EFFECT OF GRADING AND PLANTING METHODS ON CORN CROP PRODUCTION

Shetawy. M.A. El-Said[1]

ABSTRACT

Field experiments were carried out in salty clayey loam soil at the experimental farm of Gemmiza Agricultural Research Station Garbia Governorate to study the effect of different grading levels of grain corn and different planting methods on crop yield productivity during two successful summer seasons 2009/2010. The results indicated that the highest and lowest values of emergence ratio, number of plant/m^2 and grain yield ardab/fed. (96.1 and 71.5 %), (5.48 and 3.9 plants/m^2) and (3.745 and 2.678 ton/fed.) were obtained by using pneumatic planter at a medium level of gradation and mechanical planter at large level of gradation respectively by using single cross 10. Meanwhile with using varieties of Giza 2, the highest and lowest values of emergence ratio, number of plants/m^2 and grain yield ton/fed. (94.9 and 76.5 %), (5.47 and 4.3 plants/m^2)and (2.982 and 2.160 ton/fed.) were obtained by using pneumatic planter at medium level of gradation and mechanical planter at large level of gradation respectively.

INTRODUCTION

Corn crop is considered one of the most important grain crops in Egypt. The cultivated area ranges between 1.8 to 2.0 million fed. yearly. The total productivity of this cultivated area yields about 7.684 million-ton of grains. Recently, the government tends to enlarge area the growing corn to satisfy the shortage of the wheat production and try to make area self-sufficiency for bread mixing corn with wheat with a rate of 20 %. Therefore, the planting method is very important to produce a good production. **Moustafa (1993)** mentioned that the highest yield of soybean was obtained by using pneumatic planter. Pneumatic planter, and seed drill saved about 67.6 and 31.6 % respectively of seeds per feddan compared with manual planting. **Abdou (1996)** studied different systems of seedbed preparation and planting

[1] **Lect., Agric. Eng. Dept. Fac. of Agric., Al-Azhar Univ. Egypt.**

methods of corn variety Giza 2. He reported that using moldboard plow followed by disc harrow and mechanical planting (pneumatic planter) gave the maximum grain yield. **Metwalli (1998)** mentioned that the pneumatic planter with the seed disk 70 cells x 4.25 mm hole diameter, planter reduction ratio 0.587 and 60 cm row cell spacing at forward speed of about 6.7 km/h. gives the optimum conditions for planting pea. **Kamel et al. (2003)** studied effect of seed-bed preparation systems and planting methods on corn crop production. They found that the seed-bed preparation system by using moldboard plow followed by disc harrow twice and land leveler and planting by using pneumatic planter gave the highest grain yield (3.004 ton/fed). Meanwhile, seed-bed preparation system by using disc harrow twice followed by land leveler and planting gave the lowest grain yield (1.509 ton/fed). **El-sayed (2001)** studied the effect of some planting and land leveling systems on soybean-crop productivity. He found that, the optimum seed-emergence range of 92.5 – 93.46 % was obtained by using pneumatic planter and laser leveling, while the minimum was obtained with manual planting 67.20 % and traditional leveling too. The highest grain productivity (1674.4 – 1840.2 kg/fed) was obtained by using pneumatic and laser land-leveling, while the lowest yield (1496.4 – 1644.6 kg/fed) was obtained by using seed drill and traditional land-leveling. The highest net income value "CVPE" (1426.8 LE/fed) was obtained with pneumatic planter and laser land-leveling, and the lowest value (1185.7 LE/fed) was obtained with manual planting and laser land-leveling. **Paipars (2002)** found that the proper planting method producing the optimum germination ratio and uniformity of seed distribution, adequate depth planting and the highest productivity was pneumatic planter use. The objective of the present work with is mainly concentrated on study the effect of planting methods (pneumatic planter, mechanical planter and manual planting) under different gradations of corn grains (small. medium, large single and without gradation of grains) with two varieties of corn (single cross 10 and Giza 2).

