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# ROLE OF SUPPLEMENTAL IRRIGATION AND FERTILIZER TREATMENTS ON YIELD COMPONENT OF WHEAT (*Triticum durum* L.)

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## ABSTRACT

Field experiment was conducted in Girdarasha fields, College of Agriculture .Salahaddin University during the growing season 2006 to study the effect of different levels of nitrogen (0,92,184 Kg $N.ha^{-1}$) , phosphorus (0,92,184Kg $P_2O_5.ha^1$) ,potassium (0,120Kg $K_2O.ha^1$) , magnesium (0,40 Kg $MgO.ha^{-1}$) and their combinations on yield component of wheat under rainfed and supplemental irrigation by using factorial Randomized Complete Block Design with three replications. Nitrogen application had a significant effect at ($p \geq 0.05$) on weight of total dry matter, grain and straw under rainfed and supplemental irrigation. Highest values (5.09,2.20,2.89) and (8.89 ,4.28,4.61) $Mg.ha^{-1}$ were recorded from ($N_1$and $N_2$) treatments under rainfed and supplemental irrigation respectively, application of $P_1$ gave highest weight of total dry matter, grain and straw(4.76,2.07,2.69 and 9.37,4.25,5.12) $Mg.ha^{-1}$ under rainfed and supplemental irrigation. Application of potassium fertilizer caused an increase in weight of total dry matter,grain and straw. .In general combination between fertilizers affected significantly ($P \geq 0.05$)on weight of total dry matter, grain and straw under both rainfed and supplemental irrigation. Highest values( 5.79 , 2.86, 3.40) and (10.8, 4.88, 5.97) $Mg.ha^{-1}$ were recorded from combination treatments ($N_2P_1K_0Mg_0$ ,$N_2P_1K_1Mg_0$, $N_1P_0K_1Mg_1$) and ($N_1P_1K_0Mg_0$, $N_1P_2K_1Mg_0$, $N_1P_1K_0Mg_0$) under rainfed and supplemental irrigation respectively, while lowest values (2.20 ,0.60 ,1.48) and (4.13 ,1.53 ,2.33) were recorded in ($N_0P_0K_0Mg_0$ ,$N_0P_0K_0Mg_0$, $N_0P_0K_0Mg_1$) and ($N_0P_0K_0Mg_1$ ,$N_0P_0K_0Mg_1$, $N_2P_0K_0Mg_0$) under rainfed and supplemental irrigation respectively.

## INTRODUCTION

Water deficit is a primary factor that limits wheat production in Kurdistan region, since the rainfall during growing season is usually low and not constant, thus under similar condition the supplementary irrigation,especially ,when applies at particularly growth stage has an advantage to make the yield higher and more constant through years . Wheat (*Triticum durum*L.*)* is one of the most important cereal crop which contributes significantly to food security, it occupies an important position among cereal crops due to its use for diet, animal feed and as a raw material for some industrial products. Balanced fertilization and better cultural practices are needed to obtain higher yield as the potential of crops increase. This lead to the necessity of better methods of soil fertility diagnosis, when fertilization is applied ,the plant response is reflected by tissue composition although the relationship with the yield is not necessarily direct , moreover in the semi arid region, response to fertilizers depends on the amount and distribution of precipitation. Nitrogen is one of the basic elements required for obtaining higher wheat yield. It is largely used in the synthesis of protein ,chlorophyll ,and other vital compounds which are attributed to all physiological and biochemical processes of plants .The response to N fertilization varies according to location ,climate, crops and their varieties ,characteristics of the soil ,type ,rate ,time of fertilizer application and its placement (Mengel and Kirkby, 1978).

