*Minufiya J. Agric. Res. Vol.39 No. 4(2): 1465-1478 (2014)* "http://www.mujar.net"

# WHEAT PLANT GROWN ON SANDY SOIL AS AFFECTED BY DIFFERENT TYPES OF NITROGEN FERTILIZERS

**Faten A. El-Kamar**
Soils & Water and Environ. Res. Inst., Agric. Res. Center, Giza, Egypt.

**(Received: May 3, 2014)**

**ABSTRACT:** *A field experiment was conducted out on a sandy soil at Ismailia Research Station during winter season 2011/2012and 2012/2013 using wheat variety (Sakha 93) to study the effect of mineral N at rate 0, 50, 75 and 100 kg N/fed, compost at rate 0, 5 and 10 ton /fed and with or without bio-fertilizer nitrogen fixing bacteria (Azospirillium liopferum and Bacillus polymers) and their interaction on wheat yield and soil fertility. Wheat grain and straw yield showed significant response to all treatments. The highest straw and grain yields were obtained with addition of 100 kg N/fed + 10 ton compost + bio-fertilizer. No significant different were observed between this treatment and 75 kg N/fed + 10 ton compost /fed + bio-fertilizer. Mineral N addition increased N, K, Fe, Zn and Mn contents of straw and grain, while P concentration was not affected. Compost addition increased N, P, K, Fe, Zn and Mn of straw and grains. Bio-fertilizer was significant effect on N concentration of wheat straw and grain. The effect of interaction between mineral N and compost was significant on all above mentioned parameter. The effect of mineral N fertilizer on soil available N and P were non significant after harvesting while the K slightly decreased. Compost addition increased soil available N, P, Fe, Zn and Mn.*

**Key word:** *Compost- Bio-fertilizer- mineral N fertilizer – sandy soil fertility- wheat productivity*

## INTRODUCTION

There is a great concern for agriculture development and land reclamation in Egypt at present for increasing agricultural production to meat the increasing population. Most of new reclaimed soils are generally poor in plat nutrients and nutrient applied to these soils are subjected to loss by the irrigation water. Fertilization of these soils therefore a necessary practice. Response to organic or inorganic fertilizer is usually obtained. To decrease the loss of applied nutrients especially by N leaching several practices has been suggested such as mixing fine materials, organic matter or bio-fertilizer.

Wheat (Triticum astivum, L.) is one of the most important food crops all over the world including Egypt. Nutritional requirements of wheat quiet high and the application of chemical fertilizer is considered essential to obtain high grain yield. Intensive use of chemical fertilizer led to increase the pollution in soil, water and food. The progressive rise in the cost of these fertilizer and relative its low efficiency especially in sandy soil give an account for finding cut a partial or full substitution for the used classic applied chemical fertilizer. Organic and bio-fertilizer are potential substitute for such chemical fertilizer to reduce cost and minimizing environmental pollution.

Compost management practice in all agricultural production system because of increasing sustainability , improving soil physical properties and increasing soil organic matter and fertility level, Abu El-Enine (2008). Abbas *et al.* (2006) studied the effect of organic manure either alone or in combination with 15; 30; 60 or 90 N kg $fed^{-1}$ ammonium sulphate. They found that dry weight and N uptake by maize were significantly higher where the half of N from organic manure and other half in from of ammonium sulphate have been added. Nasef *et al* (2009) effects of bio and organic fertilizer application under different N-mineral fertilizer level on the concentration of some nutrients N, P ,K , Fe, Mn, Zn and Cu in both straw and grains of rice plants were increase with increasing the level of N mineral fertilizer. Zeidan *et al.* (2009) and Zaki *et al* (2012) reported that nitrogen fertilizer with or without compost addition

significantly increased spike weight, grain weight grain yield and straw yield of wheat. Raising nitrogen fertilizer level from 60 to 90 kg N fed-1 and upt 120 kg N fed-1 led to gradual increase in studied characters. Awad and Khaled (2012) stated that there is non –significant different between of 60 % or 70 % mineral fertilizer plus bio-fertilizer compost or compost were comparable to 100 % recommended dose mineral fertilizer without amended compost. Zaki *et al* (2012) and Awad and Khaled (2012) reported that addition of compost with mineral fertilizer and bio-fertilizer increased grain and straw yield of wheat.

Recently microbial inoculation of crop grain by certain free living bacteria had a greet importance as a new technology. The technique of microbial inoculation aims at minimizing the amount of applied chemical fertilizer, preventing the pollution and cost of production (Abas *et al.* 2006). Several reports have affirmed positive plant growth response after inoculation plants with symbiotic N fixing bacteria such as Azotobacter spp. Oken (1982) stated that inoculated plants with bio-fertilizer exhibited about 30 – 50 % greater uptake of nitrogen P and K than non- inoculated plants. Shaban and Omar (2006); Suzan (2007); Ashmaye *et al.* (2008); Awad and Khaled (2012) and Zaki *et al* (2012) reported that $N_2$-fixer strain alone or in combination with mineral fertilizer and organic fertilizer and their combination showed an effective on wheat grain yield and its components. So wheat production and soil fertility were determined affected by mineral nitrogen, compost and bio-fertilizer in sandy soil.

## MATERIALS AND METHODS

A field experiment was conducted out on sandy soil at Ismailia Res Station during two winter seasons 2011/2012 and 2012l 2013 , using wheat plant to study the solely and combined effect of mineral , organic and bio-fertilizers on yield and yield components and chemical composition of wheat ( Ttiticum asetivum, L.) cultivars Sakha 93. The experimental design was aplit- split plot with three replicates. Compost was allocated in the main plots, bio-fertilizer allocated in the sub plots and mineral fertilizers treatments were allocated in the sub – sub plots. The area of each plot was 10.5 $m^2$, 3.5 m long and 3.0 m wide. The experiment include 18 treatments which were the combination among three compost levels , two bio-fertilizer treatment and three mineral fertilizers levels treatments . The experimental treatments can be described as follows:

A- Compost levels
1- Without addition
2- 5 Mg $fed^{-1}$
3- 10 Mg $fed^{-1}$

B- Bio-fertilizer:
1- without inoculation
2- Inoculation with Azospirillum liopferum and Bacillus polymaxa in approximate cell counts of $10^5$ cells/gm for each.

C- Mineral fertilizer:
1- 50 kg N $fed^{-1}$ as ammonium sulphat.
2- 75 kg N $fed^{-1}$ as ammonium sulphat.
3- 100 kg N $fed^{-1}$ as ammonium sulphat.

