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EFFECT OF PLANT DENSITY ON SOME MAIZE HYBRIDS PRODUCTIVITY UNDER NEW RECLAIMED SOIL CONDITIONS AT SOUTH SINAI

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ABSTRACT: Two experiments were carried out during the 2020 and 2021 summer seasons at El- Tur area, South Sinai, Egypt to investigate the Response of some maize hybrids (MH) (*Zea mays* L.). under new reclaimed conditions on plant density (PD) Each experiment included 16 treatments which were four maize hybrids Single crosses (MH) i.e. MH_1): S.C. 162; MH_2): S.C. 168; MH_3): S.C. 176 and MH_4): S.C. 178, and four plant density (PD) treatments i.e. PD_1)**:** 35 cm; PD_2): 30 cm; PD_3): 25 cm PD_4): 20 cm). Results showed significant differences among some maize hybrids treatments in all studied traits in both seasons. Also, results cleared that values of grain and biological yields were increased by each. The results revealed significant differences between maize hybrids for all studied characters. MH_2): S.C. 168 significantly surpassed other studied hybrids in number of rows/ Ear, number of grains/row, Ear length (cm), grain yield/ha, Biological yield/ha, Protein (%), Grain return (LE/ha), Total return (LE/ha) and Net return (LE/ha). MH_2): S.C. 178 significantly surpassed other studied hybrids in plant height (cm), Straw yield/ha and Carbohydrate (%) and S.C. 162 significantly surpassed other studied hybrids in 100-grain Weight (g) and Straw return (LE/ha) in the both seasons. Plant density (PD_4): 20 cm (62500 plant/ha) significantly surpassed other studied in plant height, number of rows/ Ear, number of grains/row, Ear length (cm), 100-grain Weight (g), grain yield/ha, Straw yield/ha, Biological yield/ha, Protein (%), Carbohydrate (%), Grain return (LE/ha), Straw return (LE/ha), Total return (LE/ha) and Net return (LE/ha) in both seasons. The highest grain yield (8.562 ton/ha in the 1st season and 8.904 ton/ha in the 2nd one produced) from maize hybrids 168 with application of plant density PD_4): 20 cm (62500 plant/ha) in both seasons. However, the economic maize grain and straw yields could be obtained from maize hybrids S.C. 162and application of plant density PD_4): 20 cm (62500 plant/ha) under El- Tur area, South Sinai of Egypt.

Key words: Maize, Plant Density, Hybrids, Productivity, Biological, Grain return.

INTRODUCTION

Maize (*Zea mays* L.) is considered one of the most important edible crops all over the world, ranking the third order after wheat and rice concerning world- cultivated area and food production. It is a newly introduced food crop in Egypt to contribute to reduce food gap, especially it can be cultivated in the newly reclaimed areas out the old valley.

Many investigators found significant differences among maize hybrids in growth characteristics, yield attributes and grain yield under different edaphic and climatic conditions.

The new reclaimed soil in South Sinai is characterized by increasing salinity either in soil or in irrigated water and poor in mineral nutrients. It is well known that salinity and low fertility of the soil negatively affected the

growth and yield of field crops, particularly maize under such condition.

Grain yield of maize is more affected by variations in plant density than other members of the grass family because of low tillering ability, monoecious floral organization, and the presence of a relatively short flowering period. For each production system, there is an optimum plant density that maximizes grain yield. Maize population for maximum economic grain yield varies between 30,000 to over than 90,000 plants per hectare. The optimum plant density plays a great role in increasing maize productivity **(Al-Shebani, 1998**). The use of lower plant densities delays canopy closure and increase light interception, leading to high grain production per plant but low grain production per unit area **(Andrade *et al.*, 1999)**. On the other hand, higher plant densities enhance interplant competition for assimilates, water and nutrients (**Edmeades *et al.*, 2000**). High plant densities also stimulate barrenness and increase the anthesissilking interval (**Sangoi *et al.*, 2002**), thereby reducing kernel number per unit area - the main yield component of maize. **Alias *et al.* (2010)** observed that Pioneer-30D55 maize hybrid surpassed Pioneer-3012 and Pioneer-3062 with respect to all agro physiological traits i.e. leaf area index and dry matter accumulation with significant variation between them. **Dahmardeh (2011)** reported that grain yield of maize increased with increasing plant density and the highest amount of grain yield was obtained at 100,000 plants ha-1