MATERIALS AND METHODS

The field experiments were carried out in salty clay loam soil at the experimental farm of AL-Gemmiza Agricultural Research Station Garbia Governorate to study the effect of different grading levels of Zia maize

grains and different planting methods on crop yield during two successful summer seasons 2009/2010. The mechanical analysis of the experimental soil was carried out in Mansura plant nutrition Lab., Soil, Water and environment Res. Institute A.R.C.Giza, Egypt. The mechanical analyses of the experimental soil are summarized in **Table (1).**

Table (1): Mechanical analysis of the experimental soil.

Clay %	Silt %	coarse sand %	Fine sand %	Soil class.
35.98	40.46	1.79	21.77	Salty clay loamy soil

Materials:

Type varieties of maize crop:

Two varieties of Zia maize crop (Single cross 10 and Giza2) were used in this work under three levels of grading grains (small, medium and large sizes) and three different planting methods (pneumatic planter, mechanical planter and manual planting). Fig. 1 and Fig. 2 show the photos of the mechanical and pneumatic planters. The specifications of the tractor and two planters used in this work are indicated in the following:

Fig.1: The mechanical planter

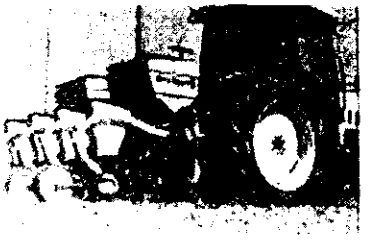

Fig.2: The pneumatic planter.

Items	Tractor technical specifications
Type	Massey Ferguson [MF 230] USA
Model	AD3.152
Rated horse power[PTO],	34.53/100 at 2000 r.p.m
Operating speed[PTO], r.p.m	1789 rpm engine/540 PTO
No. of cylinders	3
Idle speed, r.p.m	725–775
Maximum speed [No load],	2135–2185
Fuel tank, U.S.,L	14
Wheel base, inch	72–3/8
Overall Length [approx.],	116
Overall Width [approx.],	70
Front tires, 4 Ply	6–16–F2
Rear tires, 4 Ply	13.6–28–R1

Items	Planter technical specifications	
	Pneumatic	Mechanical planter
Type	Mounted	Mounted
Model	Gamma 90	Gaspardo
Made in	Italy	Italy
Control	Hydraulic	Hydraulic
No. of rows	4	4
Spacing of rows, cm	60	60
Working width, cm	240	240
Hopper capacity, kg	12- corn	15- corn
Metering device	Perforated disc	Ground wheel
Total mass, kg	450	375

Methods:

The experimental area was about 1 fed. It was divided into 12 equal plots having dimensions of 4.8 x 24 per each 12 treatments (A_1, A_2 and A_3 , B_1, B_2 and B_3, C_1, C_2 and C_3, D_1, D_2 and D_3).

where:

A_1 = large grain with mechanical planter.

A_2 = large grain with pneumatic planter.

A_3 = large grain with manual planting.

B1 = medium grain with mechanical planter.

B2 = medium grain with pneumatic planter.

B3 = medium grain with manual planting.

C1 = small grain with mechanical planter.

C2 = small grain with pneumatic planter.

C3 = small grain with manual planting.

D1 = without grading with mechanical planter.

D2 = without grading with pneumatic planter.

D3 = without grading with manual planting.

Tests were carried out and replicated three times in a completely randomized block design as shown in Fig. (1)

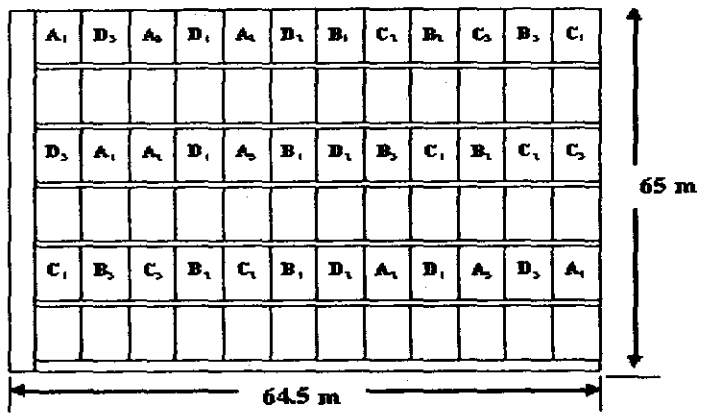

Fig.3: The experimental area design.

