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# EL EFECTO DE LA MEZCLA DE FERTILIZANTES MINERALES COMPUESTOS CON FERTILIZANTES ORGÁNICOS SOBRE EL CRECIMIENTO Y RENDIMIENTO DEL MAÍZ

*The Effect Of Mixing Compound Mineral Fertilizers With Organic Fertilizers On The Growth And Yield Of Maize.*

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## RESUMEN

El objetivo de este estudio fue evaluar el efecto de reemplazar una parte de fertilizantes minerales con fertilizantes orgánicos, mezclándolos en proporciones, sobre el crecimiento del maíz y algunas propiedades del suelo. Los fertilizantes químicos tienen efectos nocivos para el medio ambiente y los organismos vivos, y el fertilizante orgánico por sí solo se descompone lentamente y contiene pocos nutrientes.

Por lo tanto, se ha optado por mezclar fertilizante orgánico con fertilizante mineral para aumentar la fertilidad del suelo. El experimento se llevó a cabo en los campos del Departamento de Investigación Agrícola Iraquí, Estación Dabouni, en 2022, con los siguientes grupos de tratamiento:

1. Control, sin estiércol, sin fertilizantes… (T1)
2. Fertilizante orgánico (oveja) (SF) 20 ton | ha… (T2)
3. Fertilizante mineral (MF) 320 kg N, 100 kg $P_2O_3$, 120 kg $K_2O$ ha…(T3)
4. Estiércol de oveja + 25%, (MF).....(T4)
5. Estiércol de oveja + 50%, (MF) …… ….(T5)
6. Estiércol de oveja + 75%, (MF)…… … (T6)
7. Estiércol de oveja +,100% (MF)…… (T7)

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El experimento se realizó según un diseño de bloques completamente al azar con tres réplicas. Los resultados indicaron que la combinación de fertilizante orgánico y fertilizante mineral en proporciones de 25, 50, 75 y 100% produjo diferencias significativas en el crecimiento del maíz (altura, longitud de la raíz, longitud de la mazorca, área foliar, peso de la semilla de 500 gramos, rendimiento biológico y rendimiento) y algunas propiedades del suelo (MO, pH y CE) en comparación con el fertilizante mineral solo. Por lo tanto, recomendamos a los agricultores que implementen este estudio.

**PALABRAS CLAVE:**
Mineral, Fertilizantes, Orgánico, Mezcla, Maíz, Significativo

**ABSTRACT**

The aim of this study was to evaluate the effect of replacing a portion of mineral fertilizers with organic fertilizers, by mixing them together in proportions, on corn growth and some soil properties. Chemical fertilizers have harmful effects on the environment and living organisms, and organic fertilizer alone is slow to decompose and contains few nutrients.

Therefore, the idea has shifted to mixing organic fertilizer with mineral fertilizer to increase soil fertility. The experiment was conducted in the fields of the Iraqi Agricultural Research Department - Dabouni Station in 2022 with the following treatment groups:

1. Control, no manure, no fertilizer…… (T1)
2. Orgonic fertilizer (sheep) (SF) was 20 ton | ha …. (T2)
3. Mineral fertilizer ( MF) was (320 Kg N , 100 Kg $P_2O_5$ ,120 Kg $k_2o$) | ha…(T3)
4. Sheep manure + 25%, (MF).....(T4)
5. Sheep manure + 50%, (MF) …… ….(T5)
6. Sheep manure + 75%, (MF)…… (T6)
7. Sheep manure +,100% (MF)…… (T7)

The experiment was conducted according to a randomized complete block design with three replicates. The results indicated that the combination of organic fertilizer and mineral fertilizer at ratios of 25, 50, 75, and 100% produced significant differences in maize growth (height, root length, ear length, leaf area, 500-gram seed weight, biological yield, and yield) and some soil properties (O.M., pH, and EC) compared to mineral fertilizer alone.
We therefore recommend that farmers implement this study.

**KEYWORDS:**
Mineral, Fertilizers, Organic, Mixture, Maize, Significan

## INTRODUCTION

Maize occupies the second place in terms of importance after wheat and first in terms of production In Iraq (Altaweel, M . S.& Qusay A. Y.,2020)

It is widely cultivated in Iraq but the rate of corn production is still low, which requires improving productivity by using fertilizers (Saleh M.Ibraheem, 2013)
Increasing maize production is one of the most important goals for the Iraqi agricultural policy to face the human and animal demands , the mixing maize with wheat for bread making has also increased the demand of maize in Iraq(A. M. Abd El-Gawad; A. S. M. Morsy, 2017).

The combined application of organic and inorganic fertilizers can increase the activities of soil organisms and available nutrient content, furthermore, the application of organic manure mixed up with chemical fertilizer can prove to be an excellent procedure in maintaining and improving the soil fertility, and increasing fertilizer use efficiency(Wajid.,et al 2012).

The experimental results confirmed that the combination of organic and inorganic fertilizers could increase plant growth, yield, quality and soil fertility. It also confirmed that composted organic wastes can be used to substitute for around 25% of chemical nitrogen fertilizers(Neni Marlina et al., 2017).

It could be concluded that the integration of organic and inorganic fertilizers was better than using organic or inorganic fertilizer separately .

The Iraqi soil lacks organic matter and the pH in it is high, which reduces the absorption of nutrients, especially phosphorous (Al-Hilfy & Al-Temimi, 2017).

The appropriate application of organic with inorganic fertilizers increases the productivity without negative effect on yield quality and improves soil fertility than the values obtained by organic or inorganic fertilizers separately for this, we will follow methods to maintain soil fertility and increase its content of organic matter without affecting the environment by mixing organic fertilizers ( Sheep waste (low value) with mineral fertilizer, whose cost is high by reducing its percentage in use (Roba , 2018).

