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# The Influence of the Foliar Application of Urea, Licorice and Garlic Extract on Nutrients Uptake and Yield of Wheat Plants Grown on Sandy Soil. a Comparative Study.

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## ABSTRACT

The provision of the needs of Egypt's wheat is the hardest challenge in light of the widening gap between production and the increasing demands to this crop, especially with increasing population and water resources shortage in Egypt. So, two field experiments were conducted of urea fertilizer (1and 2 %), licorice (5 and 10%) and garlic extract (0.5 and 1%) as a foliar application on wheat aspects, N, K, P content and uptake under sandy soil conditions. The used experimental design was a complete randomized block design with three replicates. The treatments were added three times at 30, 45 and 60 days after sowing .The obtained results illustrated that the used treatments significantly affected wheat plant. The highest grains and straw yield values were recorded with 0.5 % garlic extract followed by 1 % garlic extract, then 2 % urea, while the lowest values were occurred with the control treatment in both seasons. The best biological yield values (5475.6 and 6359.34 kg $fed^{-1}$) in both seasons were found with the treatment of 0.5 % garlic extract. The total nitrogen content in straw was significantly affected by all used treatments where, it increased with the treatments of 1 % urea, 2% urea followed by 0.5 % garlic extract and decreased significantly with the treatment of 10% licorice extract compared with the control. The all used treatments were significantly increased potassium uptake by grains and straw compared with the control treatment. Phosphorus uptake in grains was significantly increased with increasing urea, garlic extract concentration and 5 % licorice extract while, it decreased with the treatments of 10 % licorice extract. Finally, it could be concluded that natural garlic extract is the best for enhancing wheat plant production and at the same time reducing the use of urea as a chemical fertilizer.

**Keywords :** wheat – urea – garlic extract –licorice extract.

## INTRODUCTION

Increasing production of cereal plants, especially wheat *(Triiicam aestivum L.)* is a native goal to meet the consistent demands from this crop, especially with the increase of population and water resources shortage in Egypt. Nitrogen fertilizers play a vital role in increasing wheat production, but it has been lost from the soil system through volatilization, leaching and denitrification. Foliar fertilization which, nutrient supplementation through leaves, is an efficient technique of fertilization that is enhances the availability of nutrients especially nitrogen fertilizers in sandy soils and enhance its economic benefits (Khan *et al*., 2009). Several researchers reported that urea fertilizer as a foliar application increased wheat production and nutrients uptake, Nasef (2004), Khan *et al.,* (2009), Yassen *et al.,*(2010), Njuguna *et al.,* (2011), Saleem *et al.,* (2013). In spite of this, urea fertilizer contains biuret which consider a phototoxic for plants if it increased up 0.3 % (Jain *et al.,* 1972) and biuret could also affect different metabolic processing (Mikkelsen, 1990). On the other hand, several studies stated that natural extracts such as garlic and licorice extracts had been affected the production and growth parameters of plant. Under water stress, Hammad (2008) found that the application of natural garlic extract caused significant increases in most tested parameters compared with control plants. The interactive effect of drought stress and the usage of natural substances resulted in significant increases in growth parameters, photosynthetic pigments, N, P and K content in leaves, enzymes activity and proline concentration compared with untreated plants. Morsy *et al.,* (2009) stated that garlic extracts significantly improved all growth characteristics of cucumber plant and they found that garlic extract can be used to alleviate biotic and abiotic stresses. Hussein *et al.,* (2014) reported that garlic extract significantly increased the yield of tomato in the first season and they also found that garlic extract gave the highest values of total phenolic compounds (TPCs) and total flavonoids (TFs) in treated tomato leaves. On soybean *(Glycine max L.)* plant, Mohamed and AkJadious (2014) decided that foliar spray with two concentrations of garlic extract (400 and 600 ppm) enhanced shoot and root length, leaf area, fresh and dry weight of shoots and roots and photosynthetic pigments i.e; chl a, chl b, carotenoids and total pigments. In addition Abd El-Hamied and El-Arnary (2015) decided that licorice extract at 4g $L^{-1}$ increased the leaf area, leaf mineral contents (nitrogen, phosphorus and potassium), chlorophyll, shoot length, shoot diameter in both seasons and garlic extract at 4% gave the highest number and percentage of healthy fruits. On the other side, Zuhair (2010) stated that 2g $L^{-1}$ of licorice root extract gave a significant increase of leaf area and foliage dry weight, while 4g $L^{-1}$ caused a significant increase in total chlorophyll content. Babilie, *et al.,* (2015) studied the effect of foliar spraying with different concentrations of Licorice roots (5, 10 and 15 g $L^{-1}$) on growth and seed production of the local red onion. They found that all used treatments significantly increased red onion parameters and the foliar spray with licorice root extract (15 g $L^{-1}$) was the best treatment in most studied indicators. They also decided that plant extract could potentially provide a safe alternative to chemical fertilizers and plant regulators. Additionally, these natural extracts could be protected plants from pathogens and pests. While, most of the previous studies were not on wheat and if it used on wheat plant it uses as a soaking. The main objective of this study was to compare the effect of foliar application of urea and garlic and licorice extracts on wheat yield and nutrients uptake under sandy soils conditions.

