# EFFECT OF NITROGEN IRON FERTILIZERS, IRRIGATION INTERVALS AND SOIL TYPE ON MINERAL CONTENT OF WHEAT.

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***Abstract***

A pot experiment was carried out to study the influence of irrigation intervals, N-and Fe-fertilization on uptake of some macro - and micro nutrients by wheat plants grown on alluvial and calcareous soils. The obtained results could be summarized in the following:-

N and P-uptake were significantly affected by irrigation intervals. the highest values were found in the 8 days interval treatments . Increasing N and Fe fertilization levels led to pronounced increases in N- and P-uptake in alluvial soil.

Zn, Fe, Cu and Mn uptake were significantly affected by soil type. Increasing N fertilizer levels and decreasing irrigation intervals led to increases in the micronutrients uptake . However, increasing Fe fertilization resulted in increases in Zn and Fe uptake and decreases in Mn and Cu uptake by wheat plants.

## INTRODUCTION

Fertilization and water supply are among the important factors which affect the nutrient content of plants . The yeilding capacity of wheat is related to the nutrient uptake of plant of which growth characteristics and chemical composition are good criteria.

The availability of soil moisture affects the plant growth, yield and , especial-

ly , the capability to absorb nutrients needed for plant growth and development. Batra (1967) indicated that the effect of available soil moisture on nutrients uptake is exerted through different effects on availability of nutrients in soil . Talha (1973) reported that the difference in yield of wheat under soil moisture deficiency was significant. Ehlig and Le Mert (1976) showed that yield of wheat decreased as water application decreased.

Application of fertilizer indicates changes in nutrient concentration and total uptake. Puntanker and Sharma (1985) and Terman and Noggle (1973) reported that nitrogen increased the contents of N,P and K in leaves and other plant parts. Hussein *et al.* (1984) found that increasing nitrogen levels significantly increased concentrations and the total uptake of nitrogen and phosphorus , while it decreased K-concentration and total uptake. Also , they found that increasing N-levels increased concentrations and the total uptake of Fe while Mn, Zn and Cu were not affected by N-levels . Hsu and Ashmead (1982) , Gad-Allah (1984) and Ismail *et al.* (1990) found that foliar application of iron was effective on dry matter yield and iron uptake by the plant than soil application.

The present study aims at discussing and interpretting the results of nutrients uptake by wheat plants as influenced by irrigation intervals , nitrogen -iron-fertilizers and soil type.

## MATERIALS AND METHODS

A pot Experiment was carried out using 10kg portions of calcareous and alluvial soils taken from Tahreer province Northern sector and Kalubia Governorate at Bahtim, respectively. Some soil physical and chemical properties of the soils under study are given in Tabel 1.

Wheat grains (Sakha 8) , 10 per pot, were sown and the seedlings were thinned to 6/pot after 30 days from planting . After thinning, all pots received potassium sulphate (48% $K_2O$) at the rate of 100 kg /fed. Superphosphate (15.5% $P_2O_5$) was added before planting at the rate of 150 kg/fed. Nitrogen was added as ammonium nitrate (33.5%N) at rates of 40 and 80kg /fed. Three levels of iron (iron sulphate; 20% Fe) were added at the rates of 0,10 and 20ppm Fe/fed. Both nitrogen and iron fertilizers were added at two equal doses, the first after 30 days from planting , and the second after another 30 days.

Table 1. Some physical and chemical properties of the different studied soils.

| Characters | Bahtim soil | El-Tahreer soil |
|---|---|---|
| Particle size distribution | | |
| Coarse sand % | 0.71 | 14.37 |
| Fine sand % | 17.05 | 48.34 |
| Silt % | 36.65 | 21.03 |
| Clay % | 45.62 | 15.90 |
| Texture, class | Clay loam | Sandy loam |
| E.C. mmoh/cm25oC | 1.55 | 3.09 |
| O.M. % | 1.40 | 0.80 |
| CaCO3 | 2.65 | 24.78 |
| Moisture constants | | |
| Field capacity % | 35.50 | 21.10 |
| Wilting point % | 15.60 | 12.00 |
| Available water % | 19.90 | 9.20 |

The water regime was applied in two irrigation frequencies, 8 days 16 days, repectively. The amount of water given for irrigation was the same for all treatments (1 L /pot)throughout the experimental period. Plants were harvested after 90 days from planting.