All the experiment plots were chiseled twice and the second tillage was carried out by disk harrow and leveled by land leveler before planting operations. The planter machines were calibrated and forward speed stability as recommended.

RESULTES AND DISCUSSION

1-Physical and mechanical properties of different varieties of corn under different gradation levels:

The physical and mechanical properties (volume of grain, bulk density, and mass of 1000 grain, repose angle and coefficient of friction) of two varieties of corn crop (Single cross 10 and Giza2) at three grading levels were measured and illustrated in Table (2). The data show that, physical and mechanical properties of two different varieties of corn were used in this work have effect on feeding device of mechanical and pneumatic planter were used in planting operation.

Table (2): Physical and mechanical properties of two variety of corn crop (Single cross 10 and Giza2).

Varieties of corn crop	Grading Levels of grain	Average volume of grain,cm^3	Bulk density, g/cm^3	Mass of 1000 grain,g	Repose angle, rad.	Coefficient of friction
Single cross 10	Large	0.44	0.655	398.8	0.43	2.455
	Medium	0.43	0.675	298.75	0.42	2.475
	Small	0.24	0.693	219.30	0.39	2.501
Giza 2	Large	0.53	0.697	457.80	0.48	2.575
	Medium	0.42	0.716	361.65	0.46	2.605
	Small	0.29	0.742	223.80	0.45	2.685

2- Effect of gradation levels and planting methods on emergence ratio:

Data in fig. 2 indicated that the highest value of emergence ratio was about 99.1, 89.9% and 98.9% were obtained by pneumatic planter, mechanical planter and manual planting at medium level gradation with single cross varieties of corn crop respectively, while the lowest values were 80.3, 71.5 and 82,9 % at the same previous planting methods at large level of gradation respectively. The high value of emergence ratio for planting methods at medium level was due to low mechanical damage of grains of medium-sized and increased at large level gradation. In the same trend, at medium level gradation, the value of emergence ratio with pneumatic planter was more than mechanical planter. Therefore, the highest and lowest values of emergence ratio of 96.1 and 71.5 % were obtained by pneumatic planter at medium level gradation and mechanical planter at large level gradation respectively. However, with varieties of Giza^2, the highest value of emergence ratio of about 94.9, 89.7% and 87.7% were obtained by pneumatic planter, mechanical planter and manual planting at medium level gradation respectively. Meanwhile, the lowest values of 86.9, 76.5 and 77.4 % were obtained by pneumatic planter and mechanical planter at large level gradation and manual planting at small level gradation respectively. In the same trend, at medium level gradation the value of emergence ratio with pneumatic planter was more than mechanical planter. Therefore, the highest and lowest values of emergence ratio of 94.9 and 76.5 % were obtained by pneumatic planter at medium level gradation and mechanical planter at large level gradation respectively.

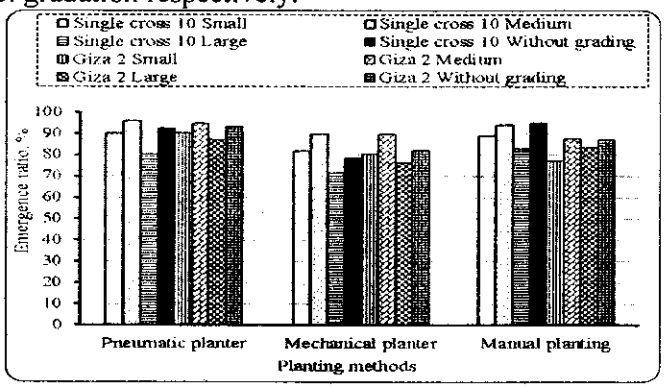

Fig.(2): Effect of gradation levels and planting methods on emergence ratio of corn.