The farmer used to use mineral fertilizers to grow corn, and to enrich the soil with mineral nutrients that could be depleted from the soil by intensive uses of lands. To attain the best results of fertilizers use in agriculture, fertilizers should be added into the soil according to known qualitative and quantitative proportions that should fit the needs of growing plants and their growth stages.

The mixing mineral with organic fertilizer to rise soil fertility and productivity without affecting environment.

The objective of the present review is to assess the effect of mixing organic with inorganic fertilizer on soil fertility and productivity.

Use of organic and inorganic fertilizers in proper combination (50:50) received higher yields than the sole application of either of the fertilizer or manure particularly (Wajid N,et al 2012).

The experimental results confirmed that the combination of organic and inorganic fertilizers could increase plant growth, yield, quality and soil fertility. It also confirmed that composted organic wastes can be used to substitute for around 25% of chemical nitrogen fertilizers ( Neni Marlina et al., 2017).

It could be concluded that the integration of organic and inorganic fertilizers was better than using organic or inorganic fertilizer separately(Ab d El-Gawad & Morsy, 2017).

Adding mineral fertilizer at different levels with organic fertilizer has led to a significant increase in plant height (Jibreel Abbas Mohammad Al-Zaidy, 2017).

Experience has shown that the use of 5 ton.ha-1organic fertilizer + 75 % inorganic fertilizer could increase N, P and K nutrients uptake well as good growth and yield (Neni Marlina et al., 2017).

The organic manure (sheep waste) increased the yield of maize by 3663.4 kg per hectare compared to mineral fertilizer which gave 3262.7 kg | ha at the same time, the organic fertilizer increased the potassium in the soil after harvest by 387 mg | kg, while in mineral fertilizer it was 373 mg | kg (Al-Hamdani and Al-Baidi &2010)

## MATERAL AND METHODS

The experiment carried out in 2022 at Al-Dabouni Research Station located in the Al-Aziziya district at longitude: 45o.063 and latitude 32o.9107 It is bordered to the south by Wasit Governorate, 90 km away, to the north by Baghdad Governorate, 120 km away. It is bordered to the east by Diyala Governorate, 30 km away, and to the west, by Babylon Governorate, 90 km away.To assess the soil fertility status, representative soil samples will be taken from the experimental soil sites before sowing in the laboratories of the Agricultural Research Department of the Iraqi Ministry of Agriculture according to following.

**Table 1.**
*Chemical, physical and biological characteristics of the studied soil before planting*

| Adjective | Value |
|---|---|
| Degree of soil reaction pH | 6.5 |
| Ece1:1 quer | … 3.0…… Dsm-1 |
| The dissolved ions | …… Me q \| L |
| Ca++ | 10.0…… |

| | |
|---|---|
| Mg++ | …9.7 ….. |
| Na+ | …5.3…. |
| Cl- | …13.0…… |
| SO4-- | …… 9.6…… |
| HCO3- | ……1,5……. |
| Ready-made elements | g kg-1 |
| N | 78.2 |
| P | 15.3 |
| K | 120.2 |
| Soil separators | % |
| Sand | 11.6 |
| Silt | 47.4 |
| Clay | 41.0 |
| O.M | 1,5 |

**Experimental Design**

Three types of fertilization treatments are taken in addition to the comparison treatment without fertilization (T1)

The first treatment of fertilizer is organic from sheep waste, with a value of 20 tons| ha were added to the soil mixed with the surface layer before planting .

The second treatment of fertilizer is mineral 320 kg N / ha ,100kg P2O5/ha and 120Kg K2O /ha (The fertilizer recommendation of the Iraqi Ministry of Agriculture)

The third treatment blending organic fertilizers with mineral fertilizers spreading it in the soil at rates of 25%, 50%. 75%, 100%

Nitrogen fertilizer will be added in the form of urea 46 % nitrogen in two batches a week after planting and the second after 50 days of germination, while triple superphosphate and potassium sulfate were added before planting and during plowing according to the following percentages above-mentioned.

The treatment was distributed to the experimental units randomly.

The cultivation could on lines of length 5 m lines between one line and another 75 cm and between a hole and another 25 cm. 3 grains of maize placed in each hole and after germination it was removed and only one remained.

The experiment was designed using a completely randomized design with three Replicators.

(T2) ….Orgonic fertilizer (sheep) 20 ton | ha

(T3)….. Mineral fertilizer was (320 Kg N , 100 Kg P2O5 ,120 Kg k2o) ha

Experimental treatments for incorporating organic fertilizers with mineral fertilizers in the following percentages

(T4)….Organic fertilizer + 1|4 (320 Kg N + 100 Kg P2O5 +120 Kg k2o)
(T5)….Organic fertilizer + 1|2 (320 Kg N + 100 Kg P2O5 +120 Kg k2o)
(T6)….Organic fertilizer + 3|4 (320 Kg N + 100 Kg P2O5 +120 Kg k2o)
(T7)….Organic fertilizer + 4|4 (320 Kg N + 100 Kg P2O5 +120 Kg k2o)

**Statistical analysis**

It was used SPSS statistical analysis to find significant differences between the studied transactions.

## RESULTS

We conclude through the study that there are significant differences in the morphological characteristics of maize plants (plant length, root length, ear length, leaf area in the plant, weight of 500 grains, grain yield, biological yield, as well as in the properties of soil EC , PH ,and O.M when using mineral fertilizer or Organic fertilizer compared to the comparison sample without fertilization as a result.

The significant differences started when organic fertilizer was used at rates of 25%, 50%, 75%, 100%, as it increased by increasing the percentage as shown in the following tables, as well as soil properties affected in the same way except for PH, which decreased by increasing the percentage.