## MATERIALS AND METHODS

Two field studies were carried out during two successive growing seasons 2012/2013 and 2013/2014 to investigate the effects of different levels of urea fertilizer, licorice and garlic extracts on wheat biological aspects and nutrient uptake and competed between them. Loamy sandy soil was used and some chemical and physical properties of studied soil were listed in Table 1.

**Table 1. Some physical and chemical properties of the experimental soil.**

| Texture | $CaCO_3$ | pH | EC | Field capacity | Saturation | Available nutrients ( mg/kg) | | |
|---|---|---|---|---|---|---|---|---|
| | % | (soil paste) | ($dSm^{-1}$) | % | Percent (%) | N | P | K |
| Loamy Sand | 0.60 | 7.95 | 3.7 | 17 | 35.6 | 31.20 | 5.00 | 66.63 |

The used treatments in the two trials, including: urea N fertilizer at a concentration of 1 and 2% (M/v), garlic extract at a concentration of 0.5 and 1% (M/v), licorice at a concentration of 5 and 10% (M/v), control (spraying with distilled water). The trials used design was the complete randomized block design and each treatment was replicated three times. The area of the plot was $4m^2$ and the experiment was carried out on wheat variety, Sakha 93 cultivar, which was sown on sixteenth November on both seasons. Each plot was seeded with 120 g (approximately 120 kg $fad^{-1}$) and all treatments were application three times at 30, 45 and 60 days from sowing. Five plants average from each trial was measured at harvest stages to determinate plant height (cm). The wheat plant leaf area was calculated using the equation of Palanis Wamy and Gomez (1974) where; leaf area = Flag Leaf length * the maximum width of leaf * 0.75.

Manual Harvesting was done when the plants are completely reached to yellowish, 7 days latter harvesting, each plot yield was weighed; grain separation, grain and straw yields were calculated. 1000 grain weight was determined.

**Soil analysis**

Particle size distribution was determined using the international pipette method as described by Haluschak (2006). Electrical conductivity and soil pH values were determined in soil paste as described by Carter and Gregorich (2007). Field capacity and saturated percentage were determined as described by black, (1965). Soil was extracted by using 2.0 N KCl according to van Reeuwijk (2002) to determine the available nitrogen using half automatic kjldhal apparatus in this extraction. While, soil was extracted by using 0.5 N $NaHCO_3$–pH, 8.5 according to van Reeuwijk (2002) to estimate available phosphorus in this extraction. To evaluate available potassium in soil, soil was extracted by using 1.0 N $(CH_3)COONH_4$ according to Hesse (1971) and by using the Flame photometer model PFP7, it was estimated.