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An experiment was conducted by Hameed *et al.* (2003) in Pakistan during 2000 to study the effect of different plant dates, seed rates and nitrogen levels on wheat . The analysis of data revealed that plots treated with 140 Kg. N. $ha^{-1}$ recorded maximum grain yield, which attained 6931 $Kg.ha^{-1}$.While lowest grain yield (4854 Kg. $ha^{-1}$) was produced by the control. Burio *et al.*(2004) referred to the positive correlation coefficient (r=0.86*) between the grain yield and levels of nitrogen application. The study was carried out to determine the effect of nitrogen levels ( 0, 60, 120 ,180$Kg.N.ha^{-1}$) on grain yield. Yield component and some quality of two triticale cultivars under rainfed conditions in Turkey in 2001-2002and 2002-2003. The results of this study indicated that grain yield , yield component increase with increasing nitrogen application rate . Highest grain yield 4.052$t.ha^{-1}$ (4052 Kg. $ha^{-1}$) in case of 120 KgN $ha^{-1}$and 4.079t. $ha^{-1}$ (4079 Kg. ha-1)with the application of 180 Kg N $ha^{-1}$ ,while the lowest grain yield 2.790 $t.ha^{-1}$ (2790 Kg. $ha^{-1}$)was obtained from the control (Mut etal., 2005). In many agricultural production systems, P has been identified as the most efficient essential nutrient after nitrogen (N), because the most essential function of P is the storage and transfer of energy in the form of ATP (adenosine triphosphate), ADP(adenosine diphosphate) and the most important structural component of nucleic acids, coenzymes, phospholipids, and nucleotides. Sultan *et al.* (2002) observed significant positive correlation (r= 0.70*) between rate of phosphorus application and yield of wheat. Mohammad and Malkawi (2004) indicated that application five rates of P (0,50,100,200 and 400 Kg P. $ha^{-1}$ ) caused a significant increase in dry matter yield and P uptake of wheat ,the highest values(3.5 gm $.plant^{-1}$and 10mg. $Kg^{-1}$) were recorded from the application of 400 Kg P. $ha^{-1}$.

Potassium is an essential element for all living organisms. In plant physiology, it is the most important cation not only in regarded to the plant tissue content but also with respect to its physiological and biochemical function .One main future of K is the high rate at which it is taken up by plant tissue ,even when the nutrient solution is relatively lower in potassium concentration. This has beneficial effect on water consumptions as lower osmotic potential which improves water retention, however, potassium enhances translocation of assimilates and its role in activation the various enzyme system. Gerwing *et al.* (1999) showed that application of (0 and 50 $Kg.ha^{-1}$) of the potassium fertilizers had significant effect on yield and protein content of wheat that were attained ,(30bu/ac(2017.5 $Kg.ha^{-1}$) ,13.9% and 32bu /ac (2152 $Kg.ha^{-1}$,13.6%) for both rates respectively. Magnesium generally taken up by plants in lower quantities than Ca and K ,the most well known role of the Mg its occurrence at the center of the chlorophyll molecule , however, beside its function in the chlorophyll, ,Mg is required in the other physiological process such as its role as a cofactor in almost all enzymes activating phosphorylation processes (Parsad and Power 1997). Magnesium application as fertilizers is not common in Iraq, specially in Kurdistan Region, thus we will list the studies conducted in the world. A pot experiment was carried out by Hussain *et al.* (2002) to investigate the impact of different Ca/Mg ratio ,(1:1 ,2:2, 3:1, 1:2, 1:3,1:4,and control) on soil properties ,maize and wheat yield for three years . It was observed that all treatments had significant effect on wheat grains and biomass yield, however , highest yield of 16.94 gm biomass and 6.77gm grain yield was obtained in (Ca/Mg 3:1)which proved significantly higher than all other treatments, also it was observed that yield decreased from 30.57 to 43.31% when the Ca/Mg ratio narrowed .