**Descriptive**

| | | | | | | 95% Confidence Interval for Mean | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | Mean | Std. Deviation | Std. Error | Lower Bound | Upper Bound | Minimum | Maximum |
| Plant height | Control (T1) | 3 | 64.000 | 1.7321 | 1.0000 | 59.697 | 68.303 | 62.0 | 65.0 |
| | Organic Fertilizer (T2) | 3 | 99.000 | 1.0000 | .5774 | 96.516 | 101.484 | 98.0 | 100.0 |
| | Mineral Fertilizer (T3) | 3 | 109.000 | 1.0000 | .5774 | 106.516 | 111.484 | 108.0 | 110.0 |
| | O + 25 % M (T4) | 3 | 120.000 | .0000 | .0000 | 120.000 | 120.000 | 120.0 | 120.0 |
| | O + 50 % M (T5) | 3 | 133.333 | 1.5275 | .8819 | 129.539 | 137.128 | 132.0 | 135.0 |
| | O + 75 % M (T6) | 3 | 156.000 | 4.3589 | 2.5166 | 145.172 | 166.828 | 151.0 | 159.0 |
| | O + M (T7) | 3 | 161.000 | 1.0000 | .5774 | 158.516 | 163.484 | 160.0 | 162.0 |
| | Total | 21 | 120.333 | 32.1019 | 7.0052 | 105.721 | 134.946 | 62.0 | 162.0 |
| Root height | Control (T1) | 3 | 25.000 | .0000 | .0000 | 25.000 | 25.000 | 25.0 | 25.0 |
| | Organic Fertilizer (T2) | 3 | 32.000 | 1.7321 | 1.0000 | 27.697 | 36.303 | 30.0 | 33.0 |
| | Mineral Fertilizer (T3) | 3 | 36.000 | .0000 | .0000 | 36.000 | 36.000 | 36.0 | 36.0 |
| | O + 25 % M (T4) | 3 | 40.667 | 1.1547 | .6667 | 37.798 | 43.535 | 40.0 | 42.0 |
| | O + 50 % M (T5) | 3 | 42.000 | .0000 | .0000 | 42.000 | 42.000 | 42.0 | 42.0 |
| | O + 75 % M (T6) | 3 | 47.000 | 2.6458 | 1.5275 | 40.428 | 53.572 | 45.0 | 50.0 |
| | O + M (T7) | 3 | 48.000 | 2.0000 | 1.1547 | 43.032 | 52.968 | 46.0 | 50.0 |
| | Control (T1) | 21 | 38.667 | 7.9394 | 1.7325 | 35.053 | 42.281 | 25.0 | 50.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ear length | Control (T1) | 3 | 14.000 | 2.0000 | 1.1547 | 9.032 | 18.968 | 12.0 | 16.0 |
| | Organic Fertilizer (T2) | 3 | 17.333 | 2.0817 | 1.2019 | 12.162 | 22.504 | 15.0 | 19.0 |
| | Mineral Fertilizer (T3) | 3 | 18.000 | .0000 | .0000 | 18.000 | 18.000 | 18.0 | 18.0 |
| | O + 25 % M (T4) | 3 | 21.000 | 1.0000 | .5774 | 18.516 | 23.484 | 20.0 | 22.0 |
| | O + 50 % M (T5) | 3 | 22.000 | 1.0000 | .5774 | 19.516 | 24.484 | 21.0 | 23.0 |
| | O + 75 % M (T6) | 3 | 25.000 | 1.0000 | .5774 | 22.516 | 27.484 | 24.0 | 26.0 |
| | O + M (T7) | 3 | 27.000 | 2.6458 | 1.5275 | 20.428 | 33.572 | 25.0 | 30.0 |
| | Total | 21 | 20.619 | 4.5108 | .9843 | 18.566 | 22.672 | 12.0 | 30.0 |
| Leaf area | Control (T1) | 3 | 4314.000 | 300.4114 | 173.4426 | 3567.737 | 5060.263 | 4001.0 | 4600.0 |
| | Organic Fertilizer (T2) | 3 | 4856.000 | 211.9151 | 122.3492 | 4329.574 | 5382.426 | 4718.0 | 5100.0 |
| | Mineral Fertilizer (T3) | 3 | 5363.000 | 345.9870 | 199.7557 | 4503.521 | 6222.479 | 5000.0 | 5689.0 |
| | O + 25 % M (T4) | 3 | 5910.000 | 10.0000 | 5.7735 | 5885.159 | 5934.841 | 5900.0 | 5920.0 |
| | O + 50 % M (T5) | 3 | 6230.000 | 216.5641 | 125.0333 | 5692.025 | 6767.975 | 6000.0 | 6430.0 |
| | O + 75 % M (T6) | 3 | 6760.000 | 103.9230 | 60.0000 | 6501.841 | 7018.159 | 6700.0 | 6880.0 |
| | O + M (T7) | 3 | 6859.333 | 445.6920 | 257.3204 | 5752.173 | 7966.494 | 6400.0 | 7290.0 |
| | Total | 21 | 5756.048 | 937.4247 | 204.5628 | 5329.337 | 6182.758 | 4001.0 | 7290.0 |
| 500 grain weight | Control | 3 | 101.000 | 2.6458 | 1.5275 | 94.428 | 107.572 | 98.0 | 103.0 |
| | Control (T1) | 3 | 120.000 | 5.0000 | 2.8868 | 107.579 | 132.421 | 115.0 | 125.0 |
| | Organic Fertilizer (T2) | 3 | 130.000 | 5.0000 | 2.8868 | 117.579 | 142.421 | 125.0 | 135.0 |
| | Mineral Fertilizer (T3) | 3 | 142.000 | 5.0000 | 2.8868 | 129.579 | 154.421 | 137.0 | 147.0 |
| | O + 25 % M (T4) | 3 | 148.000 | 5.0000 | 2.8868 | 135.579 | 160.421 | 143.0 | 153.0 |
