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# Response of Two Yellow Maize Hybrids (*Zea mays* L.) to Partial Replacement of Recommended Nitrogen Fertilizer by Organic and Biofertilizers Under Wadi El-Rayyan, El-Fayoum Governorate, Egypt, Conditions.

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**ABSTRACT**

Two field experiments were carried out at private farm in Wadi El-Rayyan, El-Fayoum Governorate, Egypt, in the two summer seasons of 2013 and 2014 to study response of the two yellow maize hybrids (*Zea mays* L.) i.e. T.W. 360 and S.C. Egasid-219 to partial replacement of recommended nitrogen fertilizer and organic, as well as, biofertilizers. The main results could be summarized as follows:S.C. Egasid-219 hybrids significantly outweighed T.W. 360 in growth attributes at 80 and 100 days after sowing, as well as, yield and its components at harvest date.With respect of partial replacement of recommended nitrogen fertilizer by organic and biofertilizers, results show clearly that application with 100% of recommended nitrogen dose (i.e. 120kg N/fed.) yielded the highest significant value from plant height, total plant dry weight, at 80 and 100 days age; followed by 60 kg N/fed. + 10 ton organic matter/fed. + Azoto + Pseudo, (60 kg N/fed. + 10 ton organic matter/fed.) + Pseudomonas; (60 kg N/fed. + 5 ton organic matter/fed.) + Azoto + Pseudo, (60 kg N/fed.+ 10 ton organic matter/fed.) + Azotobacter; (60 kg N/fed. + 5 ton organic matter/fed.) + Pseudo., and (60 kg N/fed. + 5 ton organic matter/fed.) + Azotobacter in the end of this descending order, respectively. Regarding LA, LAI and LAR, results indicated that the differences between the two treatments 120 kg N/fed. and (60 kg N/fed. + 10 ton organic matter/fed.) + Azoto + Pseudo,werenot significant and recorded the highest significant values from these three growth attributes compared with other five treatments under study, i.e. (60 kg N/fed. + 5 ton organic matter/fed.) + Azotobacter; (60 kg N/fed. + 5 ton organic matter/fed.) + Pseudomonas; (60 kg N/fed. +5 ton organic matter/fed.) + Azoto + Pseudo ; (60 kg N/fed. + 10 ton organic matter/ fed.) + Azotobacter, as well as, (60 kg N/fed. + 10 ton organic matter/fed.) + Pseudomonas, respectively. Moreover, soil application with 100% of recommended nitrogen rate (i.e. 120 kg N/fed.) gave the greatest significant values from ear length, ear diameter, number of rows/ear, grain index and carbohydrate % per dry grains at harvest date, meanwhile, treatment with (60 kg N + 10 ton organic matter/fed.) + Azoto + Pseudo produced the tallest maize plant, grain yield/plant and/or fed., biological yield, harvest index and protein % per dry grains at harvest date, compared with other six treatments under this study. It is worthy that, the effect of 120 kg N/fed. and (60 kg N + 10 ton organic matter/fed.) + Azoto + Pseudo.on straw yield/plant and/or per fed. are equaled and gave the same values, and gave the highest values from these two components compared with other five treatments under study.With respect of the interaction between the two yellow maize hybrids T.W. 360 and S.C. Egasid-29 and fertilizer treatments, data reported indicated that the most favorable treatments for growth character was Egasid-219 + 120 kg N/fed. On the other hand, treatment S.C. Egasid-219 + 120 kgN/fed. gave the highest value from ear length, ear diameter, number of rows/ear, grain index, straw yield/plant, biological yield/plant, and carbohydrate % per grains at harvest date, meanwhile, treatments S.C. Egasid-219 + (60 kg N/fed. + 10 tonorganic matter/fed.) + Azoto. + Pseudo.

