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EFFECT OF MAIZE PLANTING METHODS ON PLANT REGULARITY AND YIELD CROP

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ABSTRACT

A comparative study of three maize planting methods (P.- R.) "seed planting on flat surface and construct the rows during cultivating", (R.-P.) "construct the rows at first and plant the seeds on the rows" and (R.P.) "construct the rows and planting the seeds at the same time" was carried out on a clay soil under constand operating condition. The experimental results indicate that the planting methods (P.- R.) recorded the best uniformity of plant deviation (K-value 0.975), increasing of plant intensity 30 and 17%, seed germination 17.8 and 13.4% and crop yield 30.7 and 19.7% in comparison with (R.P.) and (R.P.) respectively. Therefore, it may be considered the treatment (P.- R.) a suitable method for maize planting.

INTRODUCTION

Maize crop is considered an economically priority crop, among other cereal crops such as wheat and rice in most countries of the world especially Egypt. It represents a vital source of daily human food (17% of total consumption), and also, plays a vital role in animal feeding. The two rotation corn area represents approximately 35% of the total arable lands, this area produces 3.2 million tons of corn per year (Agric. Stat. Year Book, 1993). The production of Dakahlia, Al-Gharbia, and Kafer El-Sheikh government represents 13.5% the hole production. Cannell and Ellis *(1978)* reported that the success or the failure of a crop production system often depends on seed-bed condition, previous tillage operations, planting methods and tillage equipment.

Increasing the productivity of maize crop is the aim of all maize agronomists. This increase can be achieved by using suitable technology. The planting mechanization is the first step for this technology. Moody (1980) designed a drill to plant maize, beans or cowpea directly into soil through a thick layer of mulch. It consists of hexagonal wheel with 6 rotating seed funnels fed axially from a hopper; as it turns the funnels inject seed through mulch of up to 2.1-2.52 t/ feddan at 25 cm of inter row spacing. A press wheel is mounted singly for hand planting or in combination on one or more axles for animal or tractor draught. Adekoya and Buchele (1987) developed a rolling punch planter with a corn-actuated opening mechanism to sow maize. Field tests showed that satisfactory drilling was achieved in an unfilled field with up to 75 % residue cover (at about 2.31 ton/ feddan). The within the-row spacing of the punched holes and the depth of planting of the seeds were independent of the travel speed. The percentage of the punched holes containing a single seed decreased as the travel speed increased. Morrison and Abrams (1978) designed a new soil furrow opener and used in combination with appropriate articulating frames and furrow closer for conservation-tillage seed drills and transplanters. This design allows operation in various field conditions from no-tillage to plowed fields on curved rows and on side slopes. Korayem *et al*. (1986) investigated the effect of seed size, cell speed and tractor maize planter and studied the cell fill, seed damage, seed spacing and scattering. Matching of seed size to cell size was

most important and greatly affected the accuracy of seed generally reduced the percentage cell fill and increased seed damage and seed spacing along the row, particularly the larger and ungraded seeds. He added that the wheel slippage in the field was a major factor in causing larger plant spacing. Lindwall and Erbach (1983) evaluated the effects of planting systems on soil properties in relation to emergence and growth of maize. Effects of down pressure on various types of press-wheels were evaluated. Planting systems effected soil conditions but usually did not affect emergence and early growth. On well structured soils in humid environments, a wide range of press-wheel options for row crop drills may be unnecessary. Abo-Habaga and Abdou (1993) reported that the maize planting on flat soil recorded increasing the yield crop about 10.3% and net profit more than 14% in comparison with ridged soil.

The purpose of this study is to investigate the effect of different methods of planting maize at small Egyptian farms on planting regularity and yield crop.

MATERIALS AND METHODS

The experiment was carried out on a clay soil at a private farm in Kafer- El-Thopaneia - Gharbia governorate, Egypt. The experimental area was one feddan (140 ×30m), It was divided in to three plots (10 x 140 m) according to the planting methods. Each plot was divided into three replicated. The planting methods were as following:

1-Seed planting on flat surface and construct the rows during cultivating(P.-R),

2-Construct the rows at first and plant the seeds on the rows (R.-P.),

3- Construct the rows and planting the seeds at the same time (R.P.)

The experiment area was prepared using a chisel plow (2-passes), rotary plow (one pass) and wooden leveler, It was planted using a flexi-planter (John-Deer 71), which was developed to construct the ridge during the planting. The planter was adjusted at 75cm between rows, 20cm between hills, 1-2 seeds in hill and planting depth about 3cm from surface of field.

The experiment was carried out during the full growing season in two successive seasons. Irrigation and fertilization for maize were carried out as recommended by the Ministry of Agriculture.