Compost was added before sowing and homogenously mixed with top soil (0- 25 cm) while the grain of wheat inoculation with cerealin were done before sowing as the methods recommended by general organization of Agriculture Crop Equalization Fund (GOACEF), which contain mixture of two nitrogen fixing bacteria, i.e., Azospirillium liopferum and Bacillus polymers in approximate cell count of $10^5$ cells/gm for each. Nitrogen added at foure equal portion, the first doses was added before sowing and 2$^{nd}$ after 15 days, the others were added every 15 days interval. The other normal agricultural practices of wheat were performed.

At wheat maturity, wheat plants were harvest and weighted then separated into grain and straw. The weight of both grain and straw were estimated in the net plot. Sub sample from grain and straw were taken, weighted and oven dried at 70 $C^o$ for chemical analysis. Soil samples of the

experimental sites were taken at the depth of (0- 30 cm) before sowing and after harvesting. Soil physical and chemical analysis before sowing is presented in Table (1 a, b and c). Total soluble salts, soluble cations and anions in soil past extract were determined according to Jakson (1978). DTPA extract of Fe, Mn and Zn were determined using Atomic Adsorption spectrophotometer according to Lindsay and Norvall (1978). The nitrogen content in grain and straw was determined by micro-Kjeldahl as described by A.O.A.C. (1990). Phosphorus determined by methods (Jakson, 1978).

Compost analysis presented in Table (2).

**Table (1). Some physical and chemical characteristics.**

**a- Physical chrematistics**

| O.M (%) | $CaCO_3$ (%) | Particle Size distribution (%) | | | | Soil texture | Field capacity | Wilting point | CEC | H.C. m/days. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Corse sand | Fin sand | Silt | Clay | | | | | |
| 0.35 | 0.32 | 77.40 | 15.60 | 2.90 | 3.10 | sandy | 11.2 | 3.9 | 7.5 | 4.1 |

**b- Chemical Characteristics**

| pH (1:2.5) | EC ($dSm^{-1}$) | Cations (meq $L^{-1}$) | | | | Anions (meq $L^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ca^{+2}$ | $Mg^{+2}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{-}$ | $HCO_3^{--}$ | Cl- | $SO_4^{--}$ |
| 8.20 | 0.35 | 1.39 | 0.50 | 0.45 | 0.15 | - | 1.35 | 0.80 | 0.34 |

**C. Some available macro and micronutrients.**

| Macronutrients (mg $kg^{-1}$) | | | Micronutrients (mg $kg^{-1}$) | | | |
|---|---|---|---|---|---|---|
| N | P | K | Fe | Zn | Mn | Cu |
| 22.00 | 6.10 | 70.00 | 3.60 | 0.600 | 3.50 | 0.31 |

**Table (2). Some chemical characteristics of compost used.**

| EC ($dSm^{-1}$) | O.C. (%) | Total N (%) | C/N ratio | Total (%) | | Available micronutrient (mg $kg^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | P | K | Fe | Zn | Mn | Cu |
| 4.10 | 21.00 | 1.10 | 19.10 | 0.90 | 1.32 | 10.2 | 5.10 | 16.20 | 2.3 |

## RESULTS AND DISCUSSION

### Wheat grain and straw yields:

The weight of grain and straw yields were significantly increased by increasing rate of N fertilizer addition. Table (3). The relative increases for grain yield was 35.1 and 51.408 % due to application of 75 and 100 kg N $fed^{-1}$, respectively as compared to 50.kg N $fed^{-1}$, while the relative increase for straw yield were 24.6 and 35.98 % in the same order The beneficial effect of N application on increasing grain and straw yields can be explained on the basis that N essential element improves plant growth though building new cells and also improves photosynthesis which in sequence increases yield of crops (El- Esh, 2007). Tran and Gilles (2000) found that economic N rates for wheat were 90 and 120 kg /ha for (1993 and 1994 years) respectively. The obtained results are in a good line with those by Hamisa and Mostafa (1998); El-Zaher *et al* (2001); El-Kouny (2007) and Awad and Khaled (2012).

Compost addition increased grain and straw yields compared with control, (Table 3). The relative increases for 5 and 10 ton compost addition were 21.45 and 37.66 % for grains; 26.6 % and 35.98 % for straw. The positive effect of compost addition on yield and its components may be due to its favorable effect on soil physical and chemical properties. Salib (2002), Ewees and Abdel Hafeez (2010) reported that, in general, crop yield and its components responded markedly to the applied organic amendments, however, their beneficial effect is cleared through released organic acids and chelating agents; enhancing the nutrient mobility and uptake by plants.

Bio-fertilization addition significantly resulted in increasing grain and straw yield compared to non inoculated treatments (Table 3). The relative increase was 8.40 % for grains and 8.3 % for straw , when bio-fertilizer was added the beneficial effect of bio-fertilizer may be due to the ability of microorganisms to N fixation and produce growth regulator substances i.e. indol acitic acid , Gibberillic acid and cytokininas. The incremental addition of N fertilizer than 50.kg N fed-1 induced a significant increase in both of plant height, spike length and 1000 grain weight. The same trend was observed with bio-fertilizer and compost application. The highest increase in the abovementioned parameters were induced by application of the highest dose of compost and N fertilizer with bio-fertilizer. Those augmentations were 11.54, 32.76 and 22.66 % for plant height, spike length and 100.grain weight, respectively in comparison with the control 63.2, 8.3 and 35.30 respectively.

This many attributed to the beneficial affect of added fertilizers on enhancing soil fertility nutrient status, chemical and physical properties Shaban and Abd El-Rahman (2007) indicated that the interaction between N rates addition and bio-fertilizers were increased grain, straw yield, weight of 1000 grains compared with un inoculation .

These phytohormens play an important role on plant growth through promoting photosynthesis and accumulation of dry matter within different plants, El-Kouny, (2007). Our results are in agreement with those obtained by Gagnon *et al.* (1997), Hassouna and Hassanein (1997), wahdan (2004) and Zaki *et al.* (2012).

The combination of compost and mineral N fertilizer at different rates gave significant increases for grain and straw yield. The highest yields were obtained under treatment received 100 Kg N $fed^{-1}$ + 10 Mg $fed^{-1}$ compost without non significant differences with treatment receiving 75 kg N $fed^{-1}$, 10Mg $fed^{-1}$ compost and inoculated bio-fertilizer.