**Keywords:** maize, nitrogen, biofertilizer, Egypt.

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## INTRODUCTION

Corn (*Zea mays* L.) is one of the most important cereal crops and consumed all over the world the world; because of its high diversity in form, quality and growth habit in a wide part of regions prone to agriculture of world is planted and utilized. Corn dye to high yield of dry substances and grain, diverse nutritional value to supply carbohydrate, crude protein and edible oil and also high efficiency of water application in agricultural economy in different nations is particular important (Charabeh *et al*, 2015). Furthermore, nitrogen is considered one of the major nutrients of growth for plant. This nutrient is a basis of formation of protein and nucleic acid and supply of its required amount is very necessary for plant. Nitrogen is applied as chemical fertilizer and its supply by this way is one of causes of water cycle pollution in nature, as well as, environmental pollution, also, production of them is very expensive. Thus, the partial replacement of recommended nitrogen fertilizer by organic manures and bio-fertilizers is frequently recommended firstly for improve biological, physical and chemical properties of soil and secondly to get clean agricultural products free of undesirable high doses of heavy metals and other environmental pollutants. Generally, our present scientific work was applied to study response of two yellow maize hybrids to partial replacement of recommended nitrogen fertilizer by organic and biofertilizers under Wadi El-Rayyan Region, El-Fayoum Governorate, Egypt; conditions.

## MATERIALS AND METHODS

At private farm in Wadi El-Rayyan Region, El-Fayoum Governorate, two field experiments were carried out; during the two successive summer seasons 2013 and 2014. At depth of 30cm, soil samples was taken for mechanical and chemical analysis according to the methods described by Chapman and Pratt (1978). Some physical and chemical characters of soil in the site of the experiment (30cm depth) were as follows : sand 54.25%, silt 20%, clay 25.75%, pH 8.02, organic matter 0.54%, $CaCO_3$ 2.09%, E.C. 2.9 mmhos/cm$^2$, soluble N 74.0 ppm. Split plot design with three replications was used, where the two yellow maize hybrids. T.W. 360 and S.C. Egasid-219 were added in the main plots, meanwhile seven combinations of fertilizer treatments were allocated randomly in the sub-plots as follows:

1- 100% of recommended nitrogen fertilizer rate (i.e. 120 kg N/fed.).
2- 50% of the recommended nitrogen fertilizer rate (60 kg N/fed.) + 5 ton/fed. chicken manure + Azotobacter.
3- 50% of the recommended nitrogen fertilizer rate (60 kg N/fed.) + 5 ton/fed. chicken manure + Pseudomonas;.
4- 50% of the recommended nitrogen fertilizer rate (60 kg N/fed.) + 5 ton/fed. chicken manure + Azoto. + Pseudo.
5- 50% of the recommended nitrogen fertilizer rate (60 kg N/fed.) + 10 ton/fed. chicken manure + Azotobacter.
6- 50% of the recommended nitrogen fertilizer rate (60 kg N/fed.) + 10 ton/fed. chicken manure + Pseudomonas;.
7- 50% of the recommended nitrogen fertilizer rate (60 kg N/fed.) + 10 ton/fed. chicken manure + Azoto. + Pseudo.

The size of each plot was 7 ridges, 5 meter long and 60cm apart, planting was done atthe 15$^{th}$May in the two seasons in hills spaced 25cm apart, two kernels per hill was added. Organic farmyard manure as chicken manure and 150 kg/fed. as calcium super phosphate (15.5% $P_2O_5$ and 50 kg/fed. as potassium sulphate (48% $K_2O$) were added before sowing. Kernels were coated with bio-fertilizer, just before sowing date using Arabic gum as an adhesive agent and were drilled two kernels per hill. Plants were thinning to one plant per hill was done at 20 days after planting.120 kg N/fed.was applied as urea (46%) in two equal doses on 21 and 35 days after sowing; as the standard inorganic N fertilizer (control treatment). Standard cultural practices of growing corn followed by the farmer of this district were adapted. For growth measurements; samples of five guarded plants were taken at random at 80 and 100 days after sowing where the following growth characters were recorded: plant height and total plant dry weight "gm". Furthermore, leaf area "dm$^2$/plant" were calculated according to Bremner and Taha (1966); whereas, from leaf area index (LAI) according to Watson (1952), meanwhile, leaf area ratio (LAR) cm$^2$/mg were measured according to Robison and Massengale(1967). Ten guarded plants were taken at random from the middle two ridges of each plot where yield attributes, i.e. plant height "cm", ear length "cm", ear diameter"cm", number of rows/ear, grain index (100 grains/gm), as well as, grain and straw yield "g/plant", whereas, kernels, straw and biological yield "ton/fed." were determined from the whole area of experimental unit and then converted to yield per feddan. Harvest index was calculated as Abdel-Gawad *et al* (1987). Protein and carbohydrate percentages per dry kernels were determined of infratec 1241 Grain Analyzer, meanwhile, all data were subjected to statistical analysis according to procedure outlined by Snedecor and Cochran (19**89)**, whereas, treatment means were compared to L.S.D test.

