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# Effect of the complete foliar fertilizer nitrophoska foliar 20 /19/19/TE on growth, yield, yield components and some chemical composition of tow barley cultivars under newly reclaimed sandy soil

**Amal G. Ahmed, Nabila M. Zaki, M. S. Hassanein and Manal F. Mohamed**

*Field Crops Research Department, National Research Centre, 33 El-Bohouth St., (former El- Tahrir St.,) Dokki, Giza, Egypt. Postal Code: 12622.*

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## ABSTRACT

Two field experiments were carried out at private farm in Wadi El-Rayyan, El-Fayoum Governorate, Egypt, in 2013/2014 and 2014/2015 seasons, to study effect of the compete foliar fertilizer compound Nitrophoska foliar 20/19/19TE on growth and yield of the two barley cultivars Giza-132 and Giza-127 under newly reclaimed sandy soil. Results could be summarized as follows: Giza-132 cultivar significant surpassed Giza-127 cultivar in growth characters at 80 and 100 days from sowing, except weight of spikes g/m$^2$ at 100 days from sowing, also, yield and its components were significant except straw yield ton/ fed. Where increment of Giza-132 than Giza-127 failed to reach the significant level at 5%. Foliar spraying with Nitrophoska foliar 20/19/19/TE show that foliar spraying with 300 cm Nitrophoska foliar/ 100 L water produced the highest significant values from growth characters at 80 and 100 days from sowing also yield and its components compared with other foliar treatments under study and control. The interaction between barley cultivars and foliar spraying indicated that all treatments under study were significant in growth characters at 80 and 100 days from sowing and yield and its components except straw yield. It is clear from results that the most effective treatment was Giza-132 barley cultivar sprayed with 300 cm Nitrophoska foliar 20/19/19/TE /100 L water.

***Key words:*** barley, cultivars, Nitrophoska foliar, growth characters, yield and its components.

## Introduction

Barley (*Hordeum spp*) was early grown in Egypt since the pre-dynastic period. Now it ranks the fourth in importance among the cereal crops grown in the world. It has been used for several purposes i.e. traditional feed source for animals and more than half of the total production is used for that, as a main source for malt in the brewing industry, and as cereal breakfast and bread, either alone or mixed with wheat, rye or oats. In addition, barley is grown at Sinai and the Northern West Coast zone. Emphasis is given to develop drought and salt tolerant varieties to be grown for such areas. To increase barley yield must raising the yield per unit area by adapting new varieties which excel the present ones and by improving the cultural practices of barley, to give the best production under local conditions. Barley is a widely cultivated cereal crop in the temperate regions. The crop is the most hardy of all the cereal grains. Its cultivation extends farther north than any other crop and at the sometime it can be cultivated in sub-tropical countries (Hussein *et al.,* 2013).

Increasing barley yield can be obtained through breeding programs to produce highly productive and quantitative gene forms; as well as; adjusting to mineral and bio-fertilizer respect to arrive to that strategy. Nitrophoska foliar 20/19/19/TE is a complete foliar fertilizer produced by SHOURA Chemicals Company. It contain, N 20%, P 19%, K 19 %, Mg 0.5 %, Mn 1000 ppm, Cu 400 ppm, B 130 ppm, S 0.3 %,Fe 1000 ppm, Zn 380 ppm and Mo 30 ppm. Foliar application techniques, as a particular way to supply macro and micro-nutrients could avoid these factors and results in rapid absorption. If applied properly, foliar spraying can be considered practical to supply nutritional plant requirements. Numerous studies confirmed positive response for the foliar application with the complete foliar, fertilizers (Hassanein and Ahmed, 1996; Shalaby, 2001, Ahmed and Ahmed, 2005 and Gomaa *et al.,* 2015).

**Corresponding Author:** Amal G. Ahmed, Field Crops Research Department, National Research Centre, 33 El-Bohouth St., (former El- Tahrir St.,) Dokki, Giza, Egypt. Postal Code: 12622.

Thus, the aim of this investigation was to study effect of Nitrophoska foliar fertilizer on growth, yield, yield components and some chemical composition of two barley cultivars under sandy soil.

