The Effect of Different Levels of Potassium on The Productivity of Genotypes of Wheat Triticum Aestivum L.

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Abstract

A field experiment was carried out in the second agricultural station of the College of Agriculture - University of Al-Muthanna in the Al Bandar area (2 km from the city center), during the season (2020-2021) to know the effect of different levels of potassium fertilizer coated and are K0 (without addition), K1 (30 kg.K.H\textsuperscript{+}), K2 (60 kg.K.H\textsuperscript{+}), K3 (90 kg.K.H\textsuperscript{+}) and K4 (120 kg.K.H\textsuperscript{+} without coated) On the vespone of the genotypes of the wheat (Iksad 59, Iranian, Iksad 901, Iksad 133 and Boohooth 22). According to what the process requires of printing to arrange the splinter panels using a design R.C.B.D and three repetitions, As the potash fertilizer treatments were placed in the main panels (Main-plots) While the genotypes were placed in the secondary plates (Sub-plot). The results showed a significant difference between the genotypes in the traits studied as the Iksad 133 genotype superior in the biological yield, while the Iranian genotype was superior in the weight of 1,000 seeds and the harvest index, and as response to potassium fertilizer, The coated treatment has outperformed 30 kg.K.H\textsuperscript{+}. The No. grains spike\textsuperscript{-1} and the weight 1000 seeds. It also excelled in the seed yield, vital yield and harvest index, which averaged reached 8.03 tons H\textsuperscript{+} and 18.33 tons H\textsuperscript{+} and 43.98 % respectively, while the coated treatment superior 90 kg.K.H\textsuperscript{+} significantly in the No. of fertile spikes. M\textsuperscript{2}. As for the interaction between the two factors, the combination (Iksad 133 x K3) was superior in the No. of fertile spikes, and the combination (Iksad 59 x K4) in the No. of spike grains, while the two combinations superior (Booooth 22 x K1) and (Iksad 133 x K1) in grain yield, which averaged 9.11 and 9.06 tons ha\textsuperscript{-1} respectively, and the combination (Iksad 133 x K1) was superior in bio-it give high mea reached 21.27 tons.ha\textsuperscript{-1}. The combination (Iranian x K2) was superior in the harvest index, It reached 48.75%.

Keywords: Potassium, Triticum aestivum, Agricultural, Fertile.

1. Introduction

The wheat *Triticum aestivum* L. is one of the most important strategic crops in the world and ranks first in terms of nutritional importance and is an essential source of nutrition, as it is an essential provider of essential amino acids, minerals and vitamins, and that its grain provides an adult with more than 25% of his protein needs and more than 50 % of its energy need [1] and despite the availability of success factors for its cultivation in Iraq, its productivity per unit area is below the required level [2] as a result of various reasons, the most important of which is related to the evaluation of new varieties and knowledge of their performance and selection of the most appropriate Including the conditions of the region due to its different environmental and agricultural requirements. Most of the Iraqi soils are characterized by a high stabilization capacity for added potassium, ranging (25-75%), and the lack of response of some plants to the added potassium fertilization is due to its stabilization and lack of access to the plant [3] and in order to increase the efficiency of some added fertilizers and reduce the lost and proven quantities of them. Several methods were followed, including the process of coated fertilizers with natural and industrial materials, including the use of zeolite mineral, which was used as a soil conditioner and improver of its fertility, by directly adding it to the soil planted with wheat due to its high selectivity for potassium and increasing the growth and productivity of the wheat crop and increasing the availability of this element in the soil [4]. The studies that focused on the coated of potassium fertilizers in general are rare, if any, and the adoption of zeolite mineral as a coating material in particular is one of the things that have not been applied previously, so coating the fertilizer with this mineral performs many functions, including increasing the speed of decomposition of added potassium and reducing losses. By reducing the speed of its installation, which reduces the added quantities and the consequent reduction in the costs of the agricultural process, since the fertilizer is not produced locally, and it limits the environmental damage, increases the availability of the element to the plant in terms of quantity and time, and improves the porosity of the soil, so this experiment.
was carried out with the aim of Knowing the performance of the genotypes, especially the newly introduced ones, under the influence of coated potassium fertilizer and determining the best ones in productivity.

2. Materials and Methods

The field experiment was carried out at the second research station of the College of Agriculture / Al-Muthanna University in the Al-Bandar region, located southwest of Al-Muthanna Governorate (2 km from the center of Al-Muthanna Governorate), during the winter season (2020-2021), with the aim of knowing the effect of coated potassium fertilizer on the growth of genotypes of wheat, and the experiment included the study of two factors: First: five genotypes of wheat (V1 Iksad 59, (V2) Iranian, (V3) Iksad 901, (V4) Iksad 133 and (V5) Boohoos 22), second: five levels of potassium fertilizer and are K0 (without addition), K1 (30 kg.K.H\(^-1\)), K2 (60 kg.K.H\(^-1\)), K3 (90 kg.K.H\(^-1\)) and K4 (120 kg.K.H\(^-1\) without coated). The experiment was applied in a split-plot using the randomized complete block design (RCBD) and with three replications, the potassium fertilizer treatments arrangement in main plots, while the genotypes arrangement in sub-plots, the total experimental units (3 x 5 x 5) = 75 experimental units The soil of the field was plowed by two opposite tillage the inverted and left for a period to dry, after which the soil was smoothed with the disc harrows and the land was leveled and divided into boards according to the design used and the waterers were opened and the shoulders were made between the boards and left a distance of 0.5 m between the secondary boards (varieties) and 2 m between the main plates (potassium treatments) and between one Block and another to maintain that the levels of potassium fertilizer do not overlap between the experimental units. The area of the experimental unit was (1x2) m. It included 10 lines with a length of 1 m and 20 cm between lines seed vates was 120 kg.ha\(^-1\). The field was fertilized before planting with phosphate fertilizer in the form of triple superphosphate fertilizer (46% P) with an amount of 80 kg P ha\(^-1\) in one dose and nitrogen fertilizer was added in the form of urea fertilizer (46% N) with an amount of 200 kg N ha\(^-1\) in two doses. The first when seedling and the second when flowering [5], and the potassium fertilizer was added in two doses, the first when planting and the second when flowering in the form of potassium sulfate fertilizer (42% K) according to the experiment parameters. The grains were planted and the first irrigation was given on 11/16/2020, the weeding process was conducted manually and whenever needed, as was the case with the irrigation process, and the plants were harvested on 4/25/2021 after the appearance of signs of crop maturity, compound sample was taken from them to conducting some chemical and physical analyzes as shown in the table (1).