The plant distribution in the row (Longitudinal and Latitudinal) was measured by taking six samples from randomly selected one-meter length for each plot. The distance between successive plants on each row was measured by meter. Plant deviation from the row were measured, counted and used to calculate the percentage of plant distribution to the total plant in the field. The uniformity of plant distribution in the row can he estimated from the value of index-K; using the following equation by Kan (1980).

$$K = \frac{S}{\bar{X}}$$

Where:

$\underline{S}$: Theoretical mean distance between plants in row. (cm)

X: Actual mean distance between plants in row. (cm)

when K=1 - the plants distribution 'in row is in very good uniformity.

K<1 - some plants were disappeared from the row.

K>1 - many plants grow together in short distance and formed many dispersion groups alongside the row.

The plant density was determined using square wooden frame (1.00 m^2), taking ten samples randomly from each plot. The number of plants was counted and determined the mean number per square meter for extrapolate the plant density.

The number of hills, in 10 m along of the row, was counted and repeated four times per every treatment. The number of plants per every hill was counted to calculated the percentage of hills having 1, 2 and 3 plants by the following equation:

$$H_{1\text{-}n} = \frac{h_{1\text{-}n}}{h_t}$$

Where:

$H_{1\text{-}n}$= Percentage of hills having number of plants

$h_{1\text{-}n}$ = Number of hills having number of plants

h_t = Total number of hills

Seeding emergence was calculated from one m^2 and repeated 10 times per every treatment after 8 days from planting and irrigation. The count of the emerged plants take place every day until no emerged plants appeared.

The crop yield was evaluated taking ten samples at random from each plot. Square wooden frame of an area of 1.00 m^2 was used as a sampling tool. The samples were harvested by hand, weighed and used to extrapolate the crop yield (kg/Fed.).

RESULTS AND DISCUSSION

- Plants deviation:

The results in Figs.(1, 2) showed the maize plants deviation from the row at the different methods of planting. According to Kan's equation, the data in fig. 1 showed that the best uniformity of plant longitudinal distribution was obtained from treatment (P.-R.), wherever the K-value was 0.975, whereas, it was 1.17 and 1.26 for treatments (R.-P.) and (R.P.) respectively. The actual mean planting distance in the row for treatment (P.-R.) was 19.5 cm, whereas the treatments (R.-P.) and (R.P.) recorded 23.4 and 25.2 cm respectively. Treatment (R.P.) recorded the shortest side displacement for plant distribution, whereas the longest was at treatment (R.-P.). Treatment (P.-R.) recorded the highest plant density around the center line of row in comparison with other ones (fig. 2). The maximum value of plant density (84%) was recorded at treatment (P.-R.) through the side distance from one cm of latitudinal displacement, while treatments (R.-P.) recorded the lowest value (64%). Whereas, treatment (R. P.) obtained (80%) plant density at the same side displacement.

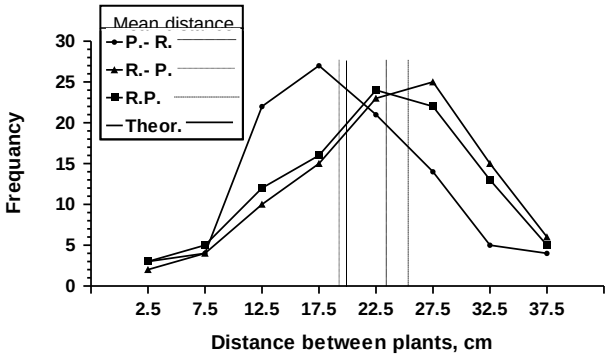

Fig. 1: Effect of planting methods on plant longitudinal distribution.

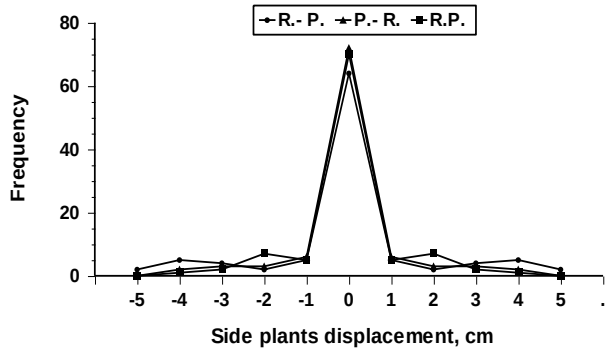

Fig. 2: Effect of planting methods on plant latitudinal displacement.

- Plants intensity

Obtained data in Fig. (3) showed the best fitted relationship between the plant intensity and number of hills per unit area and the different planting methods.