| | O + 50 % M (T5) | 3 | 160.000 | 1.7321 | 1.0000 | 155.697 | 164.303 | 158.0 | 161.0 |
| | O + 75 % M (T6) | 3 | 163.000 | 5.0000 | 2.8868 | 150.579 | 175.421 | 158.0 | 168.0 |
| | O + M (T7) | 21 | 137.714 | 21.4643 | 4.6839 | 127.944 | 147.485 | 98.0 | 168.0 |
| Grain yield | Control (T1) | 3 | 4.500 | .5000 | .2887 | 3.258 | 5.742 | 4.0 | 5.0 |
| | Organic Fertilizer (T2) | 3 | 6.700 | .8000 | .4619 | 4.713 | 8.687 | 5.9 | 7.5 |
| | Mineral Fertilizer (T3) | 3 | 7.890 | .3951 | .2281 | 6.909 | 8.871 | 7.5 | 8.3 |
| | O + 25 % M (T4) | 3 | 9.023 | .3137 | .1811 | 8.244 | 9.803 | 8.8 | 9.4 |
| | O + 50 % M (T5) | 3 | 9.030 | .7554 | .4362 | 7.153 | 10.907 | 8.3 | 9.8 |
| | O + 75 % M (T6) | 3 | 10.467 | .5132 | .2963 | 9.192 | 11.741 | 9.9 | 10.9 |
| | O + M (T7) | 3 | 11.133 | .7095 | .4096 | 9.371 | 12.896 | 10.5 | 11.9 |
| | Total | 21 | 8.392 | 2.2094 | .4821 | 7.386 | 9.398 | 4.0 | 11.9 |
| Biological yield | Control (T1) | 3 | 15.000 | 2.0000 | 1.1547 | 10.032 | 19.968 | 13.0 | 17.0 |
| | Organic Fertilizer (T2) | 3 | 20.000 | 1.0000 | .5774 | 17.516 | 22.484 | 19.0 | 21.0 |
| | Mineral Fertilizer (T3) | 3 | 23.667 | 3.0551 | 1.7638 | 16.078 | 31.256 | 21.0 | 27.0 |
| | O + 25 % M (T4) | 3 | 27.000 | 2.0000 | 1.1547 | 22.032 | 31.968 | 25.0 | 29.0 |
| | O + 50 % M (T5) | 3 | 28.000 | .0000 | .0000 | 28.000 | 28.000 | 28.0 | 28.0 |
| | O + 75 % M (T6) | 3 | 32.667 | 1.1547 | .6667 | 29.798 | 35.535 | 32.0 | 34.0 |
| | O + M (T7) | 3 | 35.667 | 1.5275 | .8819 | 31.872 | 39.461 | 34.0 | 37.0 |
| | Total | 21 | 26.000 | 6.9282 | 1.5119 | 22.846 | 29.154 | 13.0 | 37.0 |
| O.M | Control (T1) | 3 | 1.023 | .1966 | .1135 | .535 | 1.512 | .8 | 1.2 |
| | Organic Fertilizer (T2) | 3 | 1.993 | .2003 | .1157 | 1.496 | 2.491 | 1.8 | 2.2 |
| | Mineral Fertilizer (T3) | 3 | 1.397 | .4000 | .2310 | .403 | 2.390 | 1.0 | 1.8 |
| | O + 25 % M (T4) | 3 | 2.403 | .1002 | .0578 | 2.155 | 2.652 | 2.3 | 2.5 |
| | O + 50 % M (T5) | 3 | 2.607 | .1007 | .0581 | 2.357 | 2.857 | 2.5 | 2.7 |
| | O + 75 % M (T6) | 3 | 2.983 | .1258 | .0726 | 2.671 | 3.296 | 2.9 | 3.1 |
| | O + M (T7) | 3 | 3.197 | .2001 | .1155 | 2.700 | 3.694 | 3.0 | 3.4 |
| | Total | 21 | 2.229 | .7833 | .1709 | 1.872 | 2.586 | .8 | 3.4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PH | Control (T1) | 3 | 5.400 | .2000 | .1155 | 4.903 | 5.897 | 5.2 | 5.6 |
| | Organic Fertilizer (T2) | 3 | 7.000 | .0000 | .0000 | 7.000 | 7.000 | 7.0 | 7.0 |
| | Mineral Fertilizer (T3) | 3 | 7.500 | .3000 | .1732 | 6.755 | 8.245 | 7.2 | 7.8 |
| | O + 25 % M (T4) | 3 | 6.900 | .2000 | .1155 | 6.403 | 7.397 | 6.7 | 7.1 |
| | O + 50 % M (T5) | 3 | 6.500 | .1000 | .0577 | 6.252 | 6.748 | 6.4 | 6.6 |
| | O + 75 % M (T6) | 3 | 6.300 | .0000 | .0000 | 6.300 | 6.300 | 6.3 | 6.3 |
| | O + M (T7) | 3 | 5.900 | .3000 | .1732 | 5.155 | 6.645 | 5.6 | 6.2 |
| | Total | 21 | 6.500 | .6928 | .1512 | 6.185 | 6.815 | 5.2 | 7.8 |
| EC | Control (T1) | 3 | 2.700 | .1000 | .0577 | 2.452 | 2.948 | 2.6 | 2.8 |
| | Organic Fertilizer (T2) | 3 | 3.500 | .1000 | .0577 | 3.252 | 3.748 | 3.4 | 3.6 |
| | Mineral Fertilizer (T3) | 3 | 3.100 | .1732 | .1000 | 2.670 | 3.530 | 3.0 | 3.3 |
| | O + 25 % M (T4) | 3 | 3.700 | .1000 | .0577 | 3.452 | 3.948 | 3.6 | 3.8 |
| | O + 50 % M (T5) | 3 | 4.100 | .1000 | .0577 | 3.852 | 4.348 | 4.0 | 4.2 |
| | O + 75 % M (T6) | 3 | 3.900 | .1000 | .0577 | 3.652 | 4.148 | 3.8 | 4.0 |
| | O + M (T7) | 3 | 4.300 | .1000 | .0577 | 4.052 | 4.548 | 4.2 | 4.4 |
| | Total | 21 | 3.614 | .5434 | .1186 | 3.367 | 3.862 | 2.6 | 4.4 |