## RESULTS AND DISCUSSION

### Cultivar differences

### Growth parameters:

Table (1) observed that the two maize hybrids T.W. 360 and S.C. Egasid 219 significantly differences in growth parameters i.e. plant height, total plant dry weight, leaf area/ plant, leaf area index and leaf area ratio at 80 and 100 days after sowing. Furthermore, plant height, total plant dry weight, leaf area/ plant, LAI and LAR tended to increase with advance of plant age from 80 to 100 days after sowing. In addition, S.C. Egasid-219cultivar have the highest significant growth characters values compared with T.W. 360 and these phenomena were true during the different stages of growth. It is worthy that the differences between the two maize cultivars under this study, i.e. T.W. 360 and S.C. Egasid-219 in the present investigation may be due to the hybrid differences in partitioning coefficient of potosynthates that reported by Ahmed and Shalaby (2015), and Ahmed *et al* (2015), in addition to the genotypes differences in mineral element concentration Abo El-Seoud and Wafaa (2010). Generally, the hybrid differences between T.W. 360 and S.C. Egasid-219 in growth attributes that found in this study are in harmony with previous results reported by Kleinhenz (2003), Ahmed and Mekki (2005), Abo Shetaia *et al* (2005), El-Koomy *et al* (2005), Ahmed *et al* (2011), Saleh *et al* (2011), Ahmed and El-Housini (2012), Ahmed *et al* (2015) and Ahmed and Shalaby (2015).

**Table (1): Effect of cultivars and nitrogen fertilizer, organic and biofertilizer on growth characters of yellow maize hybrids plant at 80 and 100 days after sowing.(Average of 2013 and 2014 seasons).**

| Characters / Treatments | Plant height(cm) | | Total dry weight/plant (g) | | LA $(dm)^2$ | | LAI | | LAR | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 80 | 100 | 80 | 100 | 80 | 100 | 80 | 100 | 80 | 100 |
| **Cultivars** | | | | | | | | | | |
| T.W. 360 | 240.62 | 248.05 | 269.64 | 283.67 | 37.40 | 46.62 | 1.87 | 2.33 | 13.90 | 16.46 |
| S.C. Egasid-219 | 244.94 | 254.84 | 275.88 | 288.03 | 39.97 | 49.68 | 2.00 | 2.48 | 14.48 | 17.24 |
| L.S.D at 5% | 2.22 | 1.20 | 1.46 | 0.71 | 0.60 | 1.29 | 0.03 | 0.06 | 0.38 | 0.36 |
| **Nitrogen fertilizer + Organic and biofertilizer** | | | | | | | | | | |
| 120 kg N/fed. | 251.85 | 262.27 | 281.43 | 291.84 | 41.66 | 51.61 | 2.09 | 2.58 | 14.96 | 17.68 |
| 60kg N +5 ton Organic/fed+ Azoto | 230.35 | 242.00 | 261.44 | 279.41 | 34.41 | 43.76 | 1.72 | 2.20 | 13.16 | 15.66 |
| 60kg N +5 ton Organic/fed+Pseudo | 236.38 | 245.47 | 266.69 | 284.51 | 36.80 | 45.67 | 1.84 | 2.28 | 13.80 | 16.05 |
| 60kgN+5tonOrganic/fed+Azoto+Pseudo | 243.74 | 252.33 | 274.37 | 287.78 | 39.77 | 48.50 | 1.99 | 2.43 | 14.49 | 16.85 |
| 60kg N +10 ton Organic/fed + Azoto | 241.26 | 248.38 | 270.14 | 282.56 | 37.15 | 47.00 | 1.86 | 2.35 | 13.75 | 16.63 |
| 60kg N +10 ton Organic/fed+ Pseudo | 245.89 | 252.44 | 275.26 | 284.85 | 39.50 | 49.00 | 1.98 | 2.45 | 14.35 | 17.31 |
| 60kgN+10tonOrganic/fed+Azoto+Pseudo | 249.98 | 257.20 | 279.98 | 290.00 | 41.50 | 51.50 | 2.08 | 2.58 | 14.82 | 17.76 |
| L.S.D. at 5% | 1.26 | 1.05 | 1.65 | 1.16 | 0.59 | 0.59 | 0.03 | 0.03 | 0.34 | 0.27 |