Therefore, to maximize maize productivity under the newly reclaimed sandy soil, it is essential to identify the promising high yielding maize hybrids and determine the optimum plant density requirements that promote plant growth and improve grain and straw yields. So, the objective of the current study was to identify the high yielding hybrids and the proper amount of plant density for maximizing maize grain yield and its attributes under the newly reclaimed sandy soil at El- Tur area, South Sinai.

MATERIALS AND METHODS

Two experiments were carried out during the 2020 and 2021 summer seasons at El- Tur area, South Sinai, Egypt to investigate the influences of some maize hybrids (MH) and plant density (PD) under new reclaimed conditions on productivity of maize hybrids (*Zea mays* L.). Each experiment included 16 treatments which were four amounts of some maize hybrids (MH) i.e. MH_1): S.C. 162; MH_2): S.C. 168; MH_3): S.C. 176 and MH_4): S.C. 178 and four plant density (PD) treatments i.e. PD_1): 35 cm (35714 plant/ha); PD_2): 30 cm (41666 plant/ha); PD_3): 25 cm (50000 plant/ha) and PD_4): 20 cm (62500 plant/ha). This study aimed to investigate the effect of some maize hybrids and plant density on yield and yield components of maize hybrids.

Each experiment included 16 treatments, which were arranged in a split plot design in three replications. four some maize hybrids treatments were allocated randomly in the main plots, while four plant density were distributed randomly in the sup-plots. Every sub-plot area was 42 m^2 (1/100 fad).

The sowing date was after the 1st effective on February 15 and 16 in the first and second seasons, respectively. Where, seeds of maize hybrids at the rate of 35, 30, 25, 20 cm between the gorge in rows distanced at 80 cm apart with 10.5 m length. Each plot included 5 rows i.e. the plot area was 42 m^2. Harvest was carried out on June 25 for both seasons. Analysis of variance of the split plot design was computed according to **Snedecor and Cochran (1967).**

Table1. Some chemical and physical properties of representative soil samples in the experimental site before (0-30 cm depth) sowing as mean for 2020 and 2021 seasons

Soil properties	Values
Clay	3.6
Silt	8.3
Sand	87.1
Texture Grade	Sandy
PH (Ext. 1:1)	7.32
EC (Ext. 1:1), dS m^{-1}	2.34
Total $CaCO_3$ (%)	33.2
Total Organic Carbon (%)	0.25
Total Organic Matter (%)	0.423
Nitrogen (mg kg^{-1})	17.2
Phosphorus (mg kg^{-1})	1.58
Potassium (mg kg^{-1})	45.7
Irrigation Water Analysis	
PH	6.74
EC (dS m^{-1})	3.63
Aminouim N (mg L^{-1})	5.64
Nitrare N (mg L^{-1})	22.3
Phosphorus (mg L^{-1})	0.08
Potassium (mg L^{-1})	0.67

The used water for irrigation was saline groundwater (ranged from 3000 to 3500 ppm) pumped from a local well. Supply water was the fertilization packages were added in one dose as soil application at sowing time. The used sources of mineral fertilizers of N, P and K were ammonium nitrate (33.5 % N), calcium supper phosphate (15.5 % P_2O_5) and potassium sulphate (48.5 % K_2O). Whereas, Microbin in rate of 400 gm/ seeds/ fad was used as bio-fertilizer mixed with seeds at sowing time. All other the recommended agricultural practices were applied as usual in maize hybrids fields under new reclaimed conditions.

Economic evaluation

1- Total gain (LE/ ha.) = Grain yield x price + straw yield x price.

2- Net return (LE/ ha.) = Total gain – costs.

3- The costs data included costs of all farm inputs, labor and farm machinery. Price of maize grains (ton) was 4500 LE. Whereas the price of straw was (ton) = 500 LE respect.

4- **Total costs** = 16500 LE/ha.