**Table 2 .**

*ANOVA analysis showed that there was a significant difference at the 5% significance level for the coefficients*

| | | Sum of Squares | d f | Mean Square | F | Sig |
|---|---|---|---|---|---|---|
| **Plant height** | Between groups | 20556.000 | 6 | 3426.000 | 877.390 | **0.000** |
| | Within Groups | 54.667 | 14 | 3.905 | | |
| | Total | 20610.667 | 20 | | | |
| **Root plant** | Between groups | 1230.000 | 6 | 205.000 | 93.587 | **0.000** |
| | Within Groups | 30.667 | 14 | 2.190 | | |
| | Total | 1260.667 | 20 | | | |
| **Ear length** | Between groups | 370.286 | 6 | 61.714 | 23.564 | **0.000** |
| | Within Groups | 36.667 | 14 | 2.619 | | |
| | Total | 406.952 | 20 | | | |
| **Leaf area** | Between groups | 16552696.286 | 6 | 2758782.714 | 37.769 | **0.000** |
| | Within Groups | 1022606.667 | 14 | 73043.333 | | |
| | Total | 17575302.952 | 20 | | | |
| **500 grain weight** | Between groups | 8944.286 | 6 | 1490.714 | 77.296 | **0.000** |
| | Within Groups | 270.000 | 14 | 19.286 | | |
| | Total | 9214.286 | 20 | | | |
| **Grain yield** | Between groups | 92.662 | 6 | 15.444 | 43.558 | **0.000** |
| | Within Groups | 4.964 | 14 | 0<br>.355 | | |
| | Total | 97.626 | 20 | | | |
| **Bio yield** | Between groups | 916.000 | 6 | 152.667 | 48.576 | **0.000** |
| | Within Groups | 44.000 | 14 | 3.143 | | |
| | Total | 960.000 | 20 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Between groups | 11.641 | 6 | 1.940 | 43.138 | **0.000** |
| **O.M** | Within Groups | 0.630 | 14 | 0 .045 | | |
| | Total | 12.271 | 20 | | | |
| | Between groups | 9.060 | 6 | 1.510 | 39.148 | **0.000** |
| **PH** | Within Groups | 0.540 | 14 | 0.039 | | |
| | Total | 9.600 | 20 | | | |
| | Between groups | 5.726 | 6 | 0.954 | 74.222 | **0.000** |
| **EC** | Within Groups | 0.180 | 14 | 0.013 | | |
| | Total | 5.906 | 20 | | | |

## Effects of treatments on plant properties

### Plant height(cm)

The effect of mineral fertilization was significant on plant height of 109 cm when treated (T3) compared to organic fertilization with sample (T2) which gave 99 cm, while comparison treatment (T1) gave an average height of less than 64 cm, and this is consistent with what was reached (Saleh M.Ibraheem 2013) and (Hussien J.M. AL-Bayati et al., 2021) but [100% mineral fertilizer with organic fertilizer for sheep manure 20 tons | Hectare of] (T7) treatment gave the highest mean plant height of 161 cm.

different treatments on maize plant height could be arranged in descending order of T7 > T6 > T5 > T4 > T3 > T2 > T1 >

Duncan Subset for alpha = 0.05

| Fertilizer | N | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Control (T1) | 3 | 64.000 g | | | | | | |
| Organic Fertilizer (T2) | 3 | | 99.000 f | | | | | |
| Mineral Fertilizer (T3) | 3 | | | 109.000 e | | | | |
| O + 25 % M (T4) | 3 | | | | 120.000 d | | | |
| O + 50 % M (T5) | 3 | | | | | 133.333 c | | |
| O + 75 % M (T6) | 3 | | | | | | 156.000 b | |
| O + 100 % M (T7) | 3 | | | | | | | 161.000 a |
| Sig | | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000

### Root height(cm)

The results showed that the length of the roots was significantly affected when adding the infectious fertilizer (T3) as it gave a length of 36 cm compared to the average root length in the comparison sample (T1) which gave a root length of 25 cm while the organic fertilizer sample (T2) alone gave an average length of 32 cm.

It is noted that the average length of the root increases with the increase in the proportion of adding mineral fertilizer with organic fertilizer

(Jing Chen et al,.2020) A significant difference was achieved when the addition treatments were (T6) & (T7) gave root length of 47 and 48 cm respectively.

Duncan Subset for alpha = 0.05

| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Control (T1) | 3 | 25.000 e | | | | |
| Organic Fertilizer (T2) | 3 | | 32.000 d | | | |
| Mineral Fertilizer (T3) | 3 | | | 36.000 c | | |
| O + 25 % M (T4) | 3 | | | | 40.667 b | |
| O + 50 % M (T5) | 3 | | | | 42.000 b | |
| O + 75 % M (T6) | 3 | | | | | 47.000 a |
| O + 100 % M (T7) | 3 | | | | | 48.000 a |
| Sig | | 1.000 | 1.000 | 1.000 | 0.288 | 0.422 |

Means for groups in homogeneous subsets are displayed.
Uses Harmonic Mean Sample Size = 3.000
Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability $P < 0.05$

**Ear length (cm)**

The effect of ear length was significant, with the highest average ear length values reaching 27 cm in the treatment with [100% mineral fertilizer with organic fertilizer] (T7) and 25 cm in the treatment with [75% mineral fertilizer with organic fertilizer] (T6), but with the same significance, due to the effect of organic matter on growth (Jamal Deriak and Kamal Abdel-Kader,.( 2015Meanwhile, mineral fertilizer (T3) gave 18 cm and organic fertilizer (T2) 17.333 cm as an average length compared to the control treatment (T1), while (T5) and (T4) gave the same significance.