| Adjective | The value | Measuring unit |
|-----------|-----------|----------------|
| sand      | 32        | %              |
| silt      | 38        | %              |
| mud       | 30        | %              |
| soil texture |         |                |
| clay mixture |         |                |
| Soil acidity 1:1 (pH) | 7.7 | –             |
| electrical conductivity E.C\(_e\) | 6.2 | ds.m\(^-1\) |
| Organic matter | 1.12 | %               |
| available nitrogen | 61 | mg.g\(^-1\) |
| available phosphorous | 10.5 | mg.g\(^-1\) |
| available potassium | 132 | mg.g\(^-1\) |

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

3. Results and Discussion

3.1 Number of fertile spike (m\(^2\))

The results in Table (2) showed the superiority of the potassium K3 treatment in the characteristic of the number of fertile spikes per unit area, and gave the highest mean of 426.3 spikes m\(^2\), followed by the potassium K1 treatment, which averaged...
419.8 spikes m\(^{-2}\) without significant difference between them, while Treatment K2 gave the lowest average for this trait, which amounted to 384.5 m\(^{-2}\) spikes. The reason for the superiority of treatment K3 in the number of fertile spikes may be due to its superiority in the plant’s potassium content (Table 2) and its effective role in meristematic cell division, growth and formation of new organs in the plant, and this result agreed with [6-8], who showed a difference in the number of fertile heads according to the levels of potassium added to the soil. The results of the interaction between the genotypes and potassium fertilizer showed that the highest means of the number of fertile spikes and for all the studied genotypes (except for V1, which seems to be what is in the soil was sufficient for its nutritional requirement of potassium) were with the potassium treatments K3 and K1, and the combination (V4 × K3), which give high means 479.2 m\(^2\) and without a significant difference from a number of combinations, while the combination (V2 × K2) gave the lowest means of 326.7 m\(^2\) and without a significant difference from a number of combinations (Table 2), and perhaps The reason for the superiority of the above-mentioned combination in the number of fertile spikes is due to its superiority in the potassium content of the plant.

**Table 2.** Effect of potassium levels and genotypes and the interaction between them on the No. of fertile ears (m\(^2\)).

| Genetics | Potassium levels | Middle compositions |
|----------|------------------|---------------------|
|          | K0   | K1   | K2   | K3   | K4   |                |
| V1       | 431.7 | 375.0 | 395.8 | 410.8 | 417.5 | 406.2          |
| V2       | 402.5 | 423.3 | 420.8 | 442.5 | 419.2 | 421.7          |
| V3       | 429.2 | 408.3 | 424.2 | 370.0 | 400.0 | 406.3          |
| V4       | 368.3 | 467.5 | 326.7 | 479.2 | 363.3 | 401.0          |
| V5       | 395.0 | 425.0 | 355.0 | 429.2 | 339.2 | 388.7          |
| Potassium means | 405.3 | 419.8 | 384.5 | 426.3 | 387.8 |
| Values L.S.D (0.05) | Genetics (N.S) | Potassium levels (24.98) | Interaction (72.72) |

3.2 The number of seed per spike\(^{1}\)

The results indicated that the K1-coated potassium fertilizer treatment was significantly superior in the No. seed per spike and give high men reache 57.04 seed spike\(^{1}\), the potassium-coated K3 treatment with an mean of 54.13 grains in the spike\(^{1}\), then the K4 treatment and the potassium-coated K2 treatment. 60 kg K ha\(^{-1}\), while the potassium K0 treatment (without addition) finally resolved with an average of 45.59 grains of spike\(^{1}\) (Table 3). Seed pw spike, and this result agreed with [9], who observed a significant effect of the added potassium levels on the characteristic of No. seed per spike. The results of the interaction between genotypes and potassium treatments showed that the combination (V1 × K4) was superior to the number of spike grains, with an average of 63.80 grains of spike\(^{1}\), without significant difference from the number of combinations, the closest of which was the two combinations (V2 × K1). And (V3 x K3) with mean of 60.93 and 60.17 seeds spike\(^{1}\), respectively, while the combination (V2 x K0) gave the lowest average for this trait amounting to 39.97 seeds spike\(^{1}\) (Table 3). This can be explained on the basis that the genotype V1 is a genotype that was not clearly responsive to different potassium levels, which weakened the effect of this factor on most growth characteristics, including the length of the spike, thus leaving the room for the genetic aspect to have the greatest influence in determining the No. of seed in the spike. Which is one of the determining factors for this characteristic.

3.3 The weight of 1000 seeds (gm)

The results in Table (4) showed the superiority of the potassium fertilizer K1, which gave the highest weight of one thousand grains of 46.60 gm, without significant difference from the K4, which 45.12 gm, while K0 gave the lowest average for this trait, which reached to 43.27 gm, perhaps due to the reason This indicates that the K1 gave a low average of the No. of fertile spikelets per unit