At harvest time, ten guarded plants were taken randomly from each sub-plot to determine all yield attributes of maize hybrids, while, overall each sub-plot was used to determine grain, straw and biological yields. The collected data of the two seasons were subjected to proper statistical analysis of variance (**Snedecor & Cochran, 1967**) using M-STATC Program. Mean values were compared at $P<0.05$ using the Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

It is evident from the data of maize hybrids grain yield and its attributes in the two growing seasons that the data of the second season surpassed that of the first one. These results

could be explained that the experimental soil of the second season exceeded that of the first season in organic matter (Table 2).

A. Maize hybrids differences

Data in Table (2) revealed significant differences between maize hybrids for all studied characters in both seasons. Plant height (cm) ranged from 208 cm (S.C. 176) to 248 cm (S.C. 162) in the first season and 212 cm (S.C. 176) to 253 cm (S.C. 162) in the second one. These results are in harmony with those obtained by **Darwich (2018).** number of rows/ear, varied from 11.07 (S.C. 176) to 13.97 (S.C. 168) in the first season and 11.40 (S.C. 176) to 14.39 (S.C. 168) in the second one. Number of grains/row, changed from 37.82 (S.C. 162) to 43.29 (S.C. 168) in the first season and 39.33 (S.C. 162) to 45.02 (S.C. 168) in the second season. Ear length (cm), ranged from 16.40 cm (S.C. 176) to 21.96 cm (S.C. 168) in the first season and 17.22 cm (S.C. 176) to 23.05 cm (S.C. 168) in the second season. 100-grain Weight (gm), varied from 22.90 g (S.C. 176) to 29.74 g (S.C. 178) in the first season and 23.59 g (S.C. 176) to 30.63 g (S.C. 178) in the second season. Harmony findings were observed by **Mandic *et al.* (2015)**. Grain yield ton/ha significantly varied from 5.342 (S.C. 176) to 7.779 (S.C. 168) in the first season and 5.556 (S.C. 176) to 8.091 (S.C. 168) in the second season. Straw yield (ton/ha), changed from 8.789 (S.C. 176) to 9.768 (S.C. 162) in the first season and 9.031 (S.C. 176) to 10.031 (S.C. 162) in the second season. Biological yield (ton/ha) ranged from 14.131 (S.C. 176) to 17.295 (S.C. 168) in the first season and 14.587 (S.C. 176) to 17.489 (S.C. 168) in the second season. In this regard varietal differences for straw and biological yields were also documented by **Seadh *et al*. (2014).**

B. Effect of Plant density

The results in Table (2) indicated that application of Plant density increased significantly Maize plant height, number of rows/ Ear, number of grains/ row, Ear length, 100-grain Weight, grain yield, Straw yield and biological yield, in two growing seasons. Plant height (cm) ranged from 214 cm (PD_1) to 243 cm (PD_4) in the first season and 218 cm (PD_1) to 248 cm (PD_4) in the second one. Number of rows/ear, varied from 11.23 (PD_1) to 13.93 (PD_4) in the first season and 11.57 (PD_1) to 14.35 (PD_4) in the second one. Number of grains/row, changed from 37.56 (PD_1) to 43.07 (PD_4) in the first season and 39.06 (PD_1) to 44.80 (PD_4) in the second season. Ear length (cm), ranged from 17.67 cm (PD_1) to 20.15 cm (PD_4) in the first season and 18.55 cm (PD_1) to 21.16 cm (PD_4) in the second season. 100-grain Weight (gm), varied from 25.48 g (PD_1) to 28.17 g (PD_4) in the first season and 26.24 g (PD_1) to 29.02 g (PD_4) in the second season. These results are also in harmony with those reported by **Sangoi *et al*. (2002) and Ogunlela *et al.* (2005).**