Duncan Subset for alpha = 0.05

| Fertilizer | N | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Control (T1) | 3 | 14.000 d | | | |
| Organic Fertilizer (T2) | 3 | | 17.333 c | | |
| Mineral Fertilizer (T3) | 3 | | 18.000 c | | |
| O + 25 % M (T4) | 3 | | | 21.000 b | |
| O + 50 % M (T5) | 3 | | | 22.000 b | |
| O + 75 % M (T6) | 3 | | | | 25.000 a |
| O + 100 % M (T7) | 3 | | | | 27.000 a |
| Sig | | 1.000 | 0.622 | 0.462 | 0.152 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000.
Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.05

**Leaf area (cm2)**

The treatment [ O +100% M] & [O +75 % M] (T7) & (T6) were given as the area of plant leaves 6859.33 cm2 6760 cm2 respectively, but with the same level of significance, while it gave the organic (T2) 4856 cm2 and mineral fertilizer (T3) 5363 cm2 compared to the control sample (T1) which was 4314 cm2 ,this result is consistent with the findings (Al Jobouri,Saleh and Arowl M.AnwerL, 2009)

| Duncan | | Subset for alpha = 0.05 | | | | |
|---|---|---|---|---|---|---|
| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
| Control (T1) | 3 | 4314.000 e | | | | |
| Organic Fertilizer (T2) | 3 | | 4856.000 d | | | |
| Mineral Fertilizer (T3) | 3 | | | 5363.000 c | | |
| O + 25 % M (T4) | 3 | | | | 5910.000 b | |
| O + 50 % M (T5) | 3 | | | | 6230.000 b | |
| O + 75 % M (T6) | 3 | | | | | 6760.000 a |
| O + 100 % M (T7) | 3 | | | | | 6859.333 a |
| Sig | | 1.000 | 1.000 | 1.000 | 0.169 | 0.659 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000
Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.05

**weight of 500 grain**

Fertilizer treatments differed significantly between them, where the treatment [ O +100% M ] (T7) gave a significant difference in the average weight of 500 grains 163 grams, which is the same amount of significant difference in the sample (T6) [ O + 75% M] which gave 160 grams, and the reason may be attributed to the fact that adding the fertilizer increased weight of 500 grain.
(Khalaf, M. Khalifah, Mazin F Said and Mothafer A Almosuly .2017) and (El-Sayed, H.K, et al,.2021)

| Duncan | | Subset for alpha = 0.05 | | | | |
|---|---|---|---|---|---|---|
| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
| Control (T1) | 3 | 101.000 e | | | | |
| Organic Fertilizer (T2) | 3 | | 120.000 d | | | |
| Mineral Fertilizer (T3) | 3 | | | 130.000 c | | |
| O + 25 % M (T4) | 3 | | | | 142.000 b | |
| O + 50 % M (T5) | 3 | | | | 148.000 b | |
| O + 75 % M (T6) | 3 | | | | | 160.000 a |

| | | | | | | |
|---|---|---|---|---|---|---|
| O + 100 % M (T7) | 3 | | | | | 163.000 a |
| Sig | | 1.000 | 1.000 | 1.000 | 0.116 | 0.417 |

Means for groups in homogeneous subsets are displayed.Uses Harmonic Mean Sample Size = 3.000.
Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.05

**Grain yield**

[100%NPK + organic fertilizers] gave the highest grain yield about 10.467, 11.133 ton per hectare.(Al-Hilfy & Al-Temimi, 2017).

In our experiment, this same treatment of the treatment (T7) gave 11.133 ton per hectare and the treatment[ 75%M + organic fertilizers] (T6) gave 10.467 ton | hectare with the same significant difference for both treatments, and T3 > T2 > T1
They found that the production of grain yield might be due to better growth, development and dry matter accumulation with proper supply of nutrients to plant and increase in the availability (Abd El-Gawad & Morsy, 2017) and (El-Sayed, H.K, et al,.2021)

Duncan — Subset for alpha = 0.05

| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Control (T1) | 3 | 4.500 e | | | | |
| Organic Fertilizer (T2) | 3 | | 6.700 d | | | |
| Mineral Fertilizer (T3) | 3 | | | 7.890 c | | |
| O + 25 % M (T4) | 3 | | | | 9.023 b | |
| O + 50 % M (T5) | 3 | | | | 9.030 b | |
| O + 75 % M (T6) | 3 | | | | | 10.467 a |
| O + 100 % M (T7) | 3 | | | | | 11.133 a |
| Sig | | 1.000 | 1.000 | 1.000 | 0.989 | 0.192 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000
Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.05

**Biological yield**

The results showed that biological yield was significantly affected the highest value of biological yield (35.667 and 32.667 kg h-1) in treatments [ O + 100% M ] & [(O + 75 % M] (T7) & (T6) but with the same meaning While the mineral fertilization treatments(T3) was higher than the organic fertilization(T2) and they are significantly higher than the control sample(T1).