## Material and Methods

Two field experiments were carried out during the two seasons of 2013/2014 and 2014/2015 at private farm in Wadi El-Rayyan Region, El-Fayoum Governorate; to study effect of foliar application with Nitrophoska foliar on growth, yield and yield components of two barley cultivars under newly reclaimed sandy soil. The experiment included eight treatments which were the combination of two barley cultivars, i.e. Giza-132 and Giza-127, and four foliar spraying treatments as follows:

1- Control (Tap water).
2-Foliar spraying with 200 cm Nitrophoska/ 100 liter water
3-Foliar spraying with 250 cm Nitrophoska/ 100 liter water
4-Foliar spraying with 300 cm Nitrophoska/100 liter water

Soil samples was taken at depth of 30 cm for mechanical and chemical analysis as described by Chapman and Pratt, (1961). The mechanical and chemical of the soil at the experimental site were illustrated in Table (1).

**Table 1:** Mechanical and chemical analysis of soil at experimental sites (Average of 2014 and 2015 seasons)

| Sand% | Silt% | Clay% | Texture | pH | O.M.% | Available N ppm | Available K ppm | Available ppm |
|---|---|---|---|---|---|---|---|---|
| 73.59 | 22.47 | 3.45 | Sandy | 8.00 | 0.49 | 84.00 | 134.00 | 12.5 |

Split plot design with four replications was used, where the two barley cultivars, i.e. Giza-132 and Giza-127 were allocated in the main plots, meanwhile, the four treatments of foliar application with Nitrophoska foliar were randomly allocated in the sub-plots. The experimental site was ploughed twice and divided into plots of 10.5 $m^2$. Each plot included 15 rows 3.5 m long and 0.2 m apart. Grain of barley were sown on the second week of November in the two seasons. Phosphorus at the rate of 150 kg $P_2O_5$/ fed in the form of super phosphate (15.5 % $P_2O_5$) was added before sowing. Other agriculture processes were performed according to normal practice recommended by Barley Research Dep., Agric. Research Centre.The complete fertilizer Nitrophoska foliar 20/19/19/TE was sprayed twice during the growth period (30 and 50 days after sowing). Foliar spray treatments were carried out using manual atomizer and liquid soap as wetting agent was added to spray in solution at a rate of 0.1 %; while; control plants were sprayed with water only. The volume of foliar solution was maintained just to cover completely the plant foliage till drip.

Samples of five guarded plants were taken random from the middle rows of each plot of the four replication to measure growth characters at 80 and 100 days from sowing, where; plant height "cm", number of tillers/$m^2$ , number of spikes/$m^2$ , spikes dry weight (g/ $m^2$), total dry weight (g/ $m^2$). Leaf area ($dm^2$) and leaf area index. Leaves area was determined according to Bremner and Taha, (1966), whereas, leaf area index (LAI) was determined according to Watson, (1952).

At harvest, 10 plants in the two central rows were taken at random from each plot to determine plant height (cm), number of tillers/ $m^2$, number of spikes/ $m^2$, weight of spikes g/ $m^2$.One $m^2$ was harvest to determine grain yield/ $m^2$ and grain index (g). Grain, straw and biological yields (ton/fed)were determined from the whole area of experimental unit and then converted to yield/ fed.Grain protein content was estimated as N % x 5.75 on dry weight basis where nitrogen % was determined by the micro – kjeldahl methods according to A.O.A.C., (1988). Carbohydrate % was determined according to Dubois *et al* (1956).

All data were subjected to statistical analysis according to procedure outlined by Gomez and Gomez, (1984). Treatments means were compared by L.S.D at 5% level test. Combined analysis was made for the two growing seasons as results followed similar trend.

**Results and Discussion**

**A-Growth parameters:**

*A-1-Cultivar differences:*

Data in Table (2) indicated that significant differences were observed between barley cultivars Giza-132 and Giza-127 in all growth characters. It is clear that barley Giza-132 surpassed the other cultivar Giza-127 in all growth characters under study, i. e. plant height, number of tillers/$m^2$ , number of spikes/$m^2$ , weight of spikes (g/ $m^2$), total dry weight (g/ $m^2$). Leaf area ($dm^2$) and leaf area index at 80 and 100 days from sowing.