Grain yield ton/ha significantly varied from 5.802 (PD_1) to 7.335 (PD_4) in the first season and 6.034 (PD_1) to 7.628 (PD_4) in the second season. Straw yield (ton/ha), changed from 8.962 (PD_1) to 9.717 (PD_4) in the first season and 9.082 (PD_3) to 10.116 (PD_1) in the second season. Biological yield (ton/ha) ranged from 15.519 (PD_1) to 16.296 (PD4) in the first season and 16.099 (PD_3) to 16.724 (PD_4) in the second season. These results are in harmony with those obtained by **Mohammed, Amany (1999), Maddonni *et al*. (2006) and Dahmardeh (2011).**

A. Maize hybrids differences

Data in Table (3) revealed significant differences between maize hybrids for all studied characters in both seasons. Protein (%) ranged from 7.14% (S.C. 178) to 9.90 % (S.C. 168) in the first season and 9.59 % (S.C. 178) to

11.48 % (S.C. 168) in the second one. These results are in harmony with those obtained by **Darwich (2018)**. Carbohydrate (%), varied from 52.60 % (S.C. 162) to 53.70 % (S.C. 178) in the first season and 46.81 % (S.C. 162) to 57.22 % (S.C. 178) in the second one. In this regard varietal differences for straw and biological yields were also documented by **El-Metwally *et al* (2010).**

Grain return (LE/ha), changed from 24040 (S.C. 176) to 35010 (S.C. 168) in the first season and 25003 (S.C. 176) to 36407 (S.C. 168) in the second season. Straw return (LE/ha), ranged from 4395 (S.C. 176) to 4884 (S.C. 162) in the first season and 4516 (S.C. 176) to 5016 (S.C. 162) in the second season. Total return (LE/ha), varied from 28435 (S.C. 167) to 39760 (S.C. 168) in the first season and 29518 (S.C. 176) to 41106 (S.C. 178) in the second season. Net return (LE/ha) significantly varied from 11935 (S.C. 176) to 23260 (S.C. 168) in the first season and 13018 (S.C. 176) to 24606 (S.C. 168) in the second season. Harmony findings were observed **by Abd El-Aziz, *et al* (2018).**

B. Effect of Plant density

The results in Table (3) indicated that application of Plant density increased significantly Maize plant height, number of rows/ Ear, number of grains/ row, Ear length, 100-grain Weight, grain yield, Straw yield and biological yield, in two growing seasons. Protein (%) ranged from 8.17 % (PD_1) to 8.37 % (PD_4) in the first season and 10.11 % (PD_1) to 10.30 % (PD_4) in the second one. These results are in harmony with those obtained by **El-Metwally *et al* (2011).** Carbohydrate (%), varied from 52.95 % (PD_1) to 53.32 % (PD_4) in the first season and 54.25 % (PD_1) to 54.59 % (PD_4) in the second one.

Grain return (LE/ha), changed from 26108 (PD_1) to 33006 (PD_4) in the first season and 27153 (PD_1) to 34326 (PD_4) in the second season. Straw return (LE/ha), ranged from 4481 (PD_4) to 4859 (PD_1) in the first season and 4541 (PD_3) to 5058 (PD_1) in the second season. Total return (LE/ha), varied from 30970 (PD_1) to 37490 (PD_4) in the first season and 32211 (PD_1) to 38874 (PD_4) in the second season. Net return (LE/ha) varied from 14467 (PD_1) to 20987 (PD_4) in the first season and 15711 (PD_1) to 22374 (PD_4) in the second season. These results are also in harmony with those reported by **Sangoi *et al*. (2002) and Ogunlela *et al.* (2005).**

C. Effect of interactions

The interaction between maize hybrids (MH) and plant density (PD) under new reclaimed sandy soil had significant effect on grain, straw and biological yields in the two growing seasons as presented in Table (4). The obtained results indicated that maize hybrids were significantly affected by applying PD_4): 20 cm (62500 plant/ha).