Mineral fertilizer is considered as available sources of N element, it is easily leached especially in sandy soil. On the contrary, the organic fertilizer is considered as sufficient slow release fertilizer. Combining the chemical fertilizers with organic ones supplies plants with sufficient and available nutrients besides, reducing the leaching of the elements. This will increase vegetated growth and yield. These results

**Table (3). Effect of compost, mineral N fertilizer and bio-fertilizer on yield and components of wheat plants, (mean combined of two seasons).**

| Rate of compost Mg fed$^{-1}$ | Mineral N kg fed$^{-1}$ | Bio. | Plant height (cm) | Spike length (cm) | 1000 grain weight (g) | Grain Yield ( Mg fed$^{-1}$) | Straw yield (Mg fed$^{-1}$ ) |
|---|---|---|---|---|---|---|---|
| 0 | 50 | 0 | 83.20 | 8.30 | 35.30 | 1.101 | 2.090 |
| | 75 | | 86.30 | 9.10 | 37.20 | 1.510 | 2.567 |
| | 100 | | 88.50 | 9.40 | 38.50 | 1.790 | 2.989 |
| | Mean | | 86.00 | 8.90 | 37.00 | 1.467 | 2.549 |
| | 50 | Bio | 84.30 | 8.80 | 36.10 | 1.250 | 2.375 |
| | 75 | | 87.90 | 9.50 | 38.20 | 1.690 | 2.873 |
| | 100 | | 89.70 | 9.80 | 39.50 | 1.916 | 3.199 |
| | Mean | | 87.30 | 9.30 | 37.93 | 1.619 | 2.816 |
| 5 | 50 | 0 | 87.40 | 9.70 | 38.20 | 1.351 | 2.565 |
| | 75 | | 88.70 | 10.10 | 40.50 | 1.940 | 3.298 |
| | 100 | | 89.80 | 10.80 | 42.40 | 2.140 | 3.574 |
| | Mean | | 88.63 | 10.20 | 40.36 | 1.811 | 3.146 |
| | 50 | Bio | 88.20 | 10.30 | 39.10 | 1.500 | 2.850 |
| | 75 | | 89.70 | 10.80 | 41.30 | 2.080 | 3.536 |
| | 100 | | 89.90 | 11.10 | 43.20 | 2.200 | 3.674 |
| | Mean | | 89.26 | 10.73 | 4.12 | 1.927 | 3.354 |
| 10 | 50 | 0 | 89.60 | 10.80 | 40.10 | 1.550 | 2.945 |
| | 75 | | 90.80 | 10.90 | 42.30 | 2.110 | 3.587 |
| | 100 | | 91.20 | 11.20 | 45.20 | 2375 | 3.967 |
| | Mean | | 90.53 | 10.90 | 42.46 | 2.032 | 3.499 |
| | 50 | Bio. | 89.90 | 10.30 | 41.30 | 1.770 | 3.363 |
| | 75 | | 92.50 | 11.40 | 43.10 | 2.270 | 3.859 |
| | 100 | | 92.80 | 11.60 | 43.30 | 2.480 | 4.142 |
| | Mean | | 91.73 | 11.30 | 42.53 | 2.214 | 3.787 |
| LSD. 5 % N fertilizer | | | 2.30 | 0.41 | 1.10 | 0.280 | 0.290 |
| Compost | | | 2.10 | 0.40 | 2.00 | 0.290 | 0.200 |
| Bio-fertilizer | | | ns | ns | 1.30 | 0.230 | 0.130 |
| N+ compost | | | 2.50 | 0.51 | 1.30 | 0.295 | 0.205 |
| N+ biofertilizer | | | ns | ns | 1.40 | 0.250 | 0.180 |
| Comp+ Bio- | | | ns | ns | ns | 0.260 | 0.160 |
| N+ Comp+ Bio | | | ns | ns | ns | 0.300 | 0.220 |

are in agreement with Hues and Sablezyk, (1994), Ewees *et al.* (2008) and Sarwar *et al* (2009). Thus, the response of wheat to combination between organic and chemical fertilizer may gave the possibility to substitute the chemical fertilizer partially by organic manure under the condition of this study. El- Afandy (1995) concluded that application of organic together with inorganic N fertilizer increased wheat growth characters, straw and grain yields comparing with solely addition organic manure or mineral N fertilizer. Metwally and Khamis (1998) evaluated the ability of organic materials mixed with inorganic N sources to meet total N demand of wheat crop in sandy soil and concluded that addition of 50 % of entire N requirements of wheat in organic from and the rest in mineral form produce almost the same yield as in the case of 100 % mineral N fertilizer source. Whadan (2004) stated that addition of 75 % mineral from N requirements for maize and wheat and rest as organic form produced almost the same straw and grain yields when 100 % mineral nitrogen fertilizer was added . Comparison of grain and straw yields of wheat by Awad and Khaled (2012) showed that 70 % mineral N fertilizer plus compost were comparable to 100 % mineral fertilizer. The interaction effect between mineral N fertilizer and bio-fertilizer on wheat straw and grain yields was significant. The largest grain yield was obtained by addition of 100 kg N $fed^{-1}$ + bio-fertilize. This result could be due to the production of growth regulator substances by Azotobacter and subsequently affects yield and its components. The results are in line with those obtained by Hassouna and Hassaine (1997), Metwally (2000), Awad and Khaled (2012) and Zaki *et al* .(2012).

The interaction between compost and bio-fertilizer on wheat straw and grain yields had a significant effect. The addition of 5 and or 10 Mg compost plus bio-fertilizer increased, grain and straw yield significantly compared to solely addition of compost or bio-fertilizer. Similar results were obtained by Awad and Khaled (2012) who reported that Azotobater application enhanced significantly shoot biomasses in FYM amended soil. Such pronouncing effect of organic matter and bio-fertilizer in increasing growth was recorded by many authors. Ahmed (2001) stated that this increment might be ascribed to the ability of soil microorganisms to convert the unavailable forms of nutrient elements in organic fertilizer to available ones by generation of carbon dioxide from bio-fertilizer. The experimental obtained results might be due to the stimulation effect of organic matters and bio-fertilizer inoculation on improving the physical properties of the soil, increasing soil fertility and availability of many nutrient elements to plant uptake which in turn on improving the growth of wheat plants. Data presented in Table (3) indicated that interaction between organic, bio- and mineral fertilizers showed a significant effect on yield and its components. Plots treated with 10 Mg compost $fed^{-1}$ with full dose of mineral N fertilizer 100 % and inoculation by Azotobacter gave the highest amounts for yield and yield components.