It is worthy to mention that the differences between the two barley cultivars Giza-132 and Giza-127may be due to the genetic structure differences between cultivars Clark *et al.* (1997), Hassanein *et al.* (2014) and Zaki *et al* (2016).These results are in a harmony with those obtained by Abu-Grab *et al.* (2006), Koriem (2008) and Radwan *et al.* (2014) in wheat.

**Table 2:** Effect of cultivars and Nitrophoska foliar fertilizer on growth characters of barely at 80 and 100 days after sowing (Average of 2013/2014and 2014/2015 seasons).

| Characters / Treatments | Plant height (cm) | | No. of tillers($m^2$) | | No. of spikes($m^2$) | | Spikes dry wt. (g/$m^2$) | |
|---|---|---|---|---|---|---|---|---|
| | 80 | 100 | 80 | 100 | 80 | 100 | 80 | 100 |
| Cultivars | | | | | | | | |
| Giza 132 | 96.57 | 100.07 | 443.69 | 448.26 | 438.11 | 442.57 | 700.79 | 796.95 |
| Giza 127 | 86.01 | 90.60 | 437.99 | 442.83 | 433.27 | 437.78 | 709.00 | 788.36 |
| L.S.D. at 5% | 1.16 | 1.03 | 2.00 | 1.17 | 1.01 | 1.20 | 1.04 | 1.96 |
| Nitrophoska foliar fertilizer | | | | | | | | |
| Control | 83.19 | 87.84 | 434.28 | 438.38 | 428.45 | 433.30 | 712.18 | 780.34 |
| 200 cm/100L | 89.27 | 93.37 | 438.59 | 442.74 | 433.09 | 437.17 | 693.49 | 787.72 |
| 250 cm/100L | 93.88 | 97.36 | 442.99 | 448.05 | 438.54 | 442.41 | 702.60 | 796.61 |
| 300 cm/100L | 98.83 | 102.77 | 447.51 | 453.02 | 442.68 | 447.83 | 711.32 | 805.94 |
| L.S.D. at 5% | 1.15 | 1.90 | 1.18 | 1.21 | 1.30 | 1.73 | 1.10 | 2.13 |

***Table 2:*** *Cont.*

| Characters / Treatments | Total dry weight/plants (g/$m^2$) | | LA($dm^2$) | | LAI | |
|---|---|---|---|---|---|---|
| | 80 | 100 | 80 | 100 | 80 | 100 |
| Cultivars | | | | | | |
| Giza 132 | 1094.28 | 1194.51 | 31.21 | 32.63 | 2.84 | 2.98 |
| Giza 127 | 1083.98 | 1182.26 | 28.25 | 29.94 | 2.58 | 2.73 |
| L.S.D. at 5% | 2.11 | 2.10 | 0.49 | 0.89 | 0.09 | 0.12 |
| Nitrophoska foliar fertilizer | | | | | | |
| Control | 1070.23 | 1169.29 | 26.87 | 28.73 | 2.45 | 2.62 |
| 200 cm/100L | 1083.17 | 1180.67 | 28.80 | 30.46 | 2.63 | 2.78 |
| 250 cm/100L | 1095.33 | 1194.88 | 30.64 | 32.15 | 2.79 | 2.93 |
| 300 cm/100L | 1107.80 | 1208.71 | 32.61 | 33.81 | 2.97 | 3.08 |
| L.S.D. at 5% | 1.95 | 2.96 | 0.43 | 0.71 | 0.08 | 0.11 |

*A-2-Foliar Nitrophoska differences:*

Data in Table (2) illustrated that the effect of different treatments from Nitrophoska foliar 20/19/19/TE on growth characters i.e. plant height, number of tillers/$m^2$ , number of spikes/$m^2$ , weight of spikes (g/ $m^2$), total dry weight (g/ $m^2$). Leaf area ($dm^2$) and leaf area index of barley plants was significant at 80 and 100 days from sowing. Increasing foliar Nitrophoska rate from 200 cm/ 100 L to 300 cm / 100 L water increased growth characters compared with the control (untreated plant ), this increment in growth parameters may be due to that this compound contain N 20%, P19%, K 19%, Mg 0.5%, Mn 1000 ppm, Cu 400 ppm, B 130 ppm, S 0.3%, Fe 1000 ppm, Zn 380 ppm and Mo 30

ppm and these elements made positive effects on growth characters,where, the chemical fertilizers are industrially manipulated , substances composed of known quantities of nitrogen , phosphorus and potassium, and their exploitation causes air and ground water pollution by eutrophication of water bodies, Youssef and Eissa, (2014 ) and Ahmed *et al.* (2016).It is worthy to mention that the best foliar Nitrophoska for growth parameters was 300 cm/100L water.