2- Effect of gradation levels and planting methods on number of plants per m^2:

Data in fig. 3 indicate that the highest value of number of plant/m^2 of about 5.48, 4.85 and 5.15plant/m^2 were obtained by pneumatic planter, mechanical planter and manual planting at medium level gradation with single cross varieties of maize crop respectively, while the lowest values were 4.4, 3.9 and 4.5 plant/m^2 at the same previous planting methods at large level gradation respectively. The high number of plants/m^2 for planting methods at medium level was due to high emergence ratio and low mechanical damage of (medium-rized grains) and increase at large level gradation. In the same trend at medium level gradation, the values of number plants/m^2 with pneumatic planter more than mechanical planter therefore, the highest and lowest value of number of plant/m^2 of 5.48 and 3.9 plants/m^2 were obtained by pneumatic planter at medium level gradation and mechanical planter at large level gradation respectively. However, at varieties of Giza 2, the highest value of number of plant/m^2 was about 5.47, 4.85 and 5.05 plants/m^2 were obtained by pneumatic planter, mechanical planter and manual planting at medium level gradation respectively. Meanwhile, the lowest values were 4.5, 4.3 and 4.36 plants/m^2 was obtained by pneumatic planter, mechanical planter and manual planting at large level gradation respectively. In the same trend was at medium level gradation the value of plants/m^2 by pneumatic planter was more than mechanical planter. Therefore, the highest and lowest values of plants/m^2 of 5.47 and 4.3 plants/m^2 were obtained by pneumatic planter at medium level gradation and mechanical planter at large level gradation respectively.

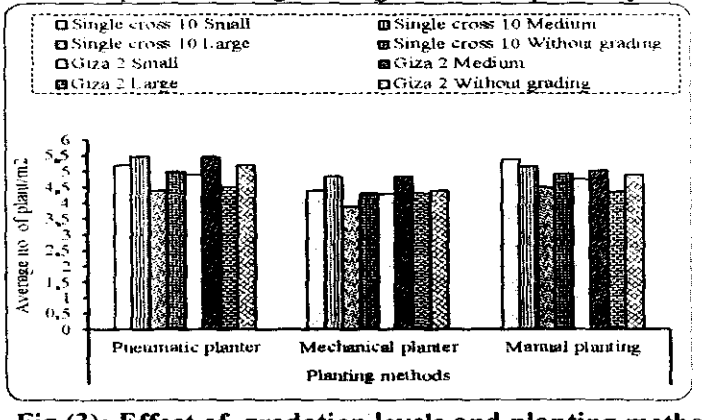

Fig.(3): Effect of gradation levels and planting methods on number plants per m^2 of corn.

3- Effect of gradation levels and planting methods on grain yield:

Data in fig. 3 indicated that the highest values of grain yield ton/fed. were about 3.745, 3,268 and 3.157 ton/fed. were obtained by pneumatic planter, mechanical planter and manual planting at medium level gradation with varieties single cross 10 of maize crop respectively, while the lowest values were 3.069, 2.678 and 2.825 ton/fed. at the same previous planting methods at large level gradation respectively. The high grain yield for planting methods at medium level gradation was due to high emergence ratio and high number of plant/m^2, while the grain yield decreased at large level gradation due to low emergence ratio and number of plants/m^2. In the same trend, at medium level gradation, the value of grain yield ton/fed. with pneumatic planter was more than mechanical planter. Therefore, the highest and lowest values of grain yield ton/fed. of 3.745 and 2.678 ton/fed. were obtained by pneumatic planter at medium level gradation and mechanical planter at large level gradation respectively.