Supplemental irrigation is defined as the application of an additional amount of water to rainfed crops when precipitation fails to provide necessary moisture for normal plant growth , important of water for crop plants is well established .Shortage of irrigation at critical stages alters normal physiological functions and reduces yield. Fizabady and Ghodsi (2004)evaluated the yield of winter wheat under different irrigation regimes which include 10,20 and 30 days irrigation. They found that the grain yield were (5240,4500 and 2450 $Kg.ha^{-1}$), respectively. Fan *et al.*(2005) mentioned that the application of 12 and 48 mm of irrigation water to wheat caused, 20% and 40% , increase in grain yield on comparing with the control treatment . The application of 70 pound/ac (93.8 $Kg.ha^{-1}$ )of nitrogen did not cause a significant increase in yield of wheat , while the application of the same rate of nitrogen with 35 pound P (46.9 $Kg.ha^{-1}$) and 50 pound K (67 $Kg.ha^{-1}$) increased grain yield from 47 bu/ac(3160 $Kg.ha^{-1}$) to 53bu/ac(3564 $Kg.ha^{-1}$), respectively (Gerwing *et al.* 2000). The application of NPK (90+90+160 $Kg.ha^{-1}$) to wheat cultivars produced extremely a higher yield, 10 t/ha (10000 $Kg.ha^{-1}$) as compared to control treatment produced 3.41 t/ha (3410 $Kg.ha^{-1}$) (Gyuris and Bona, 2002).Thus the object of this study is to investigate the influence of N,P,K,Mg and their combination on yield of wheat under rainfed and supplemental irrigation.

## MATERIALS AND METHODS

The study was carried out during the growing season of 2005-2006 at the experimental farm of the college of Agriculture, University of Salahaddin at Grdarasha field,( 3.5km to the south of Erbil city (36˚ 0N, 44˚01E), it is a part of a wide plain,411m above the mean sea level. The experimental nutrient levels in $Kg.ha^{-1}$ were :-*Nitrogen 0, 92, 182 $Kg.ha^{-1}$(urea) which is equivalent to (0,18.4 and 36.8gm $N.plot^{-1}$). *Phosphorus 0, 92, 182 $Kg.ha^{-1}$ (superphospate ) which is equivalent to (0,18.4 and 36.8 gm$P_2O_5.plot^{-1}$).*Potassium 0,120 $Kg.ha^{-1}$(potassium chloride) which is equivalent to (0, 24 gm $K_2O.plot^{-1}$).*Magnesium 0,40 $Kg.ha^{-1}$(magnesium sulphate) which is equivalent to (0, 8 gm $MgO.plot^{-1}$).The fertilizers were mixed together according to the experimental unit and broad coast to the soil surface of each plots Phosphorus ,potassium and magnesium were applied before sowing ,while nitrogen fertilizer was applied as two dosage 50% of the amount at sowing time and the other 50% at tillering stage, all fertilizers are evenly mixed with the soil. A factorial experiment was laid out in a randomized complete block design with three replications. Durum wheat (Acsad 65) cultivar was chosen for the field study ,and the rate of planting was 100 $Kg.ha^{-1}$(Darwesh, 1998). The experiment unit consisted of four rows 2m in length and spaced 20cm , it means each row received 5gm of seeds , wheat sowing took place on 26th December 2005. Water was applied to the treatments in supplementary irrigation experiment site by using sprinkler irrigation system, the amount of water applied was measured by using container system to ensure the distribution of water uniformly, while the other experiment remains under rainfed, water is applied after depletion 75% of available water. At harvest the plants were cut by hand at soil surface from each experimental unit, placing in weighted bag and immediately weighed to obtain dry weight, the plants were separated to straw and grain by threshing machine to obtain the grain weight. Analysis of variance (ANOVA) was performed on all data by using the SSPS and excel statistical programmer. Tukey'sMSD (mean significant differ rence) procedure was used for comparison of means (Steele and Torrie, 1969). Table (1) shows some physical and chemical properties of soil under the study.