Maize hybrids (S.C. 168) produced the highest Grain yield/ha (8.562and 8.904ton/ha) in the two seasons, respectively with the highest level of plant density (PD_4): 20 cm (62500 plant/ha). These results are in harmony with those observed by **Mandic *et al*. (2015)**. Whereas the lowest Grain yield/ha (6.201in the 1st season and 6.449 ton/ha in the 2nd season) were obtained from Maize hybrids (S.C. 176) with PD_1): 35 cm (35714 plant/ha). Similar trends were also reported by **Tóthné (2011)**. The highest Straw yield was obtained from Maize hybrids (S.C. 162) (10.070 ton/ha); in the first season and Maize hybrids (S.C. 178) (10.341ton/ha); in the second one by applying PD_1): 35 cm (35714 plant/ha). However, the lowest Straw yield/ha was attained from Maize hybrids S.C. 176 (7.894 in the 1st season and 7.921ton/ha in the 2nd season) with (PD_4): 20 cm (62500 plant/ha) in the in the two seasons. Harmony findings were observed by **Amer *et al*. (2004) and Abd El-Aziz, *et al* (2017).**

Table 2. Performance of maize hybrids and Plant density concerning yield attributes of maize during the 2020 and 2021 seasons

Main effect	Plant Height(cm)		No. of rows/ Ear		No. of grains/ Row		Ear length (cm)		100-grain Weight(g)		Grain Yield (ton/ ha)		Straw Yield (ton/ ha)		Biological yield (ton/ ha)	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Maize hybrids (MH)																
MH_1 (S.C. 162)	248a	253a	12.05c	12.41c	37.82d	39.33d	20.05b	21.05b	25.93c	26.70c	6.779b	7.051b	9.768a	10.031a	16.548b	17.082b
MH_2 (S.C. 168)	228c	232c	13.97a	14.39a	43.29a	45.02a	21.96a	23.05a	28.78b	29.64b	7.779a	8.091a	9.506a	9.398a	17.295a	17.489a
MH_3 (S.C. 176)	208d	212d	11.07d	11.40d	41.00b	42.64b	16.40d	17.22d	22.90d	23.59d	5.342d	5.556d	8.789b	9.031b	14.131d	14.587d
MH_4 (S.C. 178)	229b	234b	13.00b	13.39b	39.07c	40.63c	17.23c	18.10c	29.74a	30.63a	6.223c	6.472c	9.340ab	9.640ab	15.563c	16.112c
F-test	**	**	**	**	**	**	**	**	**	**	**	**	*	*	**	**
Plant density (PD)																
PD_1 (35 cm)	214d	218d	11.23d	11.57d	37.56d	39.06d	17.67d	18.55d	25.48d	26.24d	5.802d	6.034d	9.717a	10.116a	15.519b	16.150b
PD_2 (30 cm)	224c	228c	12.02c	12.38c	39.25c	40.82c	18.48c	19.41c	26.45c	27.24c	6.241c	6.490c	9.431ab	9.806ab	15.672b	16.297b
PD_3 (25 cm)	233b	237b	12.90b	13.29b	41.29b	42.94b	19.34b	20.31b	27.24b	28.05b	6.747b	7.017b	9.293ab	9.082ab	16.040ab	16.099ab
PD_4 (20 cm)	243a	248a	13.93a	14.35a	43.07a	44.80a	20.15a	21.16a	28.17a	29.02a	7.335a	7.628a	8.962b	9.096b	16.296a	16.724a
F-test	**	**	**	**	**	**	**	**	**	**	**	**	*	*	*	*

** and *: Significant at 0.01 and 0.05 levels of probability, respectively. N.S: not significant.

Table 3. Partial budget analysis as affected by Maize hybrids and Plant density during the 2020 and 2021 seasons