**Plant analysis**

Plant samples were oven dried at (70°C) until constant weight. The oven dry plant samples (grain and straw) were ground and wet digested by a sulfuric - percloric acid mixture as described by Cottenie *et al.,* (1982).

In the digesting solution, nutrients (phosphorus, nitrogen and potassium) were estimated according the methods of AOAC International (2012). Protein concentrate (%) was calculated as % protein = % N * 6.25. N, P, and K uptake were calculated separately by the following formula: Nutrient uptake in kg $fed^{-1}$ = Nutrient % in grain or straw*dry matter of grain or straw in kg $fed^{-1}$ /100 (Sharma, *et al*. 2012)

**Statistical analysis**

All data were statistically analyzed according to the technique of analysis, variance (ANOVA) , the least significant difference (LSD) method and correlation coefficient analysis were used to compare the differences between the means of treatment values according to methods described by Gomez and Gomez (1984). All measurable investigations were performed utilizing an examination fluctuation procedure by method for CoSTATE PC programming.

## RESULTS AND DISCUSSION

Data presented in Table 2 showed the effect of different treatments on wheat growth parameters such as plant height, flag leaf area and l000 grain weight. The results revealed that foliar application of different treatments significantly affected wheat plant height where, the treatments of l and 2 % urea -N and 5 and 10 % licorice significantly increased the wheat height while, the treatment of 1 % garlic extract was significantly decreased wheat height. The highest plant height values were recorded with the treatment of 5 % licorice extract in both seasons. These results may be due to the licorice extract content of amino acid, nutrient and vitamins such as B1, B2 and C which encourage plant growth as stated by Fukai *et al*., (1998). These results are in agreement with that of Abd El-Hamied and El-Amary (2015).

**Table 2. Mean values of wheat plant height (cm), flag leaf area ($cm^2$) and 1000 grain weight (g) as affected by different treatments.**

| Characters | Plant height (cm) | | Leaf area ($cm^2$) | | 1000 grain weight (gm) | |
|---|---|---|---|---|---|---|
| Treatments | 1st Season | 2ndSeason | 1st Season | 2ndSeason | 1st Season | 2ndSeason |
| Control | 92.4 | 84.0 | 26.15 | 28.77 | 43.1 | 45.3 |
| 1% Urea-N | 96.1 | 87.3 | 27.58 | 30.33 | 42.8 | 43.9 |
| 2% Urea-N | 96.4 | 87.7 | 28.50 | 31.35 | 42.5 | 44.6 |
| 5 % Licorice extract | 100.1 | 91.0 | 23.40 | 25.74 | 42.9 | 45.0 |
| 10 % Licorice extract | 94.2 | 85.7 | 24.78 | 27.25 | 43.2 | 45.4 |
| 0.5 % Garlic extract | 92.0 | 83.6 | 28.03 | 30.83 | 43.4 | 45.6 |
| 1 % Garlic extract | 86.5 | 78.7 | 25.20 | 27.72 | 38.7 | 40.6 |
| LSD at 5 % | 3.38 | 3.08 | 2.80 | 3.10 | 0.92 | 0.96 |

Flag leaf area ($cm^2$) data shown in Table 2 illustrated that the treatments of 5 % licorice extract significantly decreased flag leaf area ($cm^2$) while, the treatments of 1% urea, 2% urea and 0.5 garlic extract increased wheat leaf area, but the increment was not significant in both seasons compared with the control treatment. These results are in a contrast with that of Abd EI-Hamied and EI-Amary (2015). The treatment of 1% garlic extract significantly decreased the weight of 1000 grains while, the other used treatments didn't affect significantly the weight of 1000 grains.

**Grain and straw yield:-**

The grain yield, straw yield, grains yields dry weight and straw yield dry weight data were found in Table 3. Data illustrated that all used treatments significantly increased the grain yield in both seasons. The highest grains yield values were recorded with the treatment of 0.5 % garlic extract followed by 1% garlic extract, then 2 % urea while, the lowest values were found with the control treatment in both seasons. Data also showed that less concentration of natural extracts recorded a higher yield compared with the higher concentration. On contrast, obtained results were found with urea treatments. This result may be regarded to garlic contains of enzymes, proteins, B vitamins, minerals, maillard reaction products and flavonoids which are non sulphur-containing compounds. Furthermore, a phytoalexin (allixin) which, is very important in the biological activities in the plant (Synge, 1971 and Pandya *et al.,* 2011).These results are in line with Morsy *el al*., (2009), Hussein *et al.,* (2014).