## Effect of different treatments on nutritional stats of soil after harvesting:

### Available macronutrient and micronutrients.

The effect of mineral, compost and bio-fertilizer and their interaction on soil available macronutrients are in shown in Table (4). The addition of mineral N did not significantly affect soil available N and P after harvesting compared to the initial one (Table 1.c). However soil available K tended to decrease which may be due to the consumption of K by plant uptake. The amount of available N and P (Table 4) was promoted affected significantly with addition of compost. On the other hand, available K after harvesting was significantly affected by compost application that may be attributed to the low clay content of the soil, consequently, easily leached K with irrigation water, Ouedrago *et al* (2001) and Eida *et al.* (2008) Abou El-Enein *et al* (2008) studied the effect of soil compost amended on soil available N and P after wheat maize harvested were increases with increasing mineral nitrogen fertilizer.

**Table (4). Effect of compost, mineral N fertilizer and bio-fertilizer on some soil available macro and micronutrients after harvesting (mean combined of two seasons).**

| Rate of compost Mg fed$^{-1}$ | Mineral N kg fed$^{-1}$ | Bio. | Macronutrients (mg kg$^{-1}$) | | | Micronutrients (mg kg$^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|
| | | | N | P | K | Fe | Zn | Mn |
| 0 | 50 | 0 | 24.00 | 6.00 | 73.00 | 3.80 | 0.65 | 3.80 |
| | 75 | | 26.00 | 5.80 | 70.00 | 3.90 | 0.63 | 3.70 |
| | 100 | | 27.00 | 5.90 | 69.00 | 3.90 | 0.61 | 3.70 |
| | Mean | | 25.30 | 5.90 | 70.60 | 3.80 | 0.63 | 3.73 |
| | 50 | Bio | 25.00 | 6.30 | 69.00 | 3.70 | 0.68 | 3.90 |
| | 75 | | 28.00 | 6.40 | 68.00 | 3.60 | 0.64 | 3.80 |
| | 100 | | 29.00 | 6.40 | 68.00 | 3.60 | 0.61 | 3.70 |
| | Mean | | 26.30 | 6.37 | 68.30 | 3.63 | 0.60 | 3.8 |
| 5 | 50 | 0 | 32.00 | 7.80 | 77.00 | 4.80 | 0.62 | 4.90 |
| | 75 | | 36.00 | 7.90 | 75.00 | 4.70 | 0.96 | 4.90 |
| | 100 | | 37.00 | 8.10 | 75.00 | 4.70 | 0.96 | 5.10 |
| | Mean | | 35.00 | 7.90 | 75.60 | 4.71 | 0.97 | 4.97 |
| | 50 | Bio | 36.00 | 7.90 | 78.00 | 4.90 | 0.99 | 5.10 |
| | 75 | | 38.00 | 8.10 | 76.00 | 4.90 | 0.97 | 5.10 |
| | 100 | | 38.00 | 8.20 | 76.00 | 4.60 | 0.97 | 5.30 |
| | Mean | | 37.30 | 8.06 | 77.00 | 4.73 | 0.98 | 5.70 |
| 10 | 50 | 0 | 39.00 | 8.50 | 79.00 | 5.30 | 1.20 | 5.30 |
| | 75 | | 42.00 | 8.60 | 78.00 | 5.50 | 1.30 | 5.30 |
| | 100 | | 42.00 | 8.60 | 77.00 | 5.40 | 1.30 | 5.50 |
| | Mean | | 41.30 | 8.53 | 78.00 | 5.40 | 1.28 | 5.30 |
| | 50 | Bio. | 40.00 | 8.70 | 76.00 | 5.60 | 1.30 | 5.60 |
| | 75 | | 43.00 | 8.70 | 75.00 | 5.50 | 1.40 | 5.80 |
| | 100 | | 42.00 | 8.90 | 75.00 | 5.40 | 1.40 | 5.80 |
| | Mean | | 42.00 | 8.80 | 75.30 | 5.50 | 1.33 | 5.70 |
| LSD. 5 % N fertilizer | | | 4.40 | ns | ns | ns | ns | ns |
| Compost | | | 4.10 | 1.40 | 5.10 | 0.51 | 0.21 | 0.72 |
| Bio-fertilizer | | | 1.40 | ns | ns | ns | ns | ns |
| N+ compost | | | ns | ns | ns | ns | ns | ns |
| N+ biofertilizer | | | ns | ns | ns | ns | ns | ns |
| Comp+ Bio- | | | 1.50 | ns | ns | ns | ns | ns |
| N+ Comp+ Bio | | | ns | ns | ns | ns | ns | ns |

Data in Table (4) declared that soil available micronutrients (Fe, Mn and Zn) content were not affected by addition of mineral N fertilizer. These results confirm with data obtained by Abou El-Eanien *et al.* (2008) and Eida *et al.* (2008), who reported that N, P and K application produce little effect on available micronutrients compared to untreated soil. Compost addition increased available Fe, Zn and Mn with little differences between two rates of application. The highest available micronutrients contents occurred with the 10 Mg $fed^{-1}$ compost addition. Baldwin and Shelton (1999) pointed out that, Zn and Cu linearly related to the application rate of municipal solid waste and biosolids compost. Weber *et al* (2007) indicated that available Zn increased with application rate of different composted material. Another study was conducted by Eida *et al* (2008) indicated that addition rice straw compost and municipal, solids waste compost had positive effect on soil available Fe, Zn and Mn contents.

## Nutrient concentration of grain and straw: Macronutrients.

The effect different mineral N rates on nutrients of concentrations of wheat grains and straw are shown in Table (5). The N concentration in grains and straw increased significantly by increasing N fertilizer addition up to 100 kg $Fed^{-1}$; binge 1.37 and 0.55 % respectively where 50 kg N $fed^{-1}$ had been added then reached 2.13 and 0.63 % at 100 kg N $fed^{-1}$. The concentration of P in grains and straw was not significantly affected by increasing N rates. Increasing N fertilizer rates addition increased K concentration significantly of grains and straw from 0.34 and 1.27 % at 50 kg N $fed^{-1}$ to 0.45 and 1.54 % at 100 kg N $fed^{-1}$. Compost addition increased N, P and K concentration of grain and straw significantly compared with 50.kg N $fed^{-1}$. The N concentration in grains and straw increased from 1.70 and 0.52 % respectively, where 0.71and 2.27 % with the treatment received no compost, while addition of 10 Mg compost $fed^{-1}$. The P concentration increased from 0.20 and 0.24 for grains and straw respectively in control to 0.33 and 0.39 % at 10 Mg compost $fed^{-1}$. The K concentration in grains and straw increased significantly from 0.26 and 0.96 % for control respectively to 0.43 and 1.73 % at 10 ton compost $fed^{-1}$.