Maize hybrids (MH)	Protein (%)		Carbohydrate (%)		Harvest Index (%)		Grain Return (LE/ha)		Straw Return (LE/ha)		Total Return (ton/ ha)		Net Return (LE/ha)	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Maize hybrids (MH)														
MH_1 (S.C. 162)	7.37c	10.38c	52.60c	46.81c	45.94a	44.69a	30510b	31728b	4884a	5016a	35391b	36743b	18891b	20243b
MH_2 (S.C. 168)	9.90a	11.48a	53.14b	56.61b	46.72a	46.92a	35010a	36407a	4753a	4699a	39760a	41106a	23260a	24606a
MH_3 (S.C. 176)	8.67b	9.34b	53.14b	57.12b	45.21a	45.85a	24040d	25003d	4395b	4516b	28435d	29518d	11935d	13018d
MH_4 (S.C. 178)	7.14d	9.59d	53.70a	57.22a	45.57a	46.66a	28010c	29126c	4670ab	4820ab	32676c	33946c	16176c	17446c
F-test	**	**	*	*	N.S	N.S	**	**	*	*	**	**	*	*
Plant density (PD)														
PD_1 (35 cm)	8.17d	10.11d	52.95d	54.25d	46.17a	45.97a	26108d	27153	4859a	5058a	30970d	32211d	14467b	15711d
PD_2 (30 cm)	8.24c	10.15c	53.09c	54.39c	46.29a	45.90a	28084c	29207	4716ab	4903ab	32800c	34110c	16300a	17610c
PD_3 (25 cm)	8.30b	10.23b	53.22b	54.49b	45.59a	46.81a	30362b	31576	4647ab	4541ab	35010b	36118b	18509d	19618b
PD_4 (20 cm)	8.37a	10.30a	53.32a	54.59a	45.39a	45.44a	33006a	34326	4481b	4548b	37490a	38874a	20987c	22374a
F-test	**	**	**	**	N.S	N.S	**	**	*	*	**	**	*	*

** and *: Significant at 0.01 and 0.05 levels of probability, respectively. N.S: not significant.

The highest Biological yield was obtained from Maize hybrids (S.C. 168) and PD_3): 25 cm (50000 plant/ha), (17.770 ton/ha); in the first season and Maize hybrids (S.C. 162) (18.175 ton/ha); in the second one by applying PD_4): 20 cm (62500 plant/ha). However, the lowest Biological yield/ha was attained from Maize hybrids S.C. 176 (13.960 ton/ha) with PD_2): 30 cm (41666 plant/ha) in the first season and (14.370 ton/ha), in the second one with (PD_4): 20 cm (62500 plant/ha). Similar trends were also reported by **Iptas and Acar (2006) and Sangoi *et al*. (2002).**

The interaction between maize hybrids (MH) and plant density (PD) under new reclaimed sandy soil had significant effect on Grain return (LE/ha), Straw return (LE/ha) and Net return (LE/ha) in the two growing seasons as presented in Table (5). The obtained results indicated that maize hybrids were significantly affected Grain return (LE/ha) by applying PD_4): 20 cm (62500 plant/ha). Maize hybrids (S.C. 168) produced the highest grain yield (38528 and 40068 LE/ha) in the two seasons, respectively with the highest level of plant density (PD_4): 20 cm (62500 plant/ha). These results are in harmony with those observed by **Mandic *et al.* (2015)**. Whereas the lowest Grain return (LE/ha) (20797 in the 1st season and 21629 LE/ha in the 2nd season) were obtained from Maize hybrids (S.C. 176) with PD_1): 35 cm (35714 plant/ha). Harmony findings were observed by **Abd El-Aziz *et al.* (2017).**

Table 4. Grain, straw and biological yields of maize as affected by the interaction between maize hybrids and plant density during the both seasons of the study

Maize hybrids	Plant density	Grain yield (ton/ha)		Straw yield (ton/ha)		Biolog. yield (ton/ha)	
		2020	2021	2020	2021	2020	2021
MH_1 (S.C. 162)	PD_1	6.084i	6.327i	9.796abc	10.202abc	15.880ef	16.530ef
	PD_2	6.457g	6.716g	9.763abc	10.304abc	16.220df	17.020df
	PD_3	6.992e	7.272e	9.448cd	9.331cd	16.440cd	16.602cd
	PD_4	7.584c	7.887c	10.070a	10.288a	17.650a	18.175a
MH_2 (S.C. 168)	PD_1	7.032d	7.313d	9.715abc	9.834abc	16.750bc	17.148bc
	PD_2	7.584c	7.887c	9.496bcd	9.643bcd	17.080b	17.530b
	PD_3	7.940b	8.258b	9.830ab	9.462ab	17.770a	17.720a
	PD_4	8.562a	8.904a	8.981ef	8.653ef	17.540a	17.557a
MH_3 (S.C. 176)	PD_1	4.622n	4.807n	9.596bc	10.086bc	14.220i	14.892i
	PD_2	4.968m	5.166m	8.995ef	9.546ef	13.960i	14.713i
	PD_3	5.580k	5.803k	8.671f	8.572f	14.250i	14.375i
	PD_4	6.201h	6.449h	7.894g	7.921g	14.100i	14.370i
MH_4 (S.C. 178)	PD_1	5.470l	5.689l	9.760abc	10.341abc	15.230h	16.030h
	PD_2	5.955j	6.193j	9.470cd	9.732cd	15.430gh	15.925gh
	PD_3	6.477f	6.736f	9.223de	8.964de	15.700fg	15.700fg
	PD_4	6.992e	7.272e	8.906ef	9.523ef	15.900ef	16.795ef
	F-test	*	*	*	*	*	*