**Table 3. Mean values of wheat grains yield (kg $fed^{-1}$), straw yield (kg $fed^{-1}$), grains yield dry weight (kg $fed^{-1}$) and straw yield dry weight (kg $fed^{-1}$) as affected by different treatments in both seasons.**

| Treatments \ Characters | Grain yield (kg $fed^{-1}$) | | Straw yield (kg $fed^{-1}$) | | Grain yield dry weight (kg $fed^{-1}$) | | Straw yield dry weight (kg $fed^{-1}$) | |
|---|---|---|---|---|---|---|---|---|
| | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Control | 1057 | 1163 | 2081.9 | 2498 | 955.54 | 1095.08 | 1890.02 | 2268.03 |
| 1% urea-N | 1728 | 1900 | 3055.3 | 3666 | 1635.47 | 1799.02 | 2768.19 | 3322.83 |
| 2% urea-N | 1898 | 2088 | 3223.3 | 3868 | 1796.92 | 1976.61 | 2936.90 | 3524.28 |
| 5 % Licorice | 1486 | 1635 | 2618.8 | 3143 | 1399.11 | 1539.01 | 2428.39 | 2914.08 |
| 10 % Licorice | 1411 | 1552 | 2770 | 3324 | 1337.38 | 1471.11 | 2514.73 | 3017.68 |
| 0.5 % Garlic | 2115 | 2324 | 3362.1 | 4035 | 2000.98 | 2198.05 | 3043.48 | 3652.17 |
| 1 % Garlic | 1925 | 2118 | 3344.5 | 4013 | 1818.70 | 2000.58 | 3040.49 | 3648.35 |
| LSD at 5 % | 34.84 | 38.33 | 28.13 | 33.76 | 13.96 | 11.23 | 10.23 | 9.68 |

On the same trend, straw yield of the wheat plant significantly increased by all used-treatments, the highest straw yield values were recorded with the treatment of 0.5 % garlic extract without no significance with 1 % garlic extract in both seasons while the lowest values were found with the control treatments. On the other side, the grain yields dry weight and straw yield dry weight took the same line or trend of the grain yield and straw yields where, the treatment of O. 5% garlic extract recorded the highest values of the grain yields dry weight and straw yield dry in both seasons compared with control treatment.

As for the biological yield (kg $fed^{-1}$), data was shown in Fig (1) appeared that all used treatments significantly increased the biological yield (kg $fed^{-1}$) in both seasons compared with control treatment. The higher concentration of urea and licorice extract increased the biological yield and the increment was higher than the lowest concentration. On contrast, the lowest concentration of garlic extract increased the biological yield than the higher concentration in both seasons. The best biological yield values were 5475.6 and 6359.34 kg $fed^{-1}$ in both seasons which were found with the treatment of 0. 5 % garlic extract .This result may be attributed to its garlic extract high content of amino acids, which contain sulfur such methionine and cysteine, which is very important in the biological activities in the plant (Synge, 1971). These results are in agreement with that of Mohamed and Akladious (2014).

Harvest index indicates to the grain yield to biological yield, so if it increased the grain yield increased. Data presented in Table 4 showed that all used treatments significantly increased the harvest index compared with control treatment except the treatment of 10 % licorice extract. The best harvest index values were found with the treatment of 0.5 % garlic extract, followed by 1 % garlic extract and 2 % urea -N.