Table (1): Some physical and chemical properties of soil under study.

| | | |
|---|---|---|
| Physical properties | | |
| Particle Size Distribution $g.Kg^{-1}$ | Sand | 176.6 |
| | Silt | 719.0 |
| | Clay | 104.4 |
| Textural name | Silty loam | |
| Saturation % | 29.50 | |
| Field capacity % | 14.58 | |
| Chemical properties | | |
| pH | 7.70 | |
| ECe $dS.m^{-1}$ | 0.81 | |
| Organic matter $g.Kg^{-1}$ | 11.46 | |
| Total $CaCO_3$ $g.Kg^{-1}$ | 292.6 | |
| Active $CaCO_3$ $g.Kg^{-1}$ | 20.00 | |
| Total Nitrogen $g.Kg^{-1}$ | 0.336 | |
| Available Phosphorus $mg.Kg^{-1}$ | 4.73 | |
| CEC Cmolc . $Kg^{-1}$ | 24.90 | |
| **Cation $mmol.L^{-1}$** | | |
| Calcium | 2.20 | |
| Magnesium | 0.88 | |
| Potassium | 1.28 | |
| Sodium | 0.96 | |
| **Anion $mmol.L^{-}$** | | |
| Sulphate | 1.19 | |
| Chloride | 1.01 | |
| Bicarbonate | 2.03 | |

## RESULTS AND DISCUSSION

### 1.1Yield component of wheat

**1.1-1 Effect of nitrogen rates on yield component of wheat :**Nitrogen applications had a significant effect at ($p \geq 0.05$)on total dry matter, grain and straw yields Mg. $ha^{-1}$ under rainfed and supplemental irrigation (Table 2).Highest values (5.09 ,2.20,2.89 Mg. $ha^{-1}$) and ( 8.89 ,4.28,4.61 Mg. $ha^{-1}$ ) were recorded from ($N_1$ and $N_2$) treatments under rainfed and supplemental irrigation respectively, while the lowest values (3.51, 1.39, 2.12 Mg. $ha^{-1}$ ) and (7.65,3.30,4.35 Mg. $ha^{-1}$ ) were recorded with ($N_0$) treatment under rainfed and supplemental irrigation respectively .However, the result indicated that increasing soil moisture enhanced wheat yield response to N fertilizer especially when high N rates were applied, though the reverse was generally true in dry soil. These results may be explained on the basis that water lead to increase the nitrogen absorption and enhances vegetative growth , also nitrogen losses via ammonia volatilization decreases . A similar result and explanation has been reported by (Mohammad 1983 and Darwesh, 1998 ).

Table(2): Effect of nitrogen rates on yield component of wheat under rainfed and supplemental irrigation .

| Treatments | Rainfed irrigation | | | Supplemental irrigation | | |
|---|---|---|---|---|---|---|
| | Weight Mg.$ha^{-1}$ | | | Weight Mg.$ha^{-1}$ | | |
| | Total dry matter | Grain | Straw | Total dry matter | Grain | Straw |
| $N_0$ | 3.51 | 1.39 | 2.12 | 7.65 | 3.30 | 4.35 |
| $N_1$ | 5.09 | 2.20 | 2.89 | 8.48 | 4.22 | 4.26 |
| $N_2$ | 4.80 | 2.13 | 2.67 | 8.89 | 4.28 | 4.61 |
| Tukey´s(0.05) | 0.15 | 0.17 | 0.28 | 0.78 | 0.18 | 0.58 |

**1.1-2 Effect of phosphorus rates on yield component of wheat:** phosphorus application had a significant effect on the of total dry matter ,grain and straw yields Mg. $ha^{-1}$ under rainfed and supplemental irrigation (Table 3).Highest values (4.76, 2.07, 2.69Mg. $ha^{-1}$ ) and (9.37 , 4.25 , 5.12 Mg. $ha^{-1}$ ) were recorded from $P_1$ under rainfed and supplemental irrigation respectively while lowest values (3.99,1.64,2.35 Mg. $ha^{-1}$ ) and (6.87,3.36,3.51 Mg. $ha^{-1}$ ) were recorded with $P_0$ treatment under rainfed and supplemental irrigation respectively, However, it is clear from the mean values of the data that supplemental irrigation gave maximum yield component, even with the control. The probable reason could be that under P stress, the plant roots by exudates of organic compounds that believed to enhance phosphorus release. Such exudation under the high soil P levels is very low. On the other hand, other researchers reported to the role of P in all physiological processes in plants. These results have a close conformity with those reported by (Sander and Eghball, 1999 ).