### Yield and its components

Table (3) show significant differences between the two yellow maize hybrids T.W. 360 and S.C. Egasid-219 in plant height, ear length, ear diameter, number of rows/ear, grain index, grain and straw yields/plant, grain, straw and biological yields/feddan, harvest index, as well as, protein and carbohydrates percentages per dry grains, where, Egasid-219 hybrid significantly exceeded T.W. 360 yellow maize hybrid in all yield ant its components under this study. Again, the significant differences in yield and its attributes under this study may be due to the genetic structure differences between cultivars, and the significant differences in growth parameters (Table 1) and also to the hybrid differences in photosynthates partitioning between the plant organs (Ahmed and Shalaby, 2015 and Ahmed *et al,* 2015), and to the high differences between hybrids in mineral elements concentrations (Abo El-seoud and Wafaa, 2010). In addition, amore vigorous system reducing potentials were characterized for the high yielding hybrid and this high yielding hybrid has a higher photosynthetic electron transport chain potential which is genetically character more than lower yielding hybrid (Ahmed and Shalaby, 2015 and Ahmed *et al,* 2015). Moreover, the highest values of the photosynthetic plant canopy, i.e. LA, LAI and LAR (Table 1) may be due the superiority of S.C.Egasid-219 cultivar than T.W. 360 hybrid, where, the change in LAI caused a variation in $CO_2$ uptake and the variation in grain yield from anthesis onwards were correlated with LAI and uptakes.

The hybrid differences in yield and its attributes are in full agreement with previous results obtained by Kleinhenz (2003), Ahmed and Mekki (2005), Abo Shetaia *et al* (2005), El-Koomy *et al* (2005), Ahmed *et al* (2011), Saleh *et al* (2011), Ahmed and El-Housini (2012), Ahmed *et al* (2015) and Ahmed and Shalaby (2015).

**Effect of organic and bio-fertilizers**

**Growth characters**

Results illustrated in Table (1) observed that the response of corn plants to nitrogen as mineral fertilizer, organic fertilizer as chicken manure, as well as, biofertilizer (i.e. Azotobacter,Pseudomonas;Azoto.+Pseudo.) for growth parameters was significant, where, plant height, total plant dry weight, leaf area/ plant, leaf area index (LAI), and leaf area ratio (LAR) were significantly affected at 80 and 100 days from planting. Furthermore, soil application with 120 kg N/feddan in a form of mineral fertilizer significantly outweighed the other six fertilizer treatments under our study, i.e. 60 kg N/fed. (i.e. 50% of recommended N fertilizer) + 5 ton chicken manure/fed. + Azotobacter; 60 kg N/fed. + 5 ton chicken manure/fed.+Pseudomonas, 60 kg N/fed. + 5 ton chicken manure/fed. + Azoto + Pseudo.,also, 60 kg N/fed. + 10 ton chicken manure/fed. + Azotobacter; 60 kg N/fed. + 10 ton chicken manure/fed.+ Pseudomonas, as well as, 60 kg N/fed. + 10 ton chicken manure/fed. + mixture from Azoto. + Pseudo., respectively. On the other hand, the increment of mineral fertilizer rate with 100% from the recommended nitrogen fertilizer rate (i.e. 120 kg N/fed.) than the treatment with 50% of the recommended mineral nitrogen fertilizer rate (i.e. 60 kg N/fed.) + 10 ton/fed.chicken manure as organic fertilizer and mixture from Azoto. + Pseudo. as bio-fertilizer in leaf area/ plant and LAI values at 80 and 100 days after sowing failed to reach the significant level at 5%. Onthe contrary 50% of the recommended mineral nitrogen rate + 10 ton chicken manure + Azoto. + Pseudo. as a fertilizer treatment gave the greatest significant value from LAR of corn plant compared with other fertilizer treatments except soil application with 100% of recommended nitrogen as mineral fertilizer.