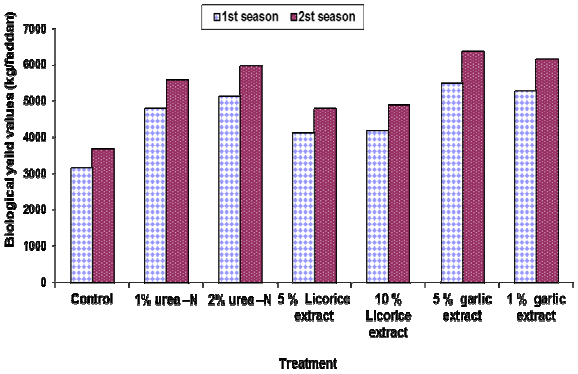


**Fig. 1. Mean values of wheat biological yield (kg $fed^{-1}$) as affected by different treatments.**

**Table 4. Mean values of wheat biological yield (kg $fed^{-1}$) and harvest index as affected by different treatments.**

| Characters | Biological yield(kg/$fed^{-1}$) 1st season | Biological yield(kg/$fed^{-1}$) 2nd season | Harvest index 1st season | Harvest index 2nd season |
|---|---|---|---|---|
| Control | 3138.9 | 3660.99 | 0.34 | 0.32 |
| 1% Urea-N | 4783.0 | 5566.78 | 0.36 | 0.34 |
| 2% Urea-N | 5121.0 | 5955.40 | 0.37 | 0.35 |
| 5 % Licorice extract | 4104.9 | 4777.28 | 0.36 | 0.34 |
| 10 % Licorice extract | 4181.2 | 4876.30 | 0.34 | 0.32 |
| 0.5 % Garlic extract | 5475.6 | 6359.34 | 0.39 | 0.37 |
| I % Garlic extract | 5269.8 | 6131.26 | 0.37 | 0.35 |
| LSD at 5 % | 41.42 | 47.19 | 0.008 | 0.008 |

**N, P, and K contents of wheat (%)**

Data in Table 5 showed the total nutrient contents (%) and protein percentage of the wheat plant. Total nitrogen content (%) in grains significantly increased with all used treatment except the 1 % garlic extract increased but this increment' was not significant. The best nitrogen

content values in grain were recorded with the treatment of 2 % urea in both seasons followed by 10 % licorice extracts. These results are in agreement with those of Abd EI-Hamied and EI-Amary (2015). Obtained data showed also that the total nitrogen content (%) in straw significantly affected by all used treatments where, it increased with the treatments of 1 % urea, 2 % urea and 0.5 % garlic extract and decreased significantly with the treatment of 10 % licorice extract compare with the control treatment. These results may be due to urea its intrinsic characteristics such as small molecular size, non-ionic nature and high solubility and rapid absorption through the leaf cuticle which reflected on nitrogen content in plant (White *et al.,* 2002)) and garlic extract contains a high percentage of amino acids, which contain sulfur such methionine and cysteine, which is very important in the biological activities in the plant, Synge (1971).

**Table 5. Means values of nitrogen and protein percent on wheat grains and straw as affected by different treatments.**

| Characters | N % in grains | | N % in Straw | | Protein % in grains | | Protein % in Straw | |
|---|---|---|---|---|---|---|---|---|
| Treatments | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Control | 1.83 | 1.74 | 0.81 | 0.77 | 11.46 | 10.89 | 5.08 | 4.81 |
| 1% urea-N | 2.06 | 1.96 | 019 ) | 0.65 | 12.86 | 12.23 | 4.30 | 4.09 |
| 2% urea-N | 2.28 | 2.17 | 0.83 | 0.78 | 14.25 | 13.54 | 5.16 | 4.90 |
| 5 % Licorice | 1.95 | 1.85 | 0.75 | 0.72 | 12.18 | 11.56 | 4.71 | 4.48 |
| 10 % Licorice | 2.18 | 2.08 | 0.71 | 0.68 | 13.65 | 12.98 | 4.46 | 4.24 |
| 0.5 % Garlic | 1.95 | 1.85 | 0.92 | 0.88 | 12.18 | 11.56 | 5.78 | 5.48 |
| 1 % Garlic | 1.85 | 1.76 | 0.77 | 0.73 | 11.55 | 10.99 | 4.81 | 4.56 |
| LSD at 5 % | 0.126 | 0.12 | 0.097 | 0.091 | 0.46 | 0.46 | 0.37 | 0.34 |

The protein content in grains and straw of wheat plant during both seasons took the same trend of total nitrogen in grain and straw, where the highest protein percentage values in grain and straw were found with the treatment of 2% urea-N.