In this concern Abed Elatif *et al* (2010) and Eisa (2010) recorded that N, P and K concentration of both wheat grains and straw increased significantly with compost and their concentration increased with increasing rate of compost. Rodd *et al* (2002) and Wahdan (2004) stated that addition N fertilizer and compost increased the concentration of N, K, Mn and Zn.

Data in Table (5) indicated that N percentage of grain and straw increased significantly by bio-fertilizer addition compared with control (without bio-fertilizer). The N concentration increased from 1.75 and 0.58 for grain and straw respectively where no bio-fertilizer added to 2.13 and 0.70 % in the same order where bio-fertilizer was added.

This may be due to the role of nitrogen fixation bacteria on increasing N availability in root zone and also increasing endogenous phytohormons (IAA, GAs) which play an important role on formation a big, active root system; increasing nutrient uptake and translocation and accumulation in a different part of plant (El-Kouny *et al.* 2007) and Zaki *et al.* (2012). These results are in agreement with those obtained by Shaban and Omar (2006). The effect of bio-fertilizer on P and K concentration was not significant.

The interaction between mineral N fertilizer and compost showed significant affect one N and K of wheat grains and straw where their highest value was 2.40 and 1.71 % respectively for grains and 0.79 and 1.71 % for straw in same order where 100 kg N $fed^{-1}$ and 10 Mg $fed^{-1}$ compost was added. However non significant difference between this treatment and 75 kg N $fed^{-1}$ and 10 Mg compost $fed^{-1}$ were occurred. These results are on line with those indicated by Singh *et al* (2002) , Wahdan (2004) Sarwasr *et al* (2009) , Awad and Khaled (2012) and Zaki *et al* (2012).

**Table (5). Effect of compost, mineral N fertilizer and bio-fertilizer on N, P and K concentration of wheat grains and straw, (mean combined of two seasons).**

| Rate of compost Mg fed$^{-1}$ | Mineral N kg fed$^{-1}$ | Bio. | Grain (%) | | | Straw (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | N | P | K | N | P | K |
| 0 | 50 | 0 | 1.50 | 0.20 | 0.24 | 0.45 | 0.22 | 0.88 |
| | 75 | | 1.60 | 0.20 | 0.26 | 0.51 | 0.24 | 0.95 |
| | 100 | | 1.80 | 0.22 | 0.26 | 0.55 | 0.24 | 0.99 |
| | Mean | | 1.65 | 0.20 | 0.25 | 0.50 | 0.23 | 0.94 |
| | 50 | Bio | 1.60 | 0.21 | 0.26 | 0.48 | 0.25 | 0.88 |
| | 75 | | 1.75 | 0.21 | 0.28 | 0.55 | 0.25 | 0.96 |
| | 100 | | 1.90 | 0.23 | 0.28 | 0.58 | 0.26 | 0.96 |
| | Mean | | 1.75 | 0.21 | 0.27 | 0.54 | 0.25 | 0.93 |
| 5 | 50 | 0 | 1.63 | 0.25 | 0.35 | 0.50 | 0.32 | 1.31 |
| | 75 | | 1.85 | 0.28 | 0.35 | 0.56 | 0.35 | 1.55 |
| | 100 | | 2.10 | 0.29 | 0.36 | 0.58 | 0.34 | 1.75 |
| | Mean | | 1.86 | 0.27 | 0.35 | 0.55 | 0.37 | 1.54 |
| | 50 | Bio | 1.73 | 0.27 | 0.36 | 0.61 | 0.35 | 1.32 |
| | 75 | | 1.96 | 0.29 | 0.37 | 0.65 | 0.36 | 1.60 |
| | 100 | | 2.20 | 0.29 | 0.37 | 0.66 | 0.36 | 1.80 |
| | Mean | | 1.94 | 0.28 | 0.36 | 0.64 | 0.35 | 1.57 |
| 10 | 50 | 0 | 1.98 | 0.29 | 0.45 | 0.65 | 0.37 | 1.63 |
| | 75 | | 2.25 | 0.32 | 0.48 | 0.71 | 0.39 | 1.78 |
| | 100 | | 2.35 | 0.37 | 0.48 | 0.72 | 0.39 | 1.89 |
| | Mean | | 2.01 | 0.32 | 0.47 | 0.69 | 0.38 | 1.73 |
| | 50 | Bio. | 1.99 | 0.31 | 0.48 | 0.66 | 0.38 | 1.63 |
| | 75 | | 2.35 | 0.34 | 0.49 | 0.72 | 0.40 | 1.80 |
| | 100 | | 2.45 | 0.38 | 0.51 | 0.74 | 0.40 | 1.90 |
| | Mean | | 2.20 | 0.34 | 0.49 | 0.71 | 0.39 | 1.70 |
| LSD. 5 % N fertilizer | | | 0.11 | ns | 0.12 | 0.031 | ns | 0.11 |
| Compost | | | 0.10 | 0.05 | 0.04 | 0.042 | 0.03 | 0.19 |
| Bio-fertilizer | | | 0.30 | ns | ns | 0.020 | ns | ns |
| N+ compost | | | 0.12 | 0.05 | 0.02 | 0.035 | ns | 0.20 |
| N+ biofertilizer | | | ns | ns | ns | ns | ns | ns |
| Comp+ Bio- | | | 0.10 | ns | ns | 0.05 | 0.031 | ns |
| N+ Comp+ Bio | | | 0.30 | ns | 0.25 | 0.055 | ns | ns |

## Micronutrients content in grains and straw:

The Fe, Zn and Mn concentration in wheat grains and straw increased significantly by increasing N fertilizer addition; the highest concentration was occurred by 100 kg N addition fed$^{-1}$. Table (6) show that the relative increase was 30.0, 30.1 and 38 % and 37.2, 33.38 and 15.97 for straw respectively compared to addition of 50 kg N fed$^{-1}$

