (2011), Okonmah (2012), Abd El-Wahed and Ali (2013), Omar (2014), and Kareem *et al.* (2017)** reported significant increment in grain yield/unit area due to organic manure fertilization.

Interactions Effect

As shown in the combined analysis, significant interaction effect between plant densities and N-farmyard combination fertilizer levels was observed on plant height (Table 1). The significant interaction effect between maize cultivars and N-farmyard combination fertilizer levels on ear diameter (Table 1), harvest index and grain: stover ratio (Table 4) during combined analysis, plant density significantly interacted with maize cultivars on number of rows/ear (Table 2). TWC 352 cultivar outperformed SC 173 cultivar in ear and grain yield/fad., (Table 3) under moderate and high plant density. But, as seen no additional information could be obtained other than the main effects. Therefore, interaction tables one not discussed.

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تأثير الكثافة النباتية ومستويات السماد النيتروجينى والسماد البلدى على انتاجية صنفين من الذرة الشامية الصفراء

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أجريت هذه الدراسة لموسمين (٢٠١٤ و ٢٠١٥) بحقل إرشادي بمركز ديرب نجم محافظة الشرقية، بهدف دراسة تأثير ثلاث كثافات نباتية (٢٠٠٠٠ ، ٢٤٠٠٠ و ٣٠٠٠٠ نبات للفدان) حيث تم زراعة الذرة الشامية على جانب واحد من الخط بعرض ٧٠ سم والمسافة بين الجور كانت ٣٠، ٢٥ و٢٠ سم على الترتيب وكانت الأصناف (هجين ثلاثى ٣٥٢ و هجين فردى ١٧٣) وتوليفة السماد النيتروجيني والسماد العضوى (٦٠، ٨٠ ١٠٠ كجم ن/للفدان بدون إضافة السماد البلدي، ٦٠، ٨٠ ١٠٠ كجم ن/للفدان بإضافة ٢٠م^3 للفدان من السماد البلدى) على محصول الذرة الشامية الصفراء وبعض صفات الجودة، تم إضافة السماد النيتروجينى على صورة يوريا (٤٦.٥% نيتروجين) على دفعتين الأولى بعد الخف والثانية بعد ٣٠ يوم من الزراعة، وتم خلط السماد البلدى بالتربة اثناء تجهيز الأرض للزراعة بمعدل ٢٠ م^3 للفدان، أجريت التجارب الحقلية في تصميم القطع المنشقة مرتين وفي ٣ مكررات حيث تم وضع الكثافات فى القطع الرئيسية و الأصناف فى القطع الشقية الأولى بينما توليفة السماد النيتروجينى والبلدى فى القطع الشقية الثانية، وتم زراعة الذرة الشامية بعد محصول البرسيم المصرى والقمح خلال الموسمين على الترتيب فى ٢٠ مايو، كانت المساحة القطعة التجريبية ٣.٥ x ٤ وتضم ٥ خطوط، تم الخف بعد ١٥ يوما من الزراعة، أضيف السماد الفوسفاتي علي صورة سوبر فوسفات عادي بمعدل ٣١ كجم فو$_2$أ$_5$/فدان أثناء تجهيز الأرض للزراعة، تم مقاومة الحشائش يدويا، تم الحصاد فى ١٨ و ١٤ سبتمبر للموسمين على الترتيب، وخلصت النتائج إلى أن زيادة الكثافة النباتية من ٢٠٠٠٠ الى ٢٤٠٠٠ و حتي ٣٠٠٠٠ نبات للفدان أدى إلى زيادة قيم كل من محصول الكيزان ومحصول الحبوب بالطن للفدان وكذلك صفتى دليل الحصاد ودليل المحصول أما باقى الصفات تحت الدراسة فلم يكن لزيادة الكثافة النباتية تأثيرا معنويا يذكر خلال موسمى الدراسة وكذلك فى التحليل المشترك، الاختلافات الصنفية لها تأثير معنوى على المحصول ومساهماته، حقق الصنف هجين فردى ١٧٣ أعلى قيمة لصفات ارتفاع النبات، طول الكوز، عدد الحبوب/ السطر، بينما حقق الصنف هجين ثلاثى ٣٥٢ أعلى قيمة لصفة قطر الكوز، عدد سطور الكوز، وزن المائة حبة، وزن حبوب الكوز، محصول الكيزان والحبوب والبيولوجى للفدان، أدى زيادة السماد النيتروجينى سواء مضافا اليه السماد البلدى او بدون اضافته الى زيادة معنوية لصفة قطر الكوز، طول الكوز، عدد سطور الكوز، عدد حبوب السطر، وزن المائة حبة، وزن حبوب الكوز، محصول الكيزان والحبوب والبيولوجى بالطن للفدان بينما نقصت صفة دليل الحصاد ودليل المحصول خلال موسمى الدراسة وكذلك فى التحليل المشترك، أما باقى الصفات لم تتأثر معنويا بتلك المعاملات، كان التفاعل معنويا بين عوامل الدراسة على المحصول ومعظم مساهماته، وأظهرت النتائج ان صنف الذرة هجين ثلاثى ٣٥٢ قد تفوق على الهجين الفردى ١٧٣ حيث حقق أعلى قيمة لمحصول الحبوب للفدان تحت الكثافتين المتوسطة والمرتفعة وبإضافة السماد النيتروجينى حتى ٨٠ كجم ن للفدان بالإضافة الى السماد البلدى بمعدل ٢٠ م^3 للفدان، وتوصى الدراسة بزراعة الذرة صفراء صنف هجين ثلاثى ٣٥٢ بكثافة نباتية حتى ٣٠٠٠٠ نبات للفدان وبإضافة السماد النيتروجينى حتى ٨٠ كجم ن للفدان بالإضافة الى السماد البلدى بمعدل ٢٠م^3 للفدان وذلك لمعظمة انتاجية محصول الذرة الشامية تحت ظروف منطقة الزراعة وكذلك الظروف البيئية المشابهة لها.

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