It is worthy that application of 100% of the recommended nitrogen fertilizer as mineral form, produced the greatest mean values from growth parameters of corn plant compared with other six fertilizer treatment under study. It may be due to the fast effect of nitrogen in chemical forms of early stages of vegetative plant growth followed by the promotive effect of organic and bio-fertilizer through flowering and grain filling stage (Ahmed and El-Housini, 2012). It is worthy that our results area in harmony with those obtained by Gomaa *et al* (2011), Zaki *et al* (2012) and Ahmed and El-Housini(2012).Despite the coincident application of organic manure and bio-fertilizers is frequently recommended firstly for improving biological, physical and chemical properties of soil and secondly to get clean agricultural products free of undesirable high doses of heavy metals and other pollutants, the decrement of recommended mineral nitrogen fertilizer rate from 100% to 50%, the adding of organic manure as chicken manure at a rate of 5 and/or 10 ton/fed. and bio-fertilizer with Azotobacter + Pseudomonas, as well as, mixture of Azotobacter + Pseudomonas could not compensate the decrement in mineral nitrogen fertilizer.

**Yield and its components**

Data reported in Table (3); proved clearly that the effect of mineral nitrogen fertilizer, organic manure and bio-fertilizer had a significant effect on plant height, ear length, ear diameter, number of rows/ear, grain index, grain yield/plant, straw yield/plant, grain yield/fed., straw yield/fed., biological yield/fed., harvest index, as well as, protein and carbohydrate percentages per dry kernels. In addition, adding 100% of the recommended nitrogen fertilizer as mineral form scored the greatest mean values from the previous yield components, except, plant height, grain yield/plant and/or fed., biological yield/fed. and harvest index that collected by 50% of the recommended nitrogen fertilizer/ fed. + 10 ton/fed. chicken manure + Azoto. + Pseudo. It is worthy that differences between 100% of recommended dose from mineral nitrogen fertilizer treatment and 50% of the recommended nitrogen fertilizer/ fed. + 10 ton/fed. chicken manure + Azoto. + Pseudo. in plant height, grain yield/plant and/or fed., biological yield/fed. and harvest index failed to reach the significant level at 5% level.

Generally, despite of the coincident application of chicken manure and Azotobacter, Pseudomonas and mixture from Azotobacter + Pseudomonas is frequently recommended firstly for improving biological, physical and chemical properties of soil and secondly to get clean agricultural products free from undesirable high doses of heavy metals and other pollutants, the great decrease in nitrogen fertilizer from 100% to 50% of the recommended mineral from rate, the application of organic chicken manure at a rate of 5 and/or 10 ton/fed. andbiofertilizers with Azotobacter; Pseudomonas; and also, mixture from Azotobacter + Pseudomonas did not compensate the great decrement in recommended mineral nitrogen fertilizer. It may be due to also to the fast effect of nitrogen in chemical forms, in promoting the vegetative growth and meristemic activity at the early stages of growth than through flowering and grain filling (Ahmed and El-Housini, 2012). Generally, our obtained results of the effect of mineral, organic and biofertilizers in this study are confirmed with those obtained by Hassanein *et al*(1997),Gomaa *et al* (2011), Zaki *et al* (2012) and Ahmed and El-Housini (2012).

**Effect of the interaction**

Table (2) indicate clearly that the effect of the interaction between the two yellow hybrid under study T.W. 360 and S.C. Egasid-219 and the mineral, organic and biofertilization was significant on growth parameters, i.e. plant height, total plant dry weight, leaf area/ plant and leaf area index at 80 and 100 days after sowing date, also, LAR after 100 days from sowing. In addition, S.C. Egasid-219 plants fertilized by 100% of the recommended nitrogen as mineral fertilizer (120 kg N/fed.) was the most favorable treatment to collect the greatest plant height, total plant dry weight, leaf area/ plant and LAI, meanwhile, Egasid-219 + 50% of the recommended nitrogen fertilizer as mineral form + 10 ton/fed, chicken manure (organic fertilizer) + Azotobacter + Pseudomonas had the greatest values from LAI at 80 and 100 days age, compared with other treatments under study.