Table(3): Effect of Phosphorus rates on yield component of wheat under rainfed and supplemental irrigation.

| Treatments | Rainfed irrigation | | | Supplemental irrigation | | |
|---|---|---|---|---|---|---|
| | Weight Mg.ha-1 | | | Weight Mg.ha-1 | | |
| | Total dry matter | Grain | Straw | Total dry matter | Grain | Straw |
| P0 | 3.99 | 1.64 | 2.35 | 6.87 | 3.36 | 3.51 |
| P1 | 4.76 | 2.07 | 2.69 | 9.37 | 4.25 | 5.12 |
| P2 | 4.64 | 2.01 | 2.631 | 8.77 | 4.18 | 4.60 |
| Tukey´s(0.05) | 0.15 | 0.17 | 0.28 | 0.78 | 0.18 | 0.58 |

**1.1-3 Effect of potassium rates on yield component of wheat:** The application of different levels of Potassium had a significant effect on the of total dry matter , grain and straw yield Mg. ha$^{-1}$ under rainfed and supplemental irrigation Table(4). The high values of the mentioned parameters (4.76, 2.05 and 2.71 Mg. ha$^{-1}$ ) and (9.08, 4.14 and 4.94 Mg. ha$^{-1}$ ) were recorded from $K_1$ under rainfed and supplemental irrigation respectively , while lowest values (4.16,1.76,2.40 Mg. ha$^{-1}$ ) and (7.60,3.72,3.88 Mg. ha$^{-1}$ ) were recorded with $K_0$ treatment under rainfed and supplemental irrigation respectively. Enhanced growth was probably due to the function of $K^+$ in plant nutrition , because $K^+$ enhances the translocation of assimilators. These results were in agreement with the findings of (Parsad, 1990).

Table(4): Effect of potassium rates on yield component of wheat under rainfed and supplemental irrigation.

| Treatments | Rainfed irrigation | | | Supplemental irrigation | | |
|---|---|---|---|---|---|---|
| | Weight Mg.ha-1 | | | Weight Mg.ha-1 | | |
| | Total dry matter | Grain | Straw | Total dry matter | Grain | Straw |
| K0 | 4.16 | 1.76 | 2.40 | 7.60 | 3.72 | 3.88 |
| K1 | 4.76 | 2.05 | 2.71 | 9.08 | 4.14 | 4.94 |
| Tukey´s(0.05) | 0.10 | 0.12 | 0.19 | 0.53 | 0.13 | 0.40 |

**1.1-4 Effect of magnesium rates on yield component of wheat**: The results in table(5) revealed that the application of Mg fertilizer did not significantly affect total dry matter matter, grain and straw yield under both rainfed and supplemental irrigation. Highest values of the above parameters under rainfed irrigation were produced by $Mg_0$ treatment (4.53,1.93,and 2.60 Mg.ha$^{-1}$).While under supplemental irrigation maximum yields ( 8.45 ,4.58 Mg.ha$^{-1}$) were produced from $Mg_1$, except the grain yield 3.99 Mg.ha$^{-1}$ was recorded with $Mg_0$ treatment. Whereas the lowest value (4.40,1.88,2.52 Mg.ha$^{-1}$) and (8.23, ,4.24 Mg.ha$^{-1}$ ) were recorded in $Mg_0$ treatment under rainfed and supplemental irrigation respectively except the grain yield 3.87 Mg.ha$^{-1}$ was recorded from $Mg_1$ treatment .The lack of a response in production to the application of magnesium would indicate that the level of magnesium content of soil under the study was adequate to meet the Mg requirements of wheat crops. The absence of response to magnesium fertilizer in this study was consistent with the results reported by (Al- Akrawi, 2002).