These results are in a harmony with those obtained byAhmed *et al.* (2016).

*A-3-Interaction differences:*

Data in Table (3) indicated that the interaction between barley cultivars and foliar spraying with Nitrophoska Foliar 20 / 19 / 19/ TE was significant on all growth characters under study at 80 and 100 days from sowing in both seasons. It is clear that the greatest mean values from growth characters were Giza- 132 cultivar with 300 cm / 100 L water Nitrophoska foliar.

**Table 3:** Effect of interaction between cultivars x Nitrophoska foliar fertilizer on growth characters of barely at 80 and 100 days after sowing (Average of 2013/2014 and 2014/2015 seasons).

| Characters / Treatments | | Plant height (cm) | | No. of tillers (m2) | | No. of spikes (m2) | | Spikes dry wt. (g/m2) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 80 | 100 | 80 | 100 | 80 | 100 | 80 | 100 |
| Cultivars x Nitrophoska foliar fertilizer | | | | | | | | | |
| Giza 132 | Control | 90.17 | 95.32 | 438.16 | 441.38 | 430.76 | 436.24 | 688.15 | 784.84 |
| | 200 cm/100L | 95.28 | 98.37 | 440.50 | 445.30 | 435.80 | 439.20 | 696.19 | 791.72 |
| | 250 cm/100L | 98.37 | 101.34 | 445.52 | 450.61 | 440.72 | 444.36 | 706.56 | 800.57 |
| | 300 cm/100L | 102.44 | 105.26 | 450.59 | 455.76 | 445.16 | 450.49 | 712.25 | 810.65 |
| Giza 127 | Control | 76.21 | 80.37 | 430.39 | 435.38 | 426.14 | 430.36 | 736.21 | 775.83 |
| | 200 cm/100L | 83.25 | 88.38 | 436.69 | 440.18 | 430.38 | 435.13 | 690.78 | 783.71 |
| | 250 cm/100L | 89.39 | 93.38 | 440.45 | 445.48 | 436.36 | 440.47 | 698.64 | 792.65 |
| | 300 cm/100L | 95.21 | 100.28 | 444.42 | 450.28 | 440.20 | 445.17 | 710.39 | 801.23 |
| L.S.D. at 5% | | 2.01 | 1.99 | 1.82 | 1.95 | 2.00 | 2.01 | 2.03 | 2.02 |

***Table 3:****Cont.*

| Characters / Treatments | | Total dry weight/plants ($g/m^2$) | | LA (dm2) | | LAI | |
|---|---|---|---|---|---|---|---|
| | | 80 | 100 | 80 | 100 | 80 | 100 |
| Cultivars x Nitrophoska foliar fertilizer | | | | | | | |
| Giza 132 | Control | 1075.24 | 1177.24 | 28.47 | 30.05 | 2.59 | 2.74 |
| | 200 cm/100L | 1088.24 | 1186.20 | 30.08 | 31.95 | 2.74 | 2.92 |
| | 250 cm/100L | 1100.47 | 1199.40 | 32.18 | 33.70 | 2.93 | 3.07 |
| | 300 cm/100L | 1113.17 | 1215.19 | 34.11 | 34.83 | 3.11 | 3.17 |
| Giza 127 | Control | 1065.23 | 1161.34 | 25.28 | 27.42 | 2.30 | 2.50 |
| | 200 cm/100L | 1078.09 | 1175.13 | 27.52 | 28.97 | 2.51 | 2.64 |
| | 250 cm/100L | 1090.18 | 1190.36 | 29.09 | 30.60 | 2.65 | 2.78 |
| | 300 cm/100L | 1102.43 | 1202.22 | 31.12 | 32.78 | 2.83 | 2.99 |
| L.S.D. at 5% | | 1.90 | 2.05 | 0.65 | 0.73 | 0.16 | 0.19 |