**Table (2): Effect of interaction between cultivars and nitrogen fertilizer, organic and biofertilizer on growth characters of yellow maize hybrids plant at 80 and 100 days after sowing.(Average of 2013 and 2014 seasons).**

| Characters / Treatments | | Plant height(cm) | | Total dry weight/plant (g) | | LA $(dm)^2$ | | LAI | | LAR | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 80 | 100 | 80 | 100 | 80 | 100 | 80 | 100 | 80 | 100 |
| Cultivars x Nitrogen fertilizer + Organic and biofertilizer | | | | | | | | | | | |
| T.W. 360 | 120 kg N/fed. | 248.48 | 256.38 | 278.07 | 289.53 | 40.10 | 50.00 | 2.01 | 2.50 | 14.72 | 17.27 |
| | 60kg N +5 ton Organic/fed+ Azoto | 228.87 | 238.85 | 258.68 | 279.37 | 33.33 | 42.00 | 1.67 | 2.12 | 12.89 | 15.03 |
| | 60kg N +5 ton Organic/fed+Pseudo | 234.59 | 241.95 | 264.38 | 282.04 | 35.33 | 44.00 | 1.77 | 2.20 | 13.37 | 15.61 |
| | 60kgN+5tonOrganic/fed+Azoto+Pseudo | 240.81 | 248.09 | 270.24 | 285.00 | 38.67 | 46.33 | 1.93 | 2.32 | 14.31 | 16.26 |
| | 60kg N +10 ton Organic/fed + Azoto | 239.49 | 246.49 | 266.90 | 281.09 | 35.33 | 46.00 | 1.77 | 2.30 | 13.24 | 16.37 |
| | 60kg N +10 ton Organic/fed+ Pseudo | 244.38 | 250.31 | 271.52 | 280.66 | 39.00 | 48.00 | 1.95 | 2.40 | 14.36 | 17.31 |
| | 60kgN+10tonOrganic/fed+Azoto+Pseudo | 247.72 | 254.24 | 277.67 | 288.00 | 40.00 | 50.00 | 2.00 | 2.50 | 14.41 | 17.36 |
| S.C. Egasid-219 | 120 kg N/fed. | 255.22 | 268.16 | 284.80 | 294.14 | 43.21 | 53.22 | 2.16 | 2.67 | 15.19 | 18.09 |
| | 60kg N +5 ton Organic/fed+ Azoto | 231.82 | 245.14 | 264.19 | 279.44 | 35.49 | 45.52 | 1.78 | 2.28 | 13.44 | 16.29 |
| | 60kg N +5 ton Organic/fed+Pseudo | 238.18 | 248.99 | 269.01 | 286.98 | 38.26 | 47.33 | 1.91 | 2.37 | 14.22 | 16.50 |
| | 60kgN+5tonOrganic/fed+Azoto+Pseudo | 246.67 | 256.56 | 278.50 | 290.57 | 40.87 | 50.67 | 2.04 | 2.53 | 14.68 | 17.44 |
| | 60kg N +10 ton Organic/fed + Azoto | 243.03 | 250.27 | 273.37 | 284.04 | 38.96 | 48.00 | 1.95 | 2.40 | 14.25 | 16.90 |
| | 60kg N +10 ton Organic/fed+ Pseudo | 247.39 | 254.57 | 278.99 | 289.05 | 40.00 | 50.00 | 2.00 | 2.50 | 14.34 | 17.30 |
| | 60kgN+10tonOrganic/fed+Azoto+Pseudo | 252.24 | 260.16 | 282.29 | 292.00 | 43.00 | 53.00 | 2.15 | 2.65 | 15.23 | 18.15 |
| L.S.D. at 5% | | 1.79 | 1.49 | n.s | 1.63 | 0.84 | 0.83 | 0.04 | 0.04 | n.s | 0.38 |