**Table (6). Effect of compost, mineral N fertilizer and bio-fertilizer on Fe, Mn and Zn concentration of grains and straw wheat, (mean combined of two seasons).**

| Rate of compost Mg fed$^{-1}$ | Mineral N kg fed$^{-1}$ | Bio. | Grain (mg kd$^{-1}$) | | | Straw (mg kd$^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Fe | Zn | Mn | Fe | Zn | Mn |
| 0 | 50 | 0 | 34.00 | 16.00 | 24.00 | 81.00 | 21.00 | 32.00 |
| | 75 | | 40.00 | 19.00 | 26.00 | 90.00 | 25.00 | 35.00 |
| | 100 | | 45.00 | 21.00 | 30.00 | 97.00 | 27.00 | 36.00 |
| | Mean | | 39.50 | 18.60 | 26.60 | 89.00 | 24.00 | 34.30 |
| | 50 | Bio | 35.00 | 17.00 | 24.00 | 82.00 | 20.00 | 33.00 |
| | 75 | | 41.00 | 18.00 | 27.00 | 93.00 | 26.00 | 36.00 |
| | 100 | | 45.00 | 22.00 | 32.00 | 98.00 | 29.00 | 37.00 |
| | Mean | | 40.60 | 16.90 | 29.00 | 91.00 | 25.00 | 35.30 |
| 5 | 50 | 0 | 40.00 | 20.00 | 28.00 | 108.00 | 27.00 | 36.00 |
| | 75 | | 46.00 | 23.00 | 35.00 | 120.00 | 32.00 | 39.00 |
| | 100 | | 49.00 | 28.00 | 37.00 | 125.00 | 37.00 | 43.00 |
| | Mean | | 45.00 | 23.60 | 33.00 | 117.00 | 32.00 | 39.30 |
| | 50 | Bio | 41.00 | 21.00 | 29.00 | 112.00 | 26.00 | 35.00 |
| | 75 | | 45.00 | 24.00 | 35.00 | 123.00 | 33.00 | 38.00 |
| | 100 | | 52.00 | 29.00 | 38.00 | 129.00 | 38.00 | 44.00 |
| | Mean | | 46.00 | 24.60 | 34.00 | 121.00 | 32.00 | 39.00 |
| 10 | 50 | 0 | 43.00 | 23.00 | 32.00 | 115.00 | 28.00 | 38.00 |
| | 75 | | 49.00 | 27.00 | 38.00 | 128.00 | 36.00 | 41.00 |
| | 100 | | 60.00 | 36.00 | 41.00 | 131.00 | 36.00 | 46.00 |
| | Mean | | 50.60 | 28.60 | 37.00 | 124.00 | 34.30 | 41.60 |
| | 50 | Bio. | 47.00 | 22.00 | 33.00 | 118.00 | 29.00 | 39.00 |
| | 75 | | 51.00 | 28.00 | 39.00 | 130.00 | 37.00 | 43.00 |
| | 100 | | 63.00 | 37.00 | 43.00 | 133.00 | 40.00 | 48.00 |
| | Mean | | 53.6 | 29.00 | 38.70 | 127.00 | 36.00 | 43.70 |
| LSD. 5 % N fertilizer | | | 5.20 | 1.50 | 2.30 | 4.10 | 3.20 | ns |
| Compost | | | 4.10 | 2.30 | 4.20 | 6.10 | 4.30 | 2.10 |
| Bio-fertilizer | | | ns | ns | ns | ns | ns | ns |
| N+ compost | | | 5.40 | 4.30 | 3.10 | 6.10 | 4.50 | ns |
| N+ biofertilizer | | | ns | ns | ns | ns | ns | ns |
| Comp+ Bio- | | | 4.30 | ns | ns | ns | ns | ns |
| N+ Comp+ Bio | | | 5.10 | 5.20 | ns | 7.1 | 5.2 | ns |

Increasing compost addition from 5 to 10 Mg $fed^{-1}$ increase Fe, Zn and Mn concentrations in grain and straw significantly. The relative increases of micronutrients concentration in grains were 13.75 and 30.25 % for Fe; 27.32 and 61.80 % for Zn and 33.50 and 37.5 % for Mn due to addition of 5 and 10 Mg $fed^{-1}$ compost respectively, while the relative increase micronutrients concentration in straw were 32.2 and 38.90 % for Fe; 32.0 and 42.9 % for Zn and 18.38 and 21.73 % for Mn in the same order. The interaction effect between N mineral fertilizer and compost was significant only for Fe and Zn concentration in grains and straw , where their highest values were 62.0 and 39.0 mg $kg^{-1}$ for grain and 132 and 39 mg kg respectively for straw due to addition of 100 kg N $fed^{-1}$ + 10 Mg compost $fed^{-1}$. El-Galla *et al.* (1990) mentioned that dissolved organic matter in compost was well known to enhance plant growth due its maintenance of Fe, Mn, Cu and Zn in soil solution at different levels. Rodd *et al.* (2002) pointed out that concentration and uptake of Fe, Zn, Mn and Cu of shoot, straw and grain of wheat plants increased due to addition of mineral and organic fertilizer. These data confirm with the data obtained by El-Sowfy and Osman (2009), Paraas *et al.* (1990) and Sarwar *et al.* (2009).

## Conclusion

It could be concluded that the soil application of compost (10 ton /fed) mineral N fertilizer (100 kg N /fed) and bio-fertilizer significantly product the higher production of straw and grain yield. Also, the interaction between the used levels of chemical fertilizes and compost or bio-fertilizers induced a significant increase in grain, straw yield and their mineral contents. Combined use of organic fertilizer and chemical fertilizer not only save mineral fertilizer , but also contribute to improve plant nutrients contents and increased their availability in soil, thus, causing a positive effect on wheat production . Results reported that higher yield and nutrients concentration of wheat grain and straw could be obtained at rate 100 kg N /fed + 10 ton compost + bio-fertilizer without significant difference between this treatment and 75 kg N/fed + 10 ton /fed + bio-fertilizer. It is worth to mention that, integrated use of organic manure and mineral N fertilizers has been found to be more sustainable and promising in maintaining stability in crop production on sandy soil while solely organic and mineral N fertilizer can not sustain the high yield.

## REFERENCES

Abbas, H.H., E. H. D. Noufal, I. M. Farid and I. M. E. Ali (2006). Organic manuring and bio-fertilization approach as potential economic and safe substitutes for mineral nitrogenous fertilization. Egypt. J. Soil. Sci. 46 (2): 219-223.

Abd- El-Latif, K. M., K. M. El-Din porass and T. A. Abou El-Dofan (2010). Assessment the role of some compost and their residual effect on growing crops. J. Agric. Sci. Mansoura Uin. 35 (1): 237- 246.