As shown in Table 6, total potassium content (%) in grains significantly affected by all used treatments where, the treatments of 1 % urea and 1 % garlic extract led to an increase in total potassium content significantly while, it decreased significantly by the treatment of 2 % urea in both seasons. These results may be regarded to the antagonism between potassium content and excessive amounts of nitrogen where, it reduced when nitrogen used in a higher level (Mulder, 1953 and Malvi, 2011). Form correlation coefficient analysis, the negative correlation coefficient (r= - 0.3) declare the previous results. Potassium content values in the second season were higher than the first one and took the same trend. On the other hand, potassium content % in straw was significantly decreased by all used treatments compared with the control treatment.

**Table 6. Means values of potassium and phosphorus percentage on wheat grains and straw as affected by different treatments.**

| Characters | % K in grains | | % K in straw | | % P in grains | | %P in straw | |
|---|---|---|---|---|---|---|---|---|
| Treatments | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season | 1st season | 2nd season |
| Control | 3.51 | 3.86 | 3.75 | 4.13 | 0.23 | 0.22 | 0.13 | 0.13 |
| 1% urea-N | 4.02 | 4.42 | 3.63 | 3.99 | 0.36 | 0.33 | 0.14 | 0.14 |
| 2% urea-N | 3.33 | 3.67 | . 3.13 | 3.44 | 0.40 | 0.37 | 0.15 | 0.15 |
| 5 % licorice | 3.59 | 3.95 | 3.54 | 3.90 | 0.19 | 0.18 | 0.16 | 0.15 |
| 10 % licorice | 3.47 | 3.82 | 3.50 | 3.85 | 0.15 | 0.14 | 0.18 | 0.16 |
| 0.5 % garlic | 3.41 | 3.75 | 2.96 | 3.26 | 0.23 | 0.21 | 0.19 | 0.18 |
| 1% garlic | 3.74 | 4.12 | 3.58 | 3.94 | 0.32 | 0.30 | 0.16 | 0.15 |
| LSD at 5 % | 0.11 | 0.12 | 0.18 | 0.2 | 0.018 | 0.017 | 0.009 | 0.008 |

The lowest values of potassium content (%) in straw were found in the treatment of 0.5 % garlic extract in both seasons. These results may be due to the big increment in straw yield and dilution effect of this increment in the most of the treatments especially garlic extract (Rengel, *et al.* 1999). So, from correlation coefficient analysis, the negative correlation coefficient (R= - 0. 65, P<=0.05) confirmed the previous results. Phosphorus content (%) in grains significantly increased with the most used treatments except the treatments of licorice; it decreased the phosphorus content (%) in grains (Table 6). This result may be caused by the synergism relation between nitrogen and phosphorus in plant where, increasing nitrogen level led to an increase of phosphorus absorption and the content of garlic and licorice extract from nutrient and substances (Synge 1971 and Fukai *et al.*, 1998). The highest values of phosphorus content (%) in the grains were recorded in the treatment of 2 % urea -N in both seasons. On the other side, phosphorus content (%) in straw increased significantly by all used treatments, garlic extract increased phosphorus content % higher than the less concentration. The best values of phosphorus content (%) in straw were found with the treatment of 0.5% garlic extract in both seasons. These results are in agreement with that of Hammad (2008) and Abd El-Hamied and ElAmary (2015).