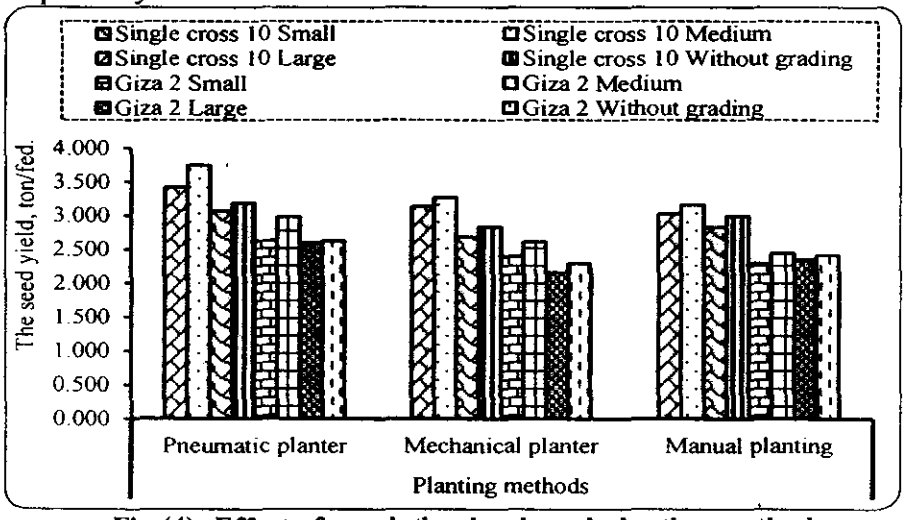

Fig.(4): Effect of gradation levels and planting methods on grain yield of corn crop.

However, at varieties of Giza 2 the highest values of grain yield ton/fed. were about 2.982, 2.611 and 2.442 ton/fed. were obtained by pneumatic planter, mechanical planter and manual planting at medium level gradation respectively. Meanwhile, the lowest values were 2.591, 2.160

and 2.289 ton/fed. obtained by pneumatic planter, mechanical planter and manual planting at large level gradation respectively. In the same trend was at medium level gradation, the value of ton/fed. by pneumatic planter was more than mechanical planter. Therefore, the highest and lowest values of ton/fed. of 21.3 and 15.43 ton/fed. were obtained by pneumatic planter at medium level gradation and mechanical planter at large level gradation respectively.

CONCLUSIONS

1. The highest values of emergence ratio 96.1 and 94.9 % were obtained by using pneumatic planter with single cross 10 and Giza 2 at medium level gradation, respectively. Meanwhile, the lowest values of emergence ratio 71.5 and 76.5 % were obtained by using mechanical planter with single cross 10 and Giza 2 at large level gradations respectively.
2. The highest values of number of plant/m^2 5.48 and 5.47 were obtained by using pneumatic planter with single cross 10 and Giza 2 at medium level gradation respectively. Meanwhile the lowest values of number of plants/m^2 3.9 and 4.3 were obtained by using mechanical planter with single cross 10 and Giza 2 at large level gradations respectively.
3. The highest values of grain yield 3.745 and 2.982 ton/fed. were obtained by using pneumatic planter with single cross 10 and Giza 2 at medium level gradation respectively. Meanwhile the lowest values of grain yield 2.678 and 2.160 ton/fed. were obtained by using mechanical planter with single cross 10 and Giza 2 at large level gradations respectively.

REFERENCES

Abdou, F.M.(1996). Effect of some seed-bed preparation systems of planting and inter-row cultivation on maize production .Misr J. Ag. Eng. Vol. 13(20:427-439.

El-Sayed G. H. (2001). Effect of some planting and land leveling system on soybean crop productivity. 1^{si} I. Conf. for Manuf. Agr. Equip.

and Mach. and 9th Conf. of Misr Society of Agr. Eng. 9-11 September 2001: 219-232.

Kamel O. M., Aref A. O. M., Khadr Kh. A. A. and Mechal W. M. (2003). Effect of seed-bed preparation systems and planting method on corn crop production. The 11th Ann. Conf. of the Misr Soci. Eng. Oct. 2003: 223-235.

Metwalli , M. M. (1998). Comparative study of the pneumatic and traditional planters for pea planting. Misr J. Ag. Eng. 15 (3): 485-494.