The wet method was used to digest plant samples. Phosphorus was determined as described by Piper (1950), while iron, copper, zinc and manganese were determined using the atomic absorption spectophotometer. Nitrogen was determined in another wet digestion as described by Pregle (1945).

The statistical analysis methods were carried out according to Snedecor and Cochran (1969).

## RESULTS AND DISCUSSION

Data in Table 2 show that, generally, the values of N and P uptake by wheat plants are significantly affected by soil type. The highest values of N and P-uptake

Table 2. Nitrogen and phosphours uptake by wheat plants as affected by soil type, irrigation intervals and N and Fe fertilization (mg/pot).

| Soil Type | Irrig ation | Fe levels | N-uptake N-levels Kg/fed. $N_o$ | $N_{40}$ | $N_{80}$ | Mean | N-uptake N-levels Kg/fed. $N_o$ | $N_{40}$ | $N_{80}$ | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Allvial | $I_1$ | Feo | 57.00 | 70.06 | 155.94 | 94.33 | 0.81 | 1.41 | 1.67 | 1.30 |
| | | Fe10 | 80.67 | 87.70 | 160.13 | 109.50 | 0.19 | 2.74 | 4.24 | 3.06 |
| | | Fe20 | 133.00 | 136.94 | 189.82 | 152.09 | 7.38 | 8.51 | 21.02 | 12.30 |
| | | Mean | 90.22 | 98.07 | 168.63 | 118.97 | 3.46 | 4.22 | 8.98 | 5.55 |
| | $I_2$ | Feo | 49.30 | 71.81 | 114.08 | 78.40 | 1.36 | 1.53 | 1.90 | 1.60 |
| | | Fe10 | 66.12 | 85.68 | 117.30 | 89.70 | 2.56 | 4.90 | 5.70 | 4.39 |
| | | Fe20 | 75.20 | 88.84 | 150.02 | 104.69 | 7.57 | 8.94 | 9.18 | 8.56 |
| | | mean | 63.54 | 82.11 | 127.13 | 90.93 | 3.83 | 5.12 | 5.59 | 4.85 |
| | | Mean | 76.88 | 90.09 | 147.88 | 104.95 | 3.65 | 4.67 | 7.29 | 5.20 |
| Calcar eous | $I_1$ | Feo | 48.50 | 70.84 | 98.24 | 72.53 | 0.41 | 0.69 | 1.03 | 0.71 |
| | | Fe10 | 66.56 | 81.18 | 107.06 | 84.93 | 3.11 | 5.24 | 5.50 | 4.62 |
| | | Fe20 | 70.62 | 97.09 | 107.35 | 91.96 | 6.62 | 7.00 | 9.36 | 7.66 |
| | | Mean | 61.89 | 83.04 | 104.22 | 83.05 | 3.38 | 4.31 | 5.30 | 4.33 |
| | $I_2$ | Feo | 41.22 | 67.50 | 82.50 | 63.74 | 0.10 | 2.34 | 3.49 | 1.98 |
| | | Fe10 | 42.81 | 69.53 | 106.08 | 72.81 | 3.84 | 4.18 | 5.22 | 4.41 |
| | | Fe20 | 52.02 | 73.26 | 127.16 | 84.15 | 5.32 | 5.85 | 6.98 | 6.05 |
| | | mean | 45.35 | 40.09 | 105.25 | 73.56 | 3.09 | 4.12 | 5.23 | 4.15 |
| | | Mean | 53.52 | 76.57 | 104.74 | 78.31 | 3.24 | 4.22 | 5.27 | 5.24 |

| L.S.D. | at 5% | at 1% | at 5% | at 1% |
|---|---|---|---|---|
| Soils (S) | 1.44 | 1.91 | 0.06 | 0.08 |
| Irrigation (1) | 1.44 | 1.91 | 0.06 | 0.08 |
| Nitrogen (N) | 1.76 | 2.34 | 0.08 | 0.10 |
| Iron (Fe) | 1.76 | 2.34 | 0.08 | 0.10 |