The biological weight increased due to the mineral fertilizer mixed with the organic fertilizer ( Gomaa, M.A., E.E. Kandil & Amera M.M. Ibrahim .2020)

| Duncan | | Subset for alpha = 0.05 | | | | |
|---|---|---|---|---|---|---|
| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
| Control (T1) | 3 | 15.000 e | | | | |
| Organic Fertilizer (T2) | 3 | | 20.000 d | | | |
| Mineral Fertilizer (T3) | 3 | | | 23.667 c | | |
| O + 25 % M (T4) | 3 | | | | 27.000 b | |
| O + 50 % M (T5) | 3 | | | | 28.000 b | |
| O + 75 % M (T6) | 3 | | | | | 32.667 a |
| O + 100 % M (T7) | 3 | | | | | 35.667 a |
| Sig | | 1.000 | 1.000 | 1.000 | 0.501 | 0.057 |

izer, which caused an increase in plant height and leaf area. Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000

Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.01

**Effect treatment on some soil properties(Organic matter) O.M**

The data showed that soil OM content was increased by using mixture organic with mineral fertilizer the table explained this .

The treatment (T7) &(T6) recorded the highest value3.197&2.983 but in the same significant ,also treatments (T5) &(T4)recorded the high value 2.607&2.403 and also in the same significant compare with (T3) ,(T2) and control (T1)

| Duncan | | Subset for alpha = 0.05 | | | | |
|---|---|---|---|---|---|---|
| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
| Control (T1) | 3 | 1.023 e | | | | |
| Organic Fertilizer (T2) | 3 | | 1.397 d | | | |
| Mineral Fertilizer (T3) | 3 | | | 1.993 c | | |
| O + 25 % M (T4) | 3 | | | | 2.403 b | |
| O + 50 % M (T5) | 3 | | | | 2.607 b | |
| O + 75 % M (T6) | 3 | | | | | 2.983 a |
| O + 100 % M (T7) | 3 | | | | | 3.197 a |
| Sig | | 1.000 | 1.000 | 1.000 | 0.260 | 0.238 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000

Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.05

**PH**

The table showed that all fertilization treatments were significantly superior to the control in soil interaction.

The level of mineral fertilizer (T3) alone was significantly superior to all fertilizer treatments, and the reason is that the organic fertilizer reduces

different treatments on PH soil height could be arranged in descending order of T3 > T2 > T4 > T5 > T6 > T7 > T1 > Because adding organic fertilizers, regardless of their nature, leads to a decrease in soil acidity (Faisal Mahmood et al,.2017)

Duncan — Subset for alpha = 0.05

| Fertilizer | N | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Control (T1) | 3 | 5.400 e | | | | |
| O + 100 % M (T7) | 3 | | 5.900 d | | | |
| O + 75 % M (T6) | 3 | | | 6.300 c | | |
| O + 50 % M (T5) | 3 | | | 6.500 c | | |
| O + 25 % M (T4) | 3 | | | | 6.900 b | |
| Organic Fertilizer (T2 | 3 | | | | 7.000 b | |
| Mineral Fertilizer (T3) | 3 | | | | | 7.500 a |
| Sig | | 1.000 | 1.000 | 0.233 | 0.543 | 1.000 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000
Columns with similar letters have no significant differences between them, while columns with different letters have significant differences at a probability P < 0.05

**Electrical Conductivity (EC)**
The application of organic fertilizers significantly reduces soil EC and available nitrogen (Yixing Zhang ,,et al 2024)
Data in this table showed the soil salinity (EC) as affected by addition of organic fertilizer and inorganic fertilizer and after harvesting maize plant.

The highest increase in soil salinity was recorded in (T3) as compared to the control. Also the value of (T2) was high 3.500 might be due to the high salt content of sheep manure and compost in comparison to the other organic materials.
different treatments on salinity height could be arranged in descending order of T3 > T4 > T5 > T4 > T6 > T2 > T1 >T7 >

Duncan — Subset for alpha = 0.05

| Fertilizer | N | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| O + 100 % M (T7) | 3 | 2.700 g | | | | | | |
| Control (T1) | 3 | | 3.100 f | | | | | |
| Organic Fertilizer (T2) | 3 | | | 3.500 e | | | | |
| O + 75 % M (T6) | 3 | | | | 3.700 d | | | |
| O + 50 % M (T5) | 3 | | | | | 3.900 c | | |
| O + 25 % M (T4) | 3 | | | | | | 4.100 b | |
| Mineral Fertilizer (T3) | 3 | | | | | | | 4.200 a |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sig | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Means for groups in homogeneous subsets are displayed. Uses Harmonic Mean Sample Size = 3.000

## DISCUSSION OF RESULTS

The results showed the difference in plant characteristics (height, root length, ear length, leaf area, weight of 500 grains, bio-yield, grain yield) according to the percentage of mineral fertilizer mixed with organic manure (sheep manure 20 tons | hectares.

It can be concluded that application of 5 ton.ha-1organic fertilizer + 75 % inorganic fertilizer could increase N, P and K nutrients uptake well as good growth and yield (Neni Marlina et al., 2017)

The results indicate the superiority of the nitrogen fertilization treatment 100% and 75% over the control sample and the organic fertilizer sample in plant height, ear length, leaf area, grain yield and weight of 500 grains (Saleh M.Ibraheem 2013)

This result may be attributed to the more photosynthetic activities of the plant because of nitrogen since it is an essential requirement for the growth..

The mineral fertilization mixed with organic fertilization affects the absorption of nutrients, especially nitrogen, which increases cell division and enters the formation of the amino acid tryptophan, of which the growth regulator is formed and helps in the height of the plant.

Adding organic fertilizer to the soil releases CO2, which combines with water to form carbonic acid Which helps in lowering the soil pH and increases the availability of nutrients in the root zone.

The addition of organic manure leads to a decrease in the values of electrical conductivity as a result of the positive effect of organic compounds in improving the physical and chemical properties of the soil, which contributed to a relative reduction Salts as a result of improving the movement of filtered water.

The mineral fertilization mixed with organic fertilization caused an increase in the area of leaf and stems and the height of the plant so that due to increase biological yield.

The reason of increasing 500 grain weight that was increasing concentration of chlorophyll so that it increases in the area of the leaf, which has an effect on weight gain.