Moustafa E. M. (1993). Mechanization of soybean crop. M. Sc. Th. Fac. Agr. Zagazig Unvi.

Paipars, Kh. A., Shraf, S. M. and EL-Sayed, G. H. (2002). Soybean response to mechanical planting methods in a clay –loam soil. Misr J. Ag. Eng. 19 (2): 327- 339.

الملخص العربي

تأثيرالتدريج وطرق الزراعة على انتاجية محصول الذرة

محمد احمد السيد شتيوي*

يمثل محصول الذرة المرتبة الثالثة بعد محصول الأرز والقمح في مصر من حيث الأهمية كغذاء للإنسان والحيوان والمساحة و للنهوض بإنتاجية المحصول. يعد اختيار الطرق المثلى للزراعة الآلية احد العوامل الرئيسية التي تؤثر في إنتاجية المحصول. وحيث أن الانتظامية في شكل وحجم البذور لها تأثير في أداء جهاز التلقيم لآلة الزراعة لذلك كان من الضروري التطرق بالدراسة لمعرفة تأثير طرق الزراعة (آلة الزراعة في خطوط الميكانيكية – آلة الزراعة على خطوط بشفط الهواء – الزراعة اليدوية) ومستويات التدريج لحبوب الذرة (حبوب صغيرة – حبوب متوسطة – حبوب كبيرة – حبوب بدون تدريج) لصنفين من الذرة (هجين فردى ١٠ و جيزة ٢) على إنتاجية محصول الحبوب. وأجريت التجارب بالمزرعة البحثية بمحطة البحوث الزراعية بالجميزة خلال موسمين ٢٠٠٩/٢٠١٠ م على مساحة١ فدان في تصميم قطاعات كاملة العشوائية. وأظهرت التجارب النتائج التالية:

- بلغت أكبر نسبة لبزوغ البادرات ٩٦.١ و ٩٤.٩% بعد ١٤ يوم من الزراعة باستخدام آلة الزراعة النيوماتيك مع مستوى التدريج للحبوب المتوسطة للصنف هجين فردى١٠ وجيزة ٢ على التوالي وذلك لعدم تعرض البذور للكسر الميكانيكى وأقل قيمة لنسبة بزوغ البادرات ٧١.٥ و ٧٦.٥ % باستخدام آلة الزراعة الميكانيكية مع مستوى التدريج للحبوب الكبيرة للصنف هجين فردى١٠ و جيزة ٢ على التوالي.

*مدرس الهندسة الزراعية – كلية الزراعة – جامعة الأزهر- القاهرة.

- تحققت أكبر قيمة لمتوسط عدد النباتات ٥.٤٨ و٥.٤٧ نبات/ م^{٢} باستخدام آلة الزراعة النيوماتيك مع مستوى التدريج للحبوب المتوسطة للصنف هجين فردى١٠ وجيزة ٢ على التوالي وأقل قيمة لمتوسط عدد النباتات ٣.٩ و ٤.٣ نبات/ م^{٢} باستخدام آلة الزراعة في خطوط الميكانيكية مع مستوى التدريج للحبوب الكبيرة للصنف هجين فردى١٠و جيزة ٢على التوالي.
- تحقق أكبر مقدار لمحصول الحبوب ٣.٧٤٥ و ٢.٩٨٢ طن / فدان باستخدام آلة الزراعة النيوماتيك مع مستوى التدريج للحبوب المتوسطة للصنف هجين فردى١٠و جيزة ٢ على التوالي بينما أقل مقدار لمحصول الحبوب ٢.٦٧٨ و ٢.١٦٠ أردب / فدان باستخدام آلة الزراعة الميكانيكية مع مستوى التدريج للحبوب الكبيرة للصنف هجين فردى١٠ و جيزة ٢ على التوالي.

وبناءً على تلك النتائج يمكن التوصية باستخدام آلة الزراعة (النيوماتيك) مع مستوى التدريج للحبوب المتوسطة لكلا الصنفين الهجين فردى ١٠ وجيزة٢.