$I_1$ = Irrigation every 8 days.
$I_2$ = Irrigation every 16 days.

were found under alluvial soil, while the lowest ones were obtained by the calcareous soil. This may be due to the improved soil conditions for plant growth under alluvial if compared with the calcareous soil.

Nitrogen and phosphorus uptake by wheat plants were significantly increased when irrigation was carried every 8 days. Meanwhile , the lowest uptake was observed after the second irrigation iterval (16 days ) which took the minimum amount of irrigation water through the growing season. These findings are in agreement with those obtained by Varma (1976) who found that the uptake of N and P by some cereal and leguminous crops increased with increasing soil moisture content.

Values of N- and P-uptake by wheat were significnantly increased with the rate of applied N and FE fertilizers. These results are in harmony with those obtained by Jariov *et al.* (1976) who reported that increasing N-rate increased plant N-uptake . Also, Andrish *et al.* (1971) reported that the more the N-applied, the more amount of phosphorus was found in whole plants.

Data in Tables 3 and 4 indicated that Zn-, Fe-, Cu- and Mn-uptake by wheat plants are influenced by the soil type . Results indicated that the total uptake of all micronutrients under investigation were signifcantly increased under alluvial soil when compared with the calcareous one. this finding may be due to the adequate organic matter content in the alluvial oil which enhances the solubility of non-soluble minerals in soil media.

With regard to the effect of irrigation intervals on the total uptake of different micronutrients under study , data in Tables 3 and 4 revealed that Zn-, Fe-, Cu- and Mn-uptake by wheat plants increased by decreasing the irrigation intervals. The decrease of the nutrients in wheat plants as soil moisture decreased may be due to reducing the solubility of minerals in the soil where the water films are thin and the path length of movement increases, hence, movement of cations to root is reduced. High tension exerts a physiological effect on the root elongation, trugidity and number of root hairs which was reduced with increasing tension. These reuslts confirm those obtained by Lal and Taylor (1970) who detected increased in the uptake of nutrient ions propably because the reducing conditions increased minerals solubility.

Nitogen fertilizer addition resutled in increases in the total uptake of all micronutrients under investigation. This effect was highly significant for Zn-, Fe-, Cu- and Mn-uptake. This might be attributed to the increase in the root surface per nuit of soil volume and the rate of nutrient uptake , or might be due to the high capacity

Table 3. Zinc and iron uptake by wheat plants as affected by soil type, irrigation intervals and N and Fe fertilization (mg/pot).