The the leaf area is due to element nitrogen affects cell division, and that the increase in the element nitrogen works to increase the concentration of chlorophyll, so the photosynthesis process increases, which is reflected positively on the leaf area.

reported that integrated use of inorganic fertilizer along with organ ic fertilizer [100% NPK + OF ] was improved soil physical conditions and increased in soil organic carbon might have resulted in higher maize yields (R.Al-Bandawy & H.Al-Alawy, 2018)

Experience has shown that mixing mineral fertilizer at a rate of 75% with organic fertilizer is 20 tons| Hectares gave higher significant differences than other mixture ratios 50% and 25% in soil organic matter content compared to mineral and organic fertilization alone.

The mineral fertilization treatment alone outperformed the rest of the treatments for the degree of soil reaction(PH) combination of organic and inorganic fertiliz- ers a realistic option in improving soil fertility and productivity. So the best ways for soil fertility is, therefore, integration of both inorganic and organic fertilizers to increases soil productivity(Roba, 2018)
(Akongwubel et al.,2012) reached when adding 15 tons per hectare of poultry manure results in an increase in the growth rate and yield of yellow maize plants, such as plant height, number of leaves, dry weight of leaves and stems, and grain yield.

**Table3.**
*The effect of mineral and organic fertilization and the mixing ratio between them on the growth and production of maize before harvest*

| | T1 | T2 | T3 | T4 | T5 | T6 | T7 | AVARGE | sig |
|---|---|---|---|---|---|---|---|---|---|
| PL | 64 ± 1.0000 g | 99 ± 0.5774 f | 109 ± 0.5774 e | 120 ± 0.0000 d | 133 ± 0.8819 c | 156 ± 2.5166 b | 161 ± 0.5714 a | 120 ± 7.0052 | .000 |
| RL | 25 ± 0.0000 e | 32 ± 1.0000 d | 36 ± 0.0000 c | 40 ± 0.6667 b | 42 ± 0.0000 b | 47 ± 1.5275 a | 48 ± 1.1547 a | 38.66 ± 1.7325 | .000 |
| EL | 14 ± 1.1547 d | 17.33 ± 1.2019 c | 18 ± 0.0000 c | 12 ± 0.5774 b | 22 ± 0.5774 b | 25 ± 0.5774 a | 27 ± 1.5275 a | 20.619 ± 0.9843 | .000 |
| LA | 4314 ±173.442 e | 4856 ± 122.344 d | 5363 ± 199.755 c | 5910 ± 5.773 b | 6230 ±125.033 b | 6760 ± 60.000 a | 6859.33 ± 257.320 a | 5756.04 ± 204.562 | .000 |
| 500 wg | 101 ± 1.5275 e | 120 ± 2.8868 d | 130 ± 2.8868 c | 142 ± 2.8868 b | 148 ± 2.8868 b | 160 ± 1.0000 a | 163 ± 2.8868 a | 137.71 ± 4.68 | .000 |
| Yield | 4.500 ± 0.2887 e | 6.700 ± 0.4619 d | 7.890 ± 0.2281 c | 9.023 ± 0.1811 b | 9.030 ±0.4362 b | 10.467 ± 0.2963 a | 11.133 ± 0.4096 a | 8.39 ±0.48 | .000 |
| B.yield | 15 ± 1.1547 e | 20 ± 0.5774 d | 23 ± 1.7638 c | 27 ± 1.1547 b | 28 ± 0.0000 b | 32.667 ± 0.6667 a | 35.667 ± 0.8819 a | 26 ±1.51 | .000 |

**Table 4.**
*The effect of mineral and organic fertilization and the mixing ratio between them on Some properties of the soil after harvest*

| | T1 | T2 | T3 | T4 | T5 | T6 | T7 | AVARGE | sig |
|---|---|---|---|---|---|---|---|---|---|
| O.M | 1.023 ± 0.1135 e | 1.1993 ± 0.1157 d | 1.397 ± 0.2310 c | 2.403 ± 0.0578 b | 2.607 ± 0.0581 b | 2.983 ± 0.0726 a | 3.197 ± 0.1155 a | 2.229 ±1.709 | .000 |
| PH | 5.400 ± 0.1155 g | 7.000 ±0.000 b | 7.500 ± 0.1732 a | 6.900 ± 0.1155 c | 6.500 ± 0.577 d | 6.300 ± 0.000 e | 5.900 ± 0.1732 f | 6.500 ± 0.1512 | .000 |
| EC | 3.100 ±0.1000 f | 3.500 ±0.0577 e | 4.300 ± 0.057 a | 4.100 ± 0.0577 b | 3.900 ± 0.0577 C | 3.700 ± 0.0577 d | 2.700 ± 0.0577 g | 3.614 ± 0.1186 | .000 |

## COCLUSIONS

All fertilization rates achieved a significant increase over the control in plant and soil properties.

There were no significant differences between the treatments of (T7) [O+100%MF] and (T6) [O + 75% MF] in root length, ear length, leaf area, weight of 500 grains, grain yield , biological yield and The content of organic matter in the soil as well no significant differences between the treatments of (T5) [organic fertilizer + 50% mineral fertilizer] and (T4) [organic fertilizer + 25% mineral fertilizer]

The mineral fertilization treatment alone outperformed the rest of the treatments for as for the degree of soil reaction(PH).

The treatment of mineral fertilization alone outperformed to organic fertilization alone in plant characteristics and soil properties except for the for the organic matter.

## RECOMMENDATIONS

Through the findings of the research, we recommend the following
Avoid using mineral fertilizer was alone on any agricultural crop because it was harmful to the environment and humans

The possibility to use organic fertilizer alone to improve soil fertility because of its good role in providing nutrients, Provided that the manure is free from diseases, salts and weed seeds.

It is preferable to use the treatment (organic fertilization + 75% mineral), which achieved high results in maize plant growth and production.

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