** and * : Significant at 0.01 and 0.05 levels of probability, respectively. values N.S: not significant.

The highest Straw return (LE/ha) was obtained from Maize hybrids (S.C. 162) (5033 LE/ha); with PD_4): 20 cm (62500 plant/ha) in the first season and (5152 LE/ha); in the second one by applying PD_2): 30 cm (41666 plant/ha). However, the lowest Straw return (LE/ha) was attained from Maize hybrids S.C. 176 (3947 LE/ha) with PD_4): 20 cm (62500 plant/ha) in the first season and (3961 LE/ha), in the second one with PD_4): 20 cm (62500 plant/ha).

The highest Net return (LE/ha) Maize hybrids (S.C. 168) produced the highest grain yield (26518 and 27895 LE/ha) in the two seasons, respectively with the highest level of plant density PD_4): 20 cm (62500 plant/ha). These results are in harmony with those

observed by **Mandic *et al*. (2015).** Whereas the lowest Net return (LE/ha) (9095 in the 1st season and 10172 LE/ha in the 2nd season) were obtained from Maize hybrids (S.C. 176) with PD_1): 35 cm (35714 plant/ha). Harmony findings were observed by **Abd El-Aziz, *et al.* (2017).**

Table 5. Partial budget analysis as affected by Plant density during the 2020 and 2021 seasons

Maize hybrids	Plant density	Grain Return (LE/ha)		Straw Return (LE/ha)		Net Return (LE/ha)	
		2020	2021	2020	2021	2020	2021
MH_1 (S.C. 162)	PD_1	27379i	28474i	4898abc	5101abc	15777j	17075j
	PD_2	29058g	30221g	4882abc	5152abc	17439h	18873h
	PD_3	31464e	32723e	4724cd	4665cd	19688f	20888f
	PD_4	34128c	35492c	5033a	5144a	22661c	24137c
MH_2 (S.C. 168)	PD_1	31644d	32910d	4858abc	4918abc	20002e	21327e
	PD_2	34128c	35493c	4748bcd	4822cd	22376d	23814d
	PD_3	35729b	37159b	4915ab	4731ab	24144b	25390b
	PD_4	38528a	40068a	4491ef	4327ef	26518a	27895a
MH_3 (S.C. 176)	PD_1	20797n	21629n	4798bc	5043bc	9095o	10172o
	PD_2	22354m	23247m	4498ef	4773ef	10351n	11520n
	PD_3	25108k	26112k	4335f	4286f	12943m	13899m
	PD_4	27905h	29022h	3947g	3961g	15352k	16482k
MH_4 (S.C. 178)	PD_1	24614l	25599l	4880abc	5171abc	12994m	14270m
	PD_2	26798j	27868j	4735cd	4866cd	15033l	16235l
	PD_3	29148f	30312f	4612de	4482de	17259i	18294i
	PD_4	31464e	32723e	4453ef	4762ef	19417g	20985g
	F-test	**	**	*	*	**	**

** and * : Significant at 0.01 and 0.05 levels of probability, respectively. values N.S: not significant.

CONCLUSION

It could be concluded that Maize hybrids (S.C. 168) and application of PD_4): 20 cm (62500 plant/ha) produced the most economical Maize hybrids production under the new reclaimed sandy soil in at El- Tur area, South Sinai, Egypt.

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