| Soil Type | Irrig ation | Fe levels | Zn | | | Mean | Fe | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | N-levels Kg/fed. | | | | N-levels Kg/fed. | | | |
| | | | $N_o$ | $N_{40}$ | $N_{80}$ | | $N_o$ | $N_{40}$ | $N_{80}$ | |
| Allvial | $I_1$ | Feo | 115 | 223 | 302 | 213 | 117 | 566 | 788 | 490 |
| | | Fe10 | 213 | 225 | 353 | 264 | 578 | 566 | 878 | 718 |
| | | Fe20 | 294 | 330 | 465 | 363 | 755 | 814 | 1127 | 895 |
| | | Mean | 207 | 259 | 373 | 280 | 483 | 690 | 931 | 701 |
| | $I_2$ | Feo | 111 | 119 | 131 | 120 | 411 | 436 | 465 | 431 |
| | | Fe10 | 130 | 176 | 631 | 312 | 414 | 606 | 640 | 587 |
| | | Fe20 | 132 | 399 | 638 | 390 | 704 | 711 | 817 | 744 |
| | | mean | 124 | 231 | 467 | 274 | 543 | 584 | 641 | 587 |
| | | Mean | 166 | 245 | 420 | 277 | 513 | 637 | 786 | 645 |
| Calcar eous | $I_1$ | Feo | 101 | 273 | 398 | 257 | 433 | 480 | 598 | 504 |
| | | Fe10 | 207 | 318 | 460 | 328 | 597 | 685 | 761 | 681 |
| | | Fe20 | 282 | 374 | 495 | 384 | 798 | 918 | 944 | 887 |
| | | Mean | 197 | 322 | 451 | 323 | 609 | 694 | 768 | 691 |
| | $I_2$ | Feo | 076 | 106 | 156 | 113 | 291 | 298 | 320 | 303 |
| | | Fe10 | 197 | 219 | 336 | 251 | 334 | 336 | 379 | 350 |
| | | Fe20 | 234 | 240 | 430 | 301 | 500 | 504 | 708 | 571 |
| | | mean | 169 | 188 | 307 | 221 | 375 | 379 | 469 | 408 |
| | | Mean | 183 | 255 | 379 | 272 | 792 | 537 | 619 | 550 |

| L.S.D. | at 5% | at 1% | at 5% | at 1% |
|---|---|---|---|---|
| Soils (S) | 5 | N.S. | 8 | 11 |
| Irrigation (1) | 5 | 6 | 8 | 11 |
| Nitrogen (N) | 5 | 8 | 8 | 11 |
| Iron (Fe) | 6 | 8 | 10 | 13 |

$I_1$ = Irrigation every 8 days. $I_2$ = Irrigation every 16 days.

N.S. = Non significant.

Table 4. Copper and manganese uptake by wheat plants as affected by soil type, irrigation intervals and N and Fe fertilization (mg/pot).

| Soil Type | Irrig ation | Fe levels | Cu | | | Mean | Mn | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | N-levels Kg/fed. | | | | N-levels Kg/fed. | | | |
| | | | $N_o$ | $N_{40}$ | $N_{80}$ | | $N_o$ | $N_{40}$ | $N_{80}$ | |
| Allvial | $I_1$ | Feo | 62.42 | 67.83 | 137.38 | 98.21 | 102.14 | 110.74 | 218.12 | 134.6 |
| | | Fe10 | 30.02 | 44.80 | 47.88 | 40.90 | 86.74 | 86.85 | 71.92 | 81.8 |
| | | Fe20 | 23.65 | 36.16 | 38.59 | 32.80 | 53.96 | 59.09 | 62.27 | 58.4 |
| | | Mean | 38.70 | 49.60 | 74.62 | 54.30 | 80.95 | 85.56 | 117.44 | 94.69 |
| | $I_2$ | Feo | 32.34 | 53.74 | 119.04 | 68.37 | 62.10 | 67.58 | 72.59 | 67.4 |
| | | Fe10 | 25.09 | 25.34 | 31.92 | 27.45 | 54.24 | 56.92 | 58.61 | 56.5 |
| | | Fe20 | 17.99 | 19.55 | 22.50 | 20.01 | 44.63 | 47.35 | 47.96 | 46.6 |
| | | mean | 25.14 | 32.88 | 57.82 | 38.61 | 53.66 | 57.28 | 59.72 | 56.8 |
| | | Mean | 31.92 | 41.24 | 66.22 | 46.46 | 67.31 | 71.42 | 88.58 | 75.7 |
| Calcar eous | $I_1$ | Feo | 49.92 | 69.19 | 89.55 | 69.55 | 56.17 | 59.40 | 76.96 | 64.1 |
| | | Fe10 | 27.54 | 32.29 | 34.65 | 31.49 | 41.91 | 43.88 | 50.72 | 45.5 |
| | | Fe20 | 12.78 | 22.05 | 26.18 | 20.34 | 27.54 | 30.67 | 42.35 | 33.5 |
| | | Mean | 30.08 | 41.18 | 50.13 | 40.46 | 41.87 | 44.65 | 56.86 | 47.7 |
| | $I_2$ | Feo | 24.86 | 25.25 | 29.25 | 26.45 | 49.88 | 50.29 | 57.33 | 52.5 |
| | | Fe10 | 20.37 | 21.95 | 23.60 | 21.97 | 36.36 | 41.74 | 44.94 | 41.0 |
| | | Fe20 | 16.76 | 16.80 | 16.91 | 16.82 | 33.82 | 35.87 | 36.89 | 35.5 |
| | | mean | 20.66 | 21.33 | 23.25 | 21.75 | 40.02 | 42.63 | 46.39 | 43.0 |
| | | Mean | 25.37 | 31.26 | 36.69 | 31.11 | 40.95 | 43.64 | 51.54 | 45.3 |