**Nutrients uptake in grain and straw of wheat.**

Data presented in Fig 2 showed the effect of different treatments on nitrogen, potassium and phosphorus uptake by gains and straw of wheat plants. Obtained data illustrated that all used treatments enhanced the nitrogen uptake by grains where, it increased significantly by all used treatments compared with the control treatment. These results may be due to the increment of grain yield dry weight resulting from the used treatments which , from correlation coefficient analysis, it declared that the higher correlation coefficient (R= 0.85in the first season and R =0.93 in the second season ( P<=0.05) between nitrogen uptake in grains yield and grains yield dry weight. The best values of nitrogen uptake by grains were found in the 2 % urea follow by 0.5 % garlic extract in both seasons. In a similar trend, nitrogen uptake by straw took the same trend of nitrogen uptake by grains where, it increased significantly by all used treatments and the highest values

were recorded in the treatment of 0.5 % garlic extract follow by 2 % urea.

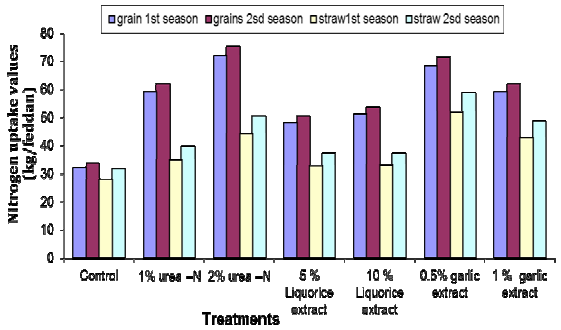


**Fig. 2. Means values of nitrogen uptake by grains and straw of wheat plant (kg fed$^{-1}$) as affected by different treatments.**

**Potassium uptake by straw and grain:-**

From the obtained data shown in Fig 3, potassium uptake by straw and grains were significantly increased by all used treatments. The low level of used treatments increased potassium uptake by grains than the higher level. The potassium uptake by straw yield took the reversible trend except with urea treatments; the low level achieved the higher increment. The best and the higher values of potassium uptake by grains and straw were recorded with the treatment of 1 % garlic extract followed by 1 % urea -N. These results may be due to the increment of grain yield dry weight resulting from the used treatments and added supply of nutrient and well developed root-system resulting in better absorption of water and nutrients (Chaturvedi, 2006).

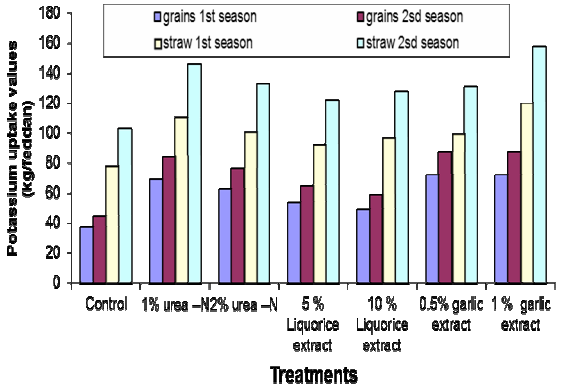


**Fig. 3. Means values of potassium uptake by grains and straw of wheat plant (kg fed$^{-1}$) as affected by different treatments**.

**Phosphorus uptake by straw and grains:-**

As illustrated in Fig. 4, phosphorus uptake in grains significantly increased with urea, garlic extract and 5 % licorice extract treatments while, it decreased with the treatments of 10 % licorice extracts. From the obtained data, phosphorus uptake in grains increased with increasing urea and garlic extract concentration. The highest values of phosphorus uptake in grains were found with the treatment of 2 % urea-N while the lowest values were found with the treatment of 10% licorice extract. These results may be due to nitrogen fertilizer (urea) encourage the phosphorus uptake. On the other hand, garlic extract contains a high percentage of amino acids, which contain sulfur such methionine and cysteine, which is very important in the biological activities in the plant

Finally, phosphorus uptake by straw significantly increased with all used treatments and the increment was higher with the highest concentration than the lowest concentration except with the garlic treatments, the lowest concentration recorded the higher increased. The best values of phosphorus uptake by straw were found with the treatments 0.5% garlic extracts.