Table(5):Effect of magnesium rates on yield component of wheat under rainfed and supplemental irrigation.

| Treatments | Rainfed irrigation | | | Supplemental irrigation | | |
|---|---|---|---|---|---|---|
| | Weight Mg.ha-1 | | | Weight Mg.ha-1 | | |
| | Total dry matter | Grain | Straw | Total dry matter | Grain | Straw |
| Mg0 | 4.53 | 1.93 | 2.60 | 8.23 | 3.99 | 4.24 |
| Mg1 | 4.40 | 1.88 | 2.52 | 8.45 | 3.87 | 4.58 |
| Tukey´s(0.05) | 0.10 | 0.12 | 0.19 | 0.53 | 0.13 | 0.40 |

**1.1-5 Combination effect of nitrogen, phosphorus, potassium and magnesium on yield component of wheat:** Weight of the total dry matter, grain and straw $Mg.ha^{-1}$ of wheat as affected by various fertilizer treatments and combination among them under rainfed and supplemental irrigation are given in Table (6). Highest values under rainfed irrigation (5.79,2.86, and3.40 $Mg.ha^{-1}$) were recorded from the combination treatments ($N_2P_1K_0Mg_0$ ,$N_2P_1K_1Mg_0$ and $N_1P_0K_1Mg_1$) respectively, while the lowest values [(2.20,0.60)and(1.48 $Mg.ha^{-1}$)] were recorded from combination treatments [($N_0P_0K_0Mg_0$)and($N_0P_0K_0Mg_1$)]. On the other hand in case of the supplemental irrigation, highest value (10.8, 4.88 and 5.97 $Mg.ha^{-1}$) of above components were obtained from the combination treatments ($N_1P_1K_0Mg_0$ ,$N_1P_2K_1Mg_0$ and $N_1P_1K_0Mg_0$), whereas lowest values of total dry matter and grain yields (4.13and 1.53 $Mg.ha^{-1}$) were recorded in combination treatment ($N_0P_0K_0Mg_1$) ,except straw yield was(2.33 $Mg.ha^{-1}$) recorded from ($N_2P_0K_0Mg_0$).However supplemental irrigation gives a high yield component than rainfed irrigation. This result could be explained on the ground that the Combination among above factors may create more suitable condition to supply N, P, K, Mg and the other elements to plant and subsequently enhance the yield component. This shows application of nitrogen, phosphorus, potassium and magnesium in an adequate amount will contribute in increasing the rate of the cell division and expansion during the growth stage. These results and explanations agree with those reported by (Akhtar *et al.* 2003)

Table(6):Combinations effect of nitrogen , phosphorus, potassium and magnesium on yield component of wheat under rainfed and supplemental irrigation.