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**Table (3): Effect of cultivars and nitrogen fertilizer ,organic and biofertilizer on yield, its components and chemical constituent of yellow maize hybrids. (Average of 2013 and 2014 seasons)**

| Characters / Treatments | Plant height (cm) | Ear length (cm) | Ear diameter (cm) | No. of rows /ear | Grain index (g) | Grain yield (g)/plant | Straw yield (g)/plant | Grain yield (ton/fed) | Straw yield (ton/fed) | Biological yield (ton/fed) | Harvest index % | Protein % | Carbohydrae % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cultivars** | | | | | | | | | | | | | |
| T.W. 360 | 260.40 | 18.462 | 4.444 | 19.47 | 25.26 | 126.00 | 234.00 | 2.773 | 5.149 | 7.922 | 34.97 | 10.32 | 80.146 |
| S.C. Egasid-219 | 271.32 | 19.338 | 5.413 | 20.13 | 26.17 | 131.33 | 235.22 | 2.890 | 5.181 | 8.071 | 35.80 | 10.47 | 80.286 |
| L.S.D at 5% | 5.22 | 0.005 | 0.025 | 0.02 | 0.04 | 1.50 | 0.74 | 0.033 | 0.016 | 0.024 | 0.33 | 0.01 | 0.002 |
| **Nitrogen fertilizer + Organic and biofertilizer** | | | | | | | | | | | | | |
| 120 kg N/fed. | 268.03 | 19.043 | 5.067 | 19.95 | 25.82 | 130.95 | 238.17 | 2.883 | 5.238 | 8.121 | 35.50 | 10.28 | 80.287 |
| 60 kg N +5 ton Organic/fed+ Azoto | 258.81 | 18.775 | 4.817 | 19.68 | 25.95 | 125.22 | 230.33 | 2.757 | 5.067 | 7.824 | 35.24 | 10.33 | 80.125 |
| 60 kg N +5 tonOrganic/fed+Pseudo | 263.41 | 18.832 | 4.872 | 19.76 | 25.67 | 127.83 | 233.67 | 2.812 | 5.143 | 7.955 | 35.20 | 10.37 | 80.190 |
| 60kg N+5tonOrganic/fed+Azoto+Pseudo | 265.98 | 18.893 | 4.907 | 19.81 | 25.73 | 130.17 | 235.17 | 2.865 | 5.173 | 8.038 | 35.64 | 10.42 | 80.230 |
| 60kg N +10 ton Organic/fed + Azoto | 262.69 | 18.852 | 4.878 | 19.75 | 25.68 | 126.50 | 232.83 | 2.785 | 5.125 | 7.910 | 35.20 | 10.42 | 80.178 |
| 60kg N +10 ton Organic/fed+ Pseudo | 267.69 | 18.915 | 4.938 | 19.80 | 25.73 | 128.67 | 235.00 | 2.828 | 5.170 | 7.998 | 35.36 | 10.47 | 80.237 |
| 60kgN+10tonOrganic/fed+Azoto+Pseudo | 274.94 | 18.990 | 5.023 | 19.88 | 25.80 | 131.33 | 238.17 | 2.892 | 5.238 | 8.130 | 35.56 | 10.50 | 80.257 |
| L.S.D. at 5% | 2.31 | 0.010 | 0.020 | 0.02 | 0.01 | 0.92 | 0.73 | 0.020 | 0.015 | 0.028 | 0.20 | 0.01 | 0.020 |

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**Table (4): Effect of interaction between cultivars and nitrogen fertilizer ,organic and biofertilizer on yield, its components and chemical constituent of yellow maize hybrids. (Average of 2013 and 2014 seasons)**