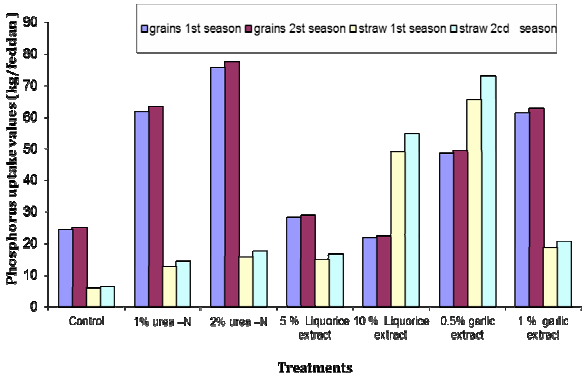


**Fig. 4. Mean values of phosphorus uptake by grains and straw of wheat plant (kg fed-1) as affected by different treatments.**

## CONCLUSION

It could be concluded that all used treatments significantly affected wheat plant. While, garlic extract treatments gave the best results concerning with grains, straw yields, biological yield, nitrogen content in grains and straw, potassium and phosphorus uptake of grains. It could be concluded that natural garlic extract enhances wheat plant production and at the same time reduces the use of urea as a chemical fertilizer under sandy soils conditions.

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## تـأثير الـرش باليوريـا ومـستخلص العرقسوس والثوم علـي العنـاصر الممتصة ومحصول نبـات القمـح النـامي فـي الأرض الرملية. دراسة مقارنـة

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تعتبر توفير احتياجات مصر من القمح التحدي الأصعب في ظل اتساع الفجوة بين الإنتاج والطلب المتزايد على هذا المحصول خاصة مع زيادة السكان و نقص موارد المياه في مصر. لذا أقيمت تجربتين حقليتين خلال شتاء عامي 2013/2012 و 2013 /2014 لدراسة تأثير الرش باليوريا (1% و 2 %) و مستخلص العرقسوس (5% و 10 %) و مستخلص الثوم (0,5% و 1 % ) علي صفات نبات القمح ومحتواه من النيتروجين والفوسفور والبوتاسيوم وكذلك الممتص منهم في الأراضي الرملية. تم استخدام تصميم التامة العشوائية في ثلاث مكررات مع اضافة المعاملات ثلاثة مرات بعد 30 و45 و 60 يوم من الزراعة أوضحت النتائج المتحصل عليها أن كل المعاملات المستخدمة اثرت معنويا علي نبات القمح حيث سجلت معاملة 0.5 % مستخلص ثوم أعلي قيم لمحصول الحبوب والقش يلي ذلك معاملة 1 % مستخلص ثوم ثم 2 % يوريا بينما كانت اقل قيمة لمعاملة الكنترول في كلا الموسمين. أفضل قيم للمحصول البيولوجي (5475,6 و 6359,34 كجم /فدان) قد سجلت مع معاملة 0,5 مستخلص ثوم . من ناحية أخري تأثر النتروجين الكلي في محصول القش معنويا مع المعاملات المستخدمة حيث ازداد مع معاملات 1% و 2 % يوريا و 0,5 مستخلص ثوم و انخفض معنويا مع معاملة 10 % مستخلص عرقسوس مقارنة بالكنترول. كذلك البوتاسيوم الممتص بواسطة الحبوب والقش ازداد معنويا مع جميع المعاملات المستخدمة مقارنة بالكنترول . ازداد الفوسفور الممتص بواسطة الحبوب والقش معنويا مع معاملات اليوريا والثوم و 5% مستخلص العرقسوس بينما انخفض مع 10 % مستخلص عرقسوس. ونلاحظ ايضا زيادة الفوسفور الممتص في الحبوب بزيادة تركيز اليوريا ومستخلص الثوم .في النهاية يمكن أن نوصي باستخدام المستخلص الطبيعي للثوم لتحسين وتعظيم انتاجية نبات القمح وفي نفس الوقت تقليل استخدام اليوريا كسماد كيميائي.