| Treatments | | | Rainfed irrigation | | | | | | Supplemental irrigation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weight Mg.ha-1 | | | | | | Weight Mg.ha-1 | | | | | |
| | | | Total dry matter | | Grain | | Straw | | Total dry matter | | Grain | | Straw | |
| | | | MgO | Mg1 | MgO | Mg1 | MgO | Mg1 | MgO | Mg1 | MgO | Mg1 | MgO | Mg1 |
| No | PO | KO | 2.20 | 2.43 | 0.60 | 0.95 | 1.60 | 1.48 | 4.58 | 4.13 | 1.80 | 1.53 | 2.78 | 2.60 |
| | | K1 | 5.28 | 3.23 | 1.96 | 1.31 | 3.32 | 1.93 | 8.68 | 7.60 | 3.58 | 3.18 | 5.09 | 4.43 |
| | P1 | KO | 3.13 | 3.39 | 1.14 | 1.48 | 1.98 | 1.91 | 7.45 | 8.23 | 3.31 | 3.24 | 4.14 | 4.98 |
| | | K1 | 4.12 | 4.53 | 1.73 | 1.78 | 2.38 | 2.75 | 9.62 | 9.99 | 4.32 | 4.47 | 5.30 | 5.53 |
| | P2 | KO | 4.18 | 3.50 | 1.58 | 1.36 | 2.61 | 2.14 | 7.13 | 7.93 | 4.08 | 3.88 | 3.05 | 4.06 |
| | | K1 | 3.74 | 4.48 | 1.53 | 1.88 | 2.21 | 2.59 | 7.17 | 9.32 | 3.13 | 4.27 | 4.03 | 5.05 |
| N1 | PO | KO | 4.55 | 4.73 | 2.10 | 1.96 | 2.45 | 2.78 | 8.15 | 8.88 | 3.62 | 3.54 | 4.53 | 4.34 |
| | | K1 | 4.02 | 5.56 | 1.68 | 2.16 | 2.33 | 3.40 | 9.40 | 8.64 | 3.90 | 3.59 | 5.50 | 5.05 |
| | P1 | KO | 4.46 | 5.28 | 1.85 | 2.33 | 2.61 | 2.95 | 10.8 | 10.0 | 4.82 | 4.78 | 5.97 | 5.22 |
| | | K1 | 5.72 | 5.63 | 2.45 | 2.36 | 3.27 | 3.28 | 9.27 | 9.54 | 4.33 | 4.44 | 4.93 | 5.10 |
| | P2 | KO | 5.13 | 5.77 | 2.27 | 2.53 | 2.86 | 3.23 | 8.36 | 9.83 | 3.68 | 4.35 | 4.68 | 5.48 |
| | | K1 | 5.31 | 4.95 | 2.41 | 2.30 | 2.90 | 2.65 | 8.08 | 9.84 | 4.88 | 4.67 | 3.21 | 5.18 |
| N2 | PO | KO | 4.78 | 4.58 | 1.91 | 1.85 | 2.88 | 2.73 | 6.87 | 6.28 | 4.54 | 3.93 | 2.33 | 2.35 |
| | | K1 | 3.94 | 4.76 | 1.73 | 2.06 | 2.21 | 2.70 | 9.36 | 8.94 | 4.52 | 3.84 | 4.84 | 5.10 |
| | P1 | KO | 5.79 | 3.78 | 2.72 | 1.61 | 3.08 | 2.17 | 9.43 | 8.79 | 4.66 | 3.73 | 4.78 | 5.07 |
| | | K1 | 5.68 | 5.64 | 2.86 | 2.54 | 2.82 | 3.10 | 9.54 | 9.83 | 4.31 | 4.62 | 5.23 | 5.21 |
| | P2 | KO | 4.90 | 4.53 | 1.98 | 2.04 | 2.93 | 2.49 | 9.57 | 9.43 | 4.45 | 4.24 | 5.12 | 5.19 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | K1 | 4.58 | 4.59 | 2.16 | 2.05 | 2.42 | 2.54 | 8.67 | 9.97 | 3.86 | 4.66 | 4.81 | 5.31 |
| Tukey´s(0.05) | | | 1.40 | | 0.93 | | 1.49 | | 3.58 | | 0.98 | | 2.55 | |

## دور الري التكميلي ومعاملات التسميد في مكونات حاصل الحنطة (*Triticum durum* L.)


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جامعة صلاح الدين-أربيل/العراق