Abou El-Enein, S.M., T.M. Mosalm, S.A.A. Eraies and M.H. AbdEl-All (2008). Effect of composted plant residues on the availability of some nutrients in newly reclaimed soils. Egypt. J. Soil Sci. 48 (3): 293- 304.

Ahmed, M. K. A. (2001). Effect of bio-fertilization and sulfur on yield of tow barely cultivars grown in newely reclaimed sandy soil. J. Agric. Sci. Mansoura. Unv. 26 (5): 2611-2615.

A.O.A.C (1990). Official Methods of Analysis of Association of Official analysis Auricular Chemists, 15th Ed Washington, D.C.U.S.A.

Ashmaya, S. H., A. Sh. Khale and Mona G. Abd El-Kader (2008). Effect of mineral nitrogen , sulphure, organic and bio-fertilizations on maize productivity in saline soil of Sahl El-Tina. Minufiya J. Agric. Res. 33 (1): 195 – 209.

Awad, M. N. and S.M. Khaled (2012). Maximizing of mineral fertilizers by compost and bio-fertilizer. Aust. J. Basic. and Appl. Sci, 6 (10): 482- 493.

Baldwin, K.R. and J. E. Shelton (1999). Availability of heavy metals in compost amendmended soil. Bioresource Technologey 64: 1 – 14.

Eida, M. F., H. K. Abd El-Maksoud, A.M. Abu El-Khir, M.A. Attis and M. A. El-Khamah (2008). Soil characteristics after growing compost amended vegetable. Egypt. J. Soil Sci. 48 (1): 31- 44.

El-Afandy, Kh. T. (1995). Physiological response of wheat under different levels of organic matter and nitrogen fertilization and its effect on yield and grain quality in south Sinai. Ph.D. Thesis. of Agric. Ain Shams. Univ.

El-Esh, I. F. I. (2007). Effect of both mineral and bio-fertilization on yield and quality of wheat. Ph. D. Thesis. Fac. Agric. Alex. Univ., Egypt.

El-Gala, A. M., O. M. Aly and E. M. El-Sikhry (1990). Effect of certain soil amendments on availability of Fe, Mn , Zn and Cu to sorghum plants. Egypt. J. Soil Sci, 30: 301- 312

El-Kouny, H. M. (2007). Effect of organic manure and bio-fertilizer on wheat grown in lacstrin soil as compared with mineral fertilizer. Egypt. J. Soil. Sci. 47 (3): 263.-280.

El-Sowfy, M. and A. T. Osman (2009). The effect role of organic manure and Ascorbic acid for inhibitory the impact of soil salinity stress under the newly reclaimed soil conditions. Egypt, J. Soil Sci 49 (3): 479- 504.

El-Zaher, H., A.M. Awad and M. A. Salem (2001). Combined effect of farm yard manure and N- fertilizer on wheat production, N, P and K contents and N use efficiencies under highly calcareous soils conditions. J. Agric. Sci. Mansoura Univ. 26 (12): 8222: 8245.

Ewees, M. S. and A. A. Abdel Hafeez (2010). Response of maize grain yield to partial substitution of N- mineral by applying organic manure, bio-inoculation and elemental sulphur as an alternative strategy to avoid the possible chemical pollution. Egypt. J. soil. Sci. 50 (1): 141-166.

Ewees, M.S., A. Sh. Osman and Dalia M. El-Sowfy (2008). Significant of applied organic manure combined with N-mineral fertilizer to alleviate the possible risks of chemical pollution for broccoli. Egypt. J. Soil Sci. 48(3): 343- 342.

Gagnon, B., R. R. Simand, R. B. Robitaill, M. Goulet and R. Rioun (1997). Effect of compost and inorganic fertilizer on spring wheat growth and N uptake. Cand. J. soil. Sci. 86: 487- 495.

Gharib, F.A., L. A. Moussa and O.N. Massoud (2008). Effect of compost and bio-fertilizer on growth, yield and essential oil of sweet majoram *Majorana hortensis* L. Plant . Inter. J. of Agric. and Biol. 10 (4): 381 – 387.

Hamissa, M. R. and A. T. A. Moustafa (1998). Fertilizer management practices for wheat using tracer technique for nitrogen and phosphorus. Adv. Agric. Res. Egypt. Special . Issue 1: 23- 64.

Hassouna, M. G. and M.A. Hassanine (1997). The use of bio-fertilizer (Halex) to increase wheat yield in calcareous soil of Egypt. Alx. Sci. Exch. 17: 175-181.

Hues, N. V. and B.A. Sobiezyk (1994). Nutrition values of some biowastes as soil amendments. Compost Soil. Sci. and Utilization. 7: 34-41.

Jakson, M.L. (1978). Soil Chemical Analysis. Constable and Co. London , England

Khater, E. A., S. B. Ibrahim and A. A. Awadalla (2004). Utilization of some farm organic wastes for improving soil productivity of the newly reclaimed areas at El-Fayoum Governorate, Egypt. Egypt. J. Soil Analyisis. 44 (3): 333- 342.

Lindsay, W.L. and W.A. Norveli (1978). Develoment of DTPA test for Zinc , Iron , Manganese and Copper . Soil. Sci. Soc. Am. J. 42: 421.

Metwally, Sh. M. and M. A. Khamis (1998). Comparative effect of organic and inorganic nitrogen sources applied to a sandy soil on availability of N and wheat yield. Egypt, J. Soil Sci. 38 (4): 35 – 54.

Metwally, S. Ch. (2000). Fertilizer use efficiency of wheat as affected by microbial inoculation and soil conditions. Ph. D. Thesis Fac. of Agric. Tanta, Univ.

Nasef, M. A., Kh. A. Shaban and Amal F. Alftah (2009). Effect of compost, compost tea and bio-fertilizer application on some chemical soil properties and rice peoductivity under saline soil condition. J. Agric. Mansoura Univ. 34 (4): 2609-2623.

Oken, Y. (1982). Azospirillium physiological properties, mode of association with roots and its application of the benefit at cereal and forage grass crops. Isr, J. Bot. 31: 214-220.

Ouedrago, E., A. Manddo and N. P. Zombre (2001). Use of compost to improve properties and crop productivity under low input agricultural system in Wast Africa, Agric, Ecos. and Envir. 48: 259-260.