| Cultivar | Characters / Treatments | Plant height (cm) | Ear length (cm) | Ear diameter (cm) | No. of rows/ear | Grain index (g) | Grain yield (g)/plant | Straw yield (g)/plant | Grain yield (ton/fed.) | Straw yield (ton/fed.) | Biological yield (ton/fed.) | Harvest index % | Protein % | Carbohydrate % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cultivars x Nitrogen fertilizer + Organic and biofertilizer | | | | | | | | | | | | | | |
| T.W. 360 | 120 kg N/fed. | 265.51 | 18.640 | 4.620 | 19.63 | 25.35 | 128.33 | 236.00 | 2.827 | 5.190 | 8.017 | 35.26 | 10.21 | 80.213 |
| | 60kg N +5 ton Organic/fed+ Azoto | 253.38 | 18.337 | 4.327 | 19.32 | 25.12 | 123.33 | 230.00 | 2.717 | 5.060 | 7.777 | 34.93 | 10.26 | 80.027 |
| | 60kg N +5tonOrganic/fed+Pseudo | 257.76 | 18.339 | 4.373 | 19.44 | 25.22 | 125.33 | 233.33 | 2.757 | 5.137 | 7.894 | 34.63 | 10.31 | 80.120 |
| | 60kg N+5tonOrganic/fed+Azoto+Pseudo | 260.33 | 18.440 | 4.407 | 19.50 | 25.27 | 126.33 | 235.00 | 2.780 | 5.170 | 7.590 | 34.98 | 10.36 | 80.170 |
| | 60kg N +10 ton Organic/fed + Azoto | 256.92 | 18.400 | 4.386 | 19.41 | 25.21 | 124.00 | 232.67 | 2.730 | 5.123 | 7.853 | 34.76 | 10.34 | 80.120 |
| | 60kg N +10 ton Organic/fed+ Pseudo | 260.92 | 18.460 | 4.437 | 19.46 | 25.28 | 126.67 | 234.33 | 2.783 | 5.157 | 7.940 | 35.06 | 10.39 | 80.173 |
| | 60kgN+10tonOrganic/fed+Azoto+Pseudo | 267.97 | 18.563 | 4.560 | 19.56 | 25.34 | 128.00 | 236.67 | 2.820 | 5.203 | 8.023 | 35.15 | 10.41 | 80.200 |
| S.C. Egasid-219 | 120 kg N/fed. | 270.54 | 19.447 | 5.513 | 20.27 | 26.28 | 133.57 | 240.33 | 2.940 | 5.297 | 8.237 | 35.74 | 10.35 | 80.36 |
| | 60 kg N +5 ton Organic/fed+ Azoto | 264.24 | 19.213 | 5.307 | 20.04 | 26.06 | 127.10 | 230.67 | 2.797 | 5.073 | 7.870 | 35.54 | 10.40 | 80.223 |
| | 60 kg N +5tonOrganic/fed+Pseudo | 269.06 | 19.270 | 5.370 | 20.08 | 26.11 | 130.33 | 234.00 | 2.867 | 5.150 | 8.017 | 35.76 | 10.44 | 80.260 |
| | 60kg N+5tonOrganic/fed+Azoto+Pseudo | 271.62 | 19.347 | 5.407 | 20.13 | 26.18 | 134.00 | 235.33 | 2.950 | 5.177 | 8.127 | 36.60 | 10.47 | 80.290 |
| | 60kg N +10 ton Organic/fed + Azoto | 267.45 | 19.303 | 5.370 | 20.09 | 26.14 | 129.00 | 233.00 | 2.840 | 5.127 | 7.967 | 35.65 | 10.50 | 80.253 |
| | 60kg N +10 ton Organic/fed+ Pseudo | 274.45 | 19.370 | 5.440 | 20.13 | 26.19 | 130.67 | 235.67 | 2.873 | 5.183 | 8.056 | 35.67 | 10.55 | 80.300 |
| | 60kgN+10tonOrganic/fed+Azoto+Pseudo | 281.91 | 19.417 | 5.487 | 20.20 | 26.26 | 134.67 | 239.67 | 2.963 | 5.273 | 8.236 | 35.98 | 10.59 | 80.313 |
| L.S.D. at 5% | | 3.26 | 0.014 | 0.029 | 0.03 | n.s | 1.30 | 1.03 | 0.029 | 0.022 | 0.039 | 0.28 | 0.01 | n.s |

With respect of the response of yield and its components and chemical constituents of kernels yield to the interaction between hybrids x mineral fertilizer x bio fertilization, data illustrated in Table (4) show clearly the response was significant except on grain index, and carbohydrate% per dry kernels that failed to reach the significant level at 5%. Generally, the yellow corn hybrid S.C. Egasid-219 plants fertilized with 100% of the recommended nitrogen fertilizer as mineral form gave the greatest values from ear length, ear diameter, number of rows/ear, grain index, straw yield/plant and/or fed., biological yield/fed., and carbohydrate% per dry kernels, whereas, the most favorable treatment for harvesting the highest values from plant height, grain yield per plant and/or fed., harvest index and protein percentage per dry grains were S.C. Egasid-219 + 50% of the recommended nitrogen fertilizer rate as mineral form + 10 ton/fed. chicken manure + Azotobacter + Pseudomonas, compared with other treatments under study.

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