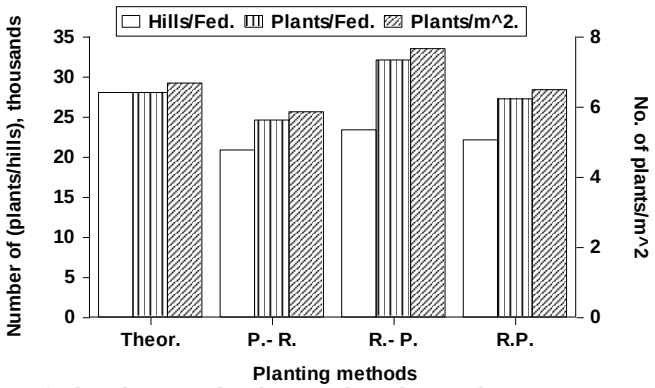

Fig. 3: Effect of planting methods on plant intensity.

Treatment (P.-R.) recorded the highest actual number of hills per feddan (83.4% from theoretical hill's number), while treatments (R.- P.) and (R.P.) obtained 74.4% and 78.9% respectively.

The highest number of plant / Fed. was recorded at treatment (P.-R.) "32053 plants", whereas treatments (R.- P.) and (R.P.) recorded 24570 and

27211 plants respectively. The results in Fig. showed that the number of hills at treatment (P.- R.) was more than 12% and 5.6%, while the number of plants increased more than 30% and 17% in comparison with treatments (R.- P.) and (R.P.) respectively. The reason of this different due to increase the number of hills, which obtained 2 plants, in treatment (R.-P.) in comparison with treatments (R.- P.) and (R.P.) as shown in fig.4.

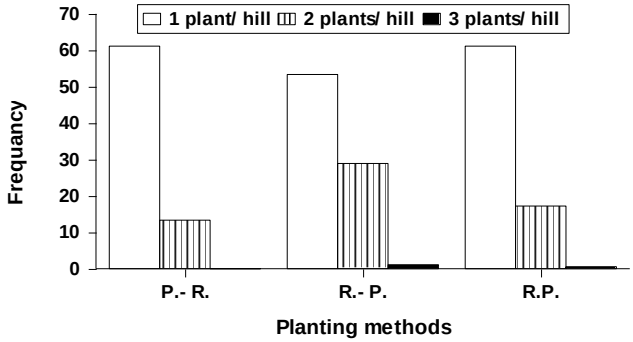

Fig. 4: Effect of planting methods on plant number/ hill.

- Seedling emergence and seed germination

The results in Fig. 5. showed that the highest emergence percentage was recorded on the 8th day at treatment (P.- R.) than the other one. After that date, the average seedling emergence at treatments (R.- P.) and (R.P.) were rapid as compared with treatment (P.- R.).

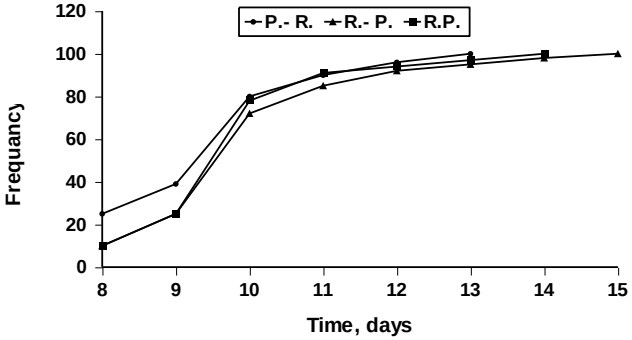

Fig. 5: Effect of planting methods on seedling emergence.

This may be due to the planting in losing soil at row increased the planting depth and consequently, the seedling emergence was delayed. Therefore, the seedling emergence was become completed after 13 days at treatment (P.- R.) , whereas it was 14 and 15 days for treatments (R.P.) and (R.- P.) respectively. On the other hand, the treatment (P.- R.) recorded the highest percentage of seed germination (66.8%) after 13 days, while treatments (R.P.) and (R.- P.) recorded seed germination percentage (58.9% and 56.7%) after 14 and 15 days respectively.

- Crop yield

The average yields of maize under each treatment for the two years are as shown in fig. 6. The experimental results indicated that the crop yield from treatment (P.- R.) were higher than the other one. Treatment (P.- R.) recorded increasing of crop yield about 30.4% and 19.7% in comparison with treatments (R.- P.) and (R.P.) respectively. The statistical analysis (at 5%) indicated that a significant difference was observed between the effect of planting methods on maize yield crop.

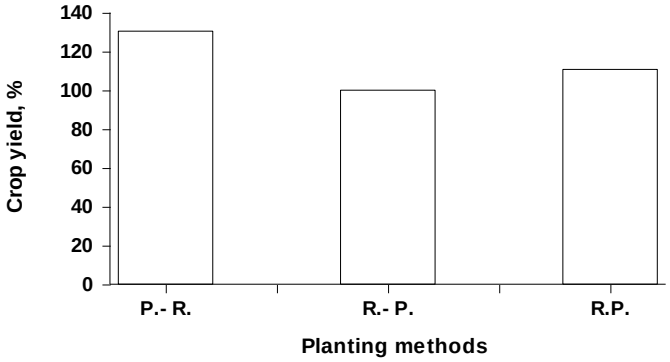

Fig. 6: Effect of planting methods on crop yield.