Paraas, M. M., Amany M. Salam, Kh. A. Shaban and A. Tarek (2009). Using soil amendments and N2-fexer Bacteria in improving the quality and yield of wheat grains as well as some characteristics of Sahl-El-Tina saline soil (North –Sinai). Egypt. J. Soil Sci. 49 (2):255-270.

Rodd, A.V., P. H. Cklenton and K. Webb (2002). Comparison of N fertilizer, source separated municipal solid waste compost and semi- solid beef manure on the nutrient concentration in boat stage barly and wheat tissue . Con. J. Soil Sci. 82 : 3- 43.

Shaban, Kh. A. and A. H. Abd El-Rahman (2007). Effect of mineral nitrogen rates and bio-fertiliation on some soil properties and wheat productivity as Sahl El-Tina. Minufiya J. Agric. Res. 32. (3): 933- 943.

Shaban , Kh. A. and M. N. Omar (2006). Improvement maize yield and some soil properties by using nitrogen mineral and PGPR group fertilization in newly cultivated saline soils. Egypt. J. soil. 46 (3): 329-342.

Salib, M. M. (2002). The integrated effect of humic acid and micronutrient in soil. Zagazig. J. Agric. Res. 29 (6): 2033-2050.

Sarwar, H., H. Schmeisky, N. Hassain, S. Mohammad, M. A. Tahir and U. Saleem (2009). Variations in nutrient concentration of wheat and paddy as affected by different levels of compost and chemical fertilizer in normal soil. Pak. J. Bot. 41 (5): 2403- 2410.

Singh, S., R.N. Singh, J. Prasad and B. Kumar (2002). Effect of green manuring , FYM and bio-fertilizer in relation to fertilizernitrogen on yield and major nutrient uptake by upland rice. J. of the Indian Soci. of Soil Sci. 50 (3): 313 – 314.

Suzan, A.K.I. (2007). Effect of ouxin levels and phosphors bio-fertilization on wheat yield and its components. M. Sci. Thesis . Fac. of Agric. Alexan. Unv. Egypt.

Tran, T.S. and T. Gilles (2000). Recovery of $N^{15}$ – labeled fertilizer by spring bread wheat at different N rate and application times. Can. J. Soil Sci. 80: 533-539.

Ulluck, L. R. and J. B. Restaino (2002). Synthetic and organic amendment affect southern blight , soil microbial communities and yield of processing tomatoes. J. Phytopathology. 92: 181 – 189.

Wahdan, M. E. (2004). Effect of bio-fertilizers in minimizing mineral fertilizers and improving sandy soil properties. M. Sc. Thesis. Fac. of Agric. Ain Shams. Univ.

Weber, J., A. Karczewska, J. Dozd and A. Kocowicz (2007). Agricultural and ecological aspects of a sandy soil as affected by the application of municipal solid was compost. Soil. Biol. Of Bioch. 39: 1294- 1302.

Zaki, N. M., M. S. Hassnein and K. M. Gamal El-Din (2007). Growth and yield cultivars irrigated with saline water in newly cultivated land as affected by bio-fertilization. J. of Appl. Sci. 10: 1121-1126.

Zaki, N. M., M.S. Hassanein, A.M. Gomaa, F.S. Radwan and A.M. Walli (2012). Effect of mineral, organic and bio-fertilizer on yield, yield components and chemical composition of some wheat cultivars. J of Appl. Sc. Res. 8 (1): 174-191.

Zeidan, E.M., I. M. Abd –El-Hamed, A. H. Bassiouny and A. A. Wally (2009) Effect of irrigation intervals, nitrogen and organic fertilization on yield and yield attributes and crud protein content of some wheat cultivars under newly reclaimed saline soil conditions. 4th Conference on Recent Technologies in Agriculture, 2009.

# نمو القمح فى ارض رملية متاثره بانواع مختلفة من التسميد النتروجينى

**فاتن عبدالعزيز الكمار**

معهد بحوث الاراضى والمياه والبيئة – مركز البحوث الزراعية – الجيزة – مصر

**الملخص العربى**

اجريت تجربة حقلية فى محطة البحوث الزراعية فى منطقة الاسماعلية خلال موسمى ٢٠١١/ ٢٠١٢ و ٢٠١٢ /٢٠١٣ لدراسة تاثير اضافة النتروجين المعدنى بمعدلات ٥٠و ٧٥ و ١٠٠ كجم نتروجين للفدان والكبوست بمعدل 0و ٥ و ١٠ طن للفدان والسماد الحيوى بدون اضافة وملقح بالبكتريا المثبتة للنتروجين على انتاجية محصول القمح صنف سخا ٩٣ وصفاته وعلى خصوبة التربة.

اوضحت النتئج ان جميع الاسمدة المضافة ادت الى زيادة معنوية بالنسبة للكنترول. وزيادة معدلات النتروجين الى ١٠٠ كجم نتروجين للفدان اعطت اعلى زيادة بالنسبة للمعدلات الاخرى وقد وجد ان زيادة الكمبوست الى ١٠ طن للفدان اعطى زيادة معنوية عن اضافة ٥ طن للفدان وايضا التسميد الحيوى قد اعطى زيادة معنوية للمحصول مقارنة بدون تسميد . كانت اعلى زيادة معنوية بالنسبة للمحصول الحبوب والقش عند اضافة ١٠٠ كجم نتروجين للفدان + ١٠ طن كمبوست للفدان مع اضافة السماد الحيوى بدون فرق معنوى بين تلك المعاملة وبين اضافة ٧٥ كجم نتروجين للفدان + ١٠ طن كمبوست للفدان + اضافة السماد الحيوى . ادت اضافة النتروجين المعدنى الى زيادة نسبة النتروجين والبوتاسيوم والحديد والزنك والمنجنيز فى الحبوب والقش ولم تؤثر معنويا على نسبة الفوسفور فى الحبوب والقش. ادت اضافة ١٠٠ كجم نتروجين + ١٠ طن كمبوست اعلى زيادة معنوية بالنسبة للنتروجين و البوتاسيوم والحديد والزنك بدون فرق معنوى عند اضافة ٧٥ كجم نتروجين + ١٠ طن كمبوست + سماد حيوى.

لم يؤدى زيادة اضافة السماد النتروجين الى زيادة معنوية فى قيم النتروجين والفوسفور والحديد والزنك والمنجنيز الميسر فى الأرض بينما لوحظ انخفاض فى قيم البوتاسيوم الميسر .

ادت اضافة الكمبوست الى زيادة معنوية فى قيم جميع العناصر الكبرى والصغرى السابقة.