**B- Yield, yield components and chemical composition:**

*B-1- Cultivar differences:*

Significant differences between the two barley cultivars were detected in Table (4) all characters under study except straw yield ton /feddan. Barley cultivar Giza-132 produced the highest value in plant height (cm), number of tillers/ $m^2$, number of spikes/ $m^2$, weight of spikes g/ $m^2$, grain yield g/ $m^2$, grain index (g),grain yield (ton/fed) , biological yield (ton/fed), protein percentage and carbohydrate percentage. These differences may be due to the genetic differences among the two cultivars, while the differences in 1000 grains weight (g) might be attributed to the variation in

translocation rate of photosynthate from leaves to the storing organs (grain).Similar finding were reported by Abu-Grab *et al.* (2006), Koriem (2008) in wheat, Ortiz *et al.* (2002 a, b) in barley, Ibrahim *et al.* (2011) and Radwan *et al.* (2014) in wheat.

The differences between the two barley cultivars in yield, yield components and chemical composition may be due to the differences in genetic structure between cultivars, addition to the differences between cultivars in glucose required for synthesis of different chemical constituents compound at different plant organs, to differences in carbon equivalent and partitioning of photosynthates between the plant organs (Ahmed *et al.* 2016).

**Table 4:** Effect of cultivars and nitrophoska foliar fertilizer on yield and its components of barely (Average of 2013/2014 and 2014/2015 seasons).

| Characters / Treatments | Plant height (cm) | No. of tillers (m2) | No. of spikes (m2) | Weight of spikes (g/m2) | Gain yield (g/m2) | Grain index (g) |
|---|---|---|---|---|---|---|
| Cultivars | | | | | | |
| Giza 132 | 104.11 | 443.12 | 437.69 | 874.91 | 525.95 | 39.05 |
| Giza 127 | 95.3 | 437.83 | 433.31 | 869.21 | 521.58 | 37.08 |
| L.S.D. at 5% | 2.01 | 1.90 | 1.50 | 2.00 | 1.09 | 0.80 |
| Nitrophoska foliar fertilizer | | | | | | |
| Control | 91.82 | 433.19 | 428.33 | 856.22 | 514.45 | 34.27 |
| 200 cm/100L | 98.29 | 437.96 | 432.37 | 867.30 | 520.93 | 37.18 |
| 250 cm/100L | 101.97 | 442.90 | 438.50 | 876.51 | 527.82 | 39.36 |
| 300 cm/100L | 106.75 | 447.84 | 442.81 | 888.22 | 531.86 | 41.44 |
| L.S.D. at 5% | 2.00 | 1.99 | 1.65 | 1.93 | 1.00 | 0.90 |

***Table 4:*** *Cont.*

| Characters / Treatments | Straw yield (ton/fed.) | Grain yield (ton/fed.) | Biological yield (ton/fed.) | Protein % | Carbohydrate % |
|---|---|---|---|---|---|
| Cultivars | | | | | |
| Giza 132 | 5.452 | 2.749 | 8.201 | 8.81 | 81.66 |
| Giza 127 | 5.417 | 2.622 | 8.038 | 8.67 | 81.05 |
| L.S.D. at 5% | n.s | 0.110 | 0.150 | 0.10 | 0.09 |
| Nitrophoska foliar fertilizer | | | | | |
| Control | 5.187 | 2.423 | 7.610 | 8.41 | 80.93 |
| 200 cm/100L | 5.363 | 2.633 | 7.997 | 8.71 | 81.21 |
| 250 cm/100L | 5.538 | 2.713 | 8.252 | 8.85 | 81.56 |
| 300 cm/100L | 5.648 | 2.772 | 8.420 | 8.99 | 81.74 |
| L.S.D. at 5% | 0.110 | 0.110 | 0.377 | 0.07 | 0.15 |