CONCLUSION

The experimental results of this work emphasized that the planting method (P.- R.) “seed planting on flat surface and construct the rows during cultivating” is the most suitable planting method of maize for the following reasons:

1-It obtained a best uniformity of plant latitudinal and longitudinal distribution.

2- It obtained the highest plants intensity/fed. And also crop yield.

3-It obtained the highest seed germination and shortest time to become complete the seedling emergence.

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تأثير نظم زراعة الذرة على انتظامية النباتات وإنتاجية المحصول.

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نظرًا للأهمية الاقتصادية التي يحتلها محصول الذرة على المستوى العالمي بصفة عامة والمستوى المحلي بصفة خاصة، فقد ازداد الاهتمام بهذا المحصول والعمل على زيادة إنتاجيته. وتعتبر عملية الزراعة من أهم العمليات التي لها تأثير كبير على إنتاجية هذا المحصول. لذا أجريت هذه الدراسة بغرض التوصل إلى أنسب نظام لميكنة زراعة محصول الذرة. أستخدم في هذه الدراسة آلة زراعة في جور (Flexi planter – John deare 71) مكونة من ٤ وحدات، تم ضبط الآلة بحيث تكون المسافة بين الجور ٢٠سم ، وبين الوحدات ٧٥سم، عدد البذور في الجوره ما بين ١-٢ بذرة وعمق الزراعة ٣سم.

تم اتباع ثلاثة نظم للزراعة هي:

(1) الزراعة على أرض مستوية، ثم إقامة الخطوط بعد الإنبات أثناء العزقة الأولى (.P.- R).
(2) إقامة الخطوط أولاً، ثم الزراعة على الخطوط (.R.- P).
(3) الزراعة وإقامة الخطوط في عملية واحدة (.R.P).

أجريت هذه الدراسة في تربة طينية بمزرعة خاصة بقرية كفر الثعبانية – مركز سمنود. قسمت أرض التجربة ومسحتها فدان واحد (١٤٠×٣٠م) إلى ثلاثة أقسام بأبعاد(١٤٠×١٠م) تبعًا لنظم الزراعة. وقد تم التوصل لعدة نتائج يمكن تلخيصها كما يلي:

- حققت معاملة (.R -P) أعلى انتظامية لتوزيع النباتات في الخط، حيث كان معامل K = ٠,٩٧٥ بالمقارنة بالمعاملتين الأخرتين (.P -R) ، (.R.P) والذي كان معامل K لكل منهما = ١,٢٦ ، ١,١٧ على التوالي. كما حققت معاملة (.R -P) أعلى كثافة للنباتات حول المحور الطولي للخط بمسافة ١سم من الجانبين مقداره ٨٤%، في حين كانت كثافة النباتات على نفس البعد للمعاملتين (.P -R) ، (.R.P) هما ٧٤ ، ٨٠%.
- حققت معاملة (.R -P) أكثر عدد من الجور المنزرعة ٨٣,٤% من عدد الجور المتوقعة نظريًا، في حين كان عدد الجور المنزرعة للمعاملتين (.P -R) ، (.R.P) هما ٧٤,٤ ، ٧٨,٩% فقط. كما حققت المعاملة (.P -R) زيادة في عدد النباتات عن المعاملتين (.P -R) ، (.R.P) مقدارهما ٣٠ ، ١٧%.
- حققت معاملة (.R -P) أعلى نسبة ظهور نباتات بعد ثمانية أيام من الزراعة والري ٢٥%، حيث اكتمل الإنبات وظهور للبادرات بعد ١٣يوم. بينما حققت المعاملتين (.P -R) ، (.R.P) حوالي ١٠%، اكتمل الإنبات وظهور للبادرات بعد ١٤يوم للمعاملة (.R.P) وبعد ١٥ يوم للمعاملة (.P -R).
- حققت معاملة (.R -P) أعلى إنتاجية للمحصول بالمقارنة للمعاملتين (.P -R) ، (.R.P) ، حيث بلغت الزيادة في إنتاجية المحصول للمعاملة (.R -P) بمقدار ٣٠,٤% ، ١٩,٧% بالمقارنة للمعاملتين (.P -R) ، (.R.P)على التوالي.

بناءًا على النتائج السابقة يمكن اعتبار طريقة الزراعة على أرض مستوية، ثم إقامة الخطوط بعد الإنبات أثناء العزقة الأولى (.R -P) من أنسب الطرق الميكانيكية لزراعة محصول الذرة تحت الظروف المصرية في منطقة الدلتا.