| L.S.D. | at 5% | at 1% | at 5% | at 1% |
|---|---|---|---|---|
| Soils (S) | 0.58 | 0.77 | 0.99 | 1.3 |
| Irrigation (1) | 0.58 | 0.77 | 0.99 | 1.3 |
| Nitrogen (N) | 0.71 | 0.95 | 1.22 | 1.6 |
| Iron (Fe) | 0.71 | 0.95 | 1.22 | 1.6 |

$I_1$ = Irrigation every 8 days.

$I_2$ = Irrigation every 16 days.

of the plants supplied with N-fertilizers in building metabolites which might contribute much to the increase of the dry matter content and nutrients uptake by plants.

Data in Tables 3 and 4 show that increasing Fe-level from 10 to 20 ppm significantly increased the values of Zn and Fe uptake and significantly decreased the uptake of Cu and Mn elements. Similar results were obtained by Hussien *et al* (1984).

The present results lead to the conclusion that irrigation every 8 days, in combination with N and Fe fertilizers with 80kg N and 20pp, Fe/fed. gave the best quantity and the quality of yield of wheat plants grown on both alluvial and calcareous soils.

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# تأثير فترات الرى ومستويات من التسميد بالنتروجين والحديد ونوع الارض على امتصاص العناصر الغذائية لنبات القمح

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معهد بحوث الاراضى والمياه – مركز البحوث الزراعية – الجيزة

في تجربة لدراسة تأثير ثلاث مستويات من التسميد النتروجيني صفر، ٤٠، ٨٠ كجم نتروجين للفدان) وثلاث مستويات من الحديد (صفر ، ١٠، ٢٠ جزء في المليون) أضيف كل من النتروجين والحديد علي دفعتين متساويتين الاولي بعد شهر من الزراعه والثانية بعد شهر من الأولي وتم ري التجربه علي فترتين ( الاولي كل ٨ايام والثانيه كل ١٦ يوم ) بمعدل لتر للأصيص فى كل رية– وقد تم تقدير كل من النتروجين ، الفوسفور ، الزنك ، الحديد، النحاس ، المنجنيز الممتص بواسطة نبات القمح المنزرع في نوعين من الاراضي الاولي كانت رسوبية الثانيه جيرية وأظهرت النتائج المتحصل عليها الاتي :

– تأثير كل من النتروجين والفوسفور الممتص تأثراً معنوياً بفترات الري وكانت أعلي القيم المتحصل عليها في حالة الري كل ثمانية أيام ، كما أدت معدلات التسميد بالنتروجين والحديد الي زيادة النتروجين والفوسفور الممتص بواسطة النبات وخاصة في الاراضي الرسوبية

– كانت قيم الزنك والحديد والنحاس والمنجنيز الممتص في الاراضي الرسوبية أعلي منها في الأراضي الجيرية وأدت زيادة معدل التسميد النتروجيني الي زيادة هذة العناصر في النبات كما أدت زيادة التسميد بالحديد الي زيادة الكمية الممتصة من هذين العنصرين والي نقص الكمية الممتصه من المنجنيز والنحاس.