### الخلاصة

أجريت التجربة الحقلية في حقول كرده ره شه التابعة لكلية الزراعة في جامعة صلاح الدين – أربيل خلال مدة النمو ٢٠٠٦ لدراسة تأثير المستويات المختلفة من النتروجين (٠ و ٩٢ و ١٨٤ كغمN/هكتار) والفسفور(٠ و ٩٢ و ١٨٤ كغم$P_2O_5$/ هكتار) والبوتاسيوم (١٢٠,٠كغم$K_2O$/هكتار) والمغنيسيوم (40,0 كغمMgO/هكتار) والتداخل فيما بينها في حاصل الحنطة تحت الظروف الديمية والري التكميلي باستخدام تصميم قطاعات العشوائية الكاملة وبثلاث مكررات . أضافة مستويات مختلفة من النايتروجين، أثّر ذلك معنويا في المستوى المعنوي ($p \geq 0.05$ ) في الوزن الجاف الكلي ووزن كل من الحبوب والقش تحت الظروف الديمية والري التكميلي ، حيث أعلى قيم سجلت (٥.٠٩ و ٢.٢٠ و ٢.٨٩) و (٨.٨٩ و ٤.٢٨ و ٤.٦١)$Mg.ha^{-1}$ للأوزان المذكورة في معاملة ($N_2,N_1$) تحت الظروف الديمية والري التكميلي ، بينما أدنى قيم سجلت (٣.٥١ و ١.٣٩ و ٢.١٢) و (٧.٦٥ و ٣.٣٠ و ٤.٥)$Mg.ha^{-1}$ في معاملة ($N_0$) تحت الظروف الديمية والري التكميلي على التوالي . أضافة($P_1$) أعطى أعلى قيم للوزن الجاف الكلي ووزن الحبوب ووزن القش إذ بلغت (٤.٧٦ و ٢.٠٧ و ٢.٦٩) و (٩.٧ و ٤.٢٥ و ٥.١٢)$Mg.ha^{-1}$ تحت الظروف الديمية والري التكميلي على التوالي، بينما أدنى قيم سجلت (٣.٩٩ و ١.٦٤ و ٢.٣٥) و (٦.٨٧ و ٣.٦ و ٣.٥١)$Mg.ha^{-1}$ لتلك الأوزان في معامله( $P_0$) تحت الظروف الديمية والري التكميلي على التوالي. أضافة السماد البوتاسي سبب زيادة في وزن المادة الجافة ووزن الحبوب والقش، كانت أعلى الأوزان للمكونات المذكورة (٤.٧٦ و ٢.٠٥ و ٢.٧١) و (٩.٠٨ و ٤.١٤ و ٤.٩٤)$Mg.ha^{-1}$ سجلت في معاملة ($K_1$) تحت ظروف الديمية والري التكميلي على التوالي. بشكل عام أثر التداخل بين الاسمدة معنويا ($p \geq 0.05$) في وزن المادة الجافة ووزن الحبوب ووزن القش تحت الظروف الديمية والري التكميلي اذ أعلى قيم سجلت (٥.٧٩ و ٢.٨٦ و ٣.٤٠) و (١٠.٨ و ٤.٨٨ و ٥.٩٧)$Mg.ha^{-1}$ لتلك الأوزان في المعاملة العاملية ( $N_2P_1K_0Mg_0$ و$N_2P_1K_1Mg_0$ و$N_1P_0K_1Mg_1$) و ( $N_1P_1K_0Mg_0$ و $N_1P_2K_1Mg_1$ و$N_1P_1K_0Mg_0$) تحت الظروف الديمية والري التكميلي على التوالي، بينما سجلت ادنى قيم لاوزان المذكورة (٢.٢٠ و ٠.٦٠ و ١.٤٨) و (٤.١٣ و ١.٥٣ و ٢.٣٣) $Mg.ha^{-1}$ في المعاملات التالية ($N_0P_0K_0Mg_0$،$N_0P_0K_0Mg_0$، $N_0P_0K_0Mg_1$) ($N_0P_0K_0Mg_1$، $N_0P_0K_0Mg_1$، $N_2P_0K_0Mg_0$) ، تحت الظروف الديمية والري التكميلي على التوالي.


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