*B-2- Foliar Nitrophoska differences:*

Data in Table (4) observed that the effect of different treatments from Nitrophoska foliar 20/19/19/TE were significant on all yield characters under study as well as protein and carbohydrate i.e. plant height (cm), number of tillers/ $m^2$, number of spikes/ $m^2$, weight of spikes g/ $m^2$, grain yield g/ $m^2$,grain index (g),grain yield (ton/fed),straw yield (ton/ fed) and biological yield (ton/fed).It is clear from the data that Increasing foliar Nitrophoska rate from 200 cm to 250 cm to 300 cm / 100 L water increased all yield characters compared with the control (untreated plant ).The increment of yield and its components according to foliar spraying with Nitrophoska foliar 20/19/19/TE, may be due to that this compound contain N 20%, P19%, K 19%, Mg 0.5%, Mn 1000 ppm, Cu 400 ppm, B 130 ppm, S 0.3%, Fe 1000 ppm, Zn 380 ppm and Mo 30 ppm and these elements made positive effects on plant, where, the chemical fertilizers are industrially manipulated substances composed of known quantities of nitrogen , phosphorus and potassium, and their exploitation causes air and ground water pollution, besides, the foliar spraying with nutrients keep the fertilizer from lost.These results are reported by Bhardwaj *et al.* (2014) and Ahmed *et al.* (2016).

*B-3-Interaction differences:*

Table (5) indicated that effect of the interaction between barley cultivars and spraying with Nitrophoska Foliar 20/ 19/ 19/ TE was significant in all yield and its components characters except straw yield (ton/fed).It is clear from Table (5) that the most effective treatment on yield and its components and chemical composition is Giza-132 barley cultivar + foliar spraying with 300 cm Nitrophoska foliar20/ 19/ 19/TE.

Table 5: Effect of interaction between cultivars x nitrophoska foliar fertilizer on yield and its components of barely (Average of 2013/2014 and 2014/2015 seasons).

| Characters / Treatments | | Plant height (cm) | No. of tillers(m2) | No. of spikes(m2) | Weight of spikes(g/m2) | Gain yield (g/m2) | Grain index (g) |
|---|---|---|---|---|---|---|---|
| Cultivars x Nitrophoska foliar fertilizer | | | | | | | |
| Giza 132 | Control | 98.24 | 436.20 | 430.22 | 860.20 | 516.24 | 35.23 |
| | 200 cm/100L | 102.35 | 440.43 | 434.65 | 868.43 | 521.70 | 38.17 |
| | 250 cm/100L | 105.48 | 445.45 | 440.71 | 880.73 | 530.32 | 40.36 |
| | 300 cm/100L | 110.36 | 450.38 | 445.19 | 890.28 | 535.54 | 42.42 |
| Giza 127 | Control | 85.40 | 430.17 | 426.43 | 852.24 | 512.66 | 33.30 |
| | 200 cm/100L | 94.23 | 435.49 | 430.09 | 866.17 | 520.16 | 36.19 |
| | 250 cm/100L | 98.46 | 440.34 | 436.28 | 872.28 | 525.31 | 38.35 |
| | 300 cm/100L | 103.14 | 445.30 | 440.42 | 886.15 | 528.17 | 40.47 |
| L.S.D. at 5% | | 2.11 | 1.88 | 1.71 | 2.03 | 1.31 | 0.81 |

***Table 5:*** *Cont.*

| Characters / Treatments | | Straw yield (ton/fed.) | Grain yield (ton/fed.) | Biological yield (ton/fed.) | Protein % | Carbohydrate % |
|---|---|---|---|---|---|---|
| Cultivars x Nitrophoska foliar fertilizer | | | | | | |
| Giza 132 | Control | 5.187 | 2.412 | 7.599 | 8.53 | 81.23 |
| | 200 cm/100L | 5.387 | 2.712 | 8.099 | 8.78 | 81.51 |
| | 250 cm/100L | 5.570 | 2.811 | 8.381 | 8.89 | 81.92 |
| | 300 cm/100L | 5.663 | 2.913 | 8.576 | 9.02 | 81.98 |
| Giza 127 | Control | 5.187 | 2.420 | 7.607 | 8.28 | 80.63 |
| | 200 cm/100L | 5.340 | 2.620 | 7.960 | 8.63 | 80.90 |
| | 250 cm/100L | 5.507 | 2.697 | 8.203 | 8.81 | 81.19 |
| | 300 cm/100L | 5.633 | 2.750 | 8.383 | 8.95 | 81.50 |
| L.S.D. at 5% | | n.s | 0.140 | 0.300 | 0.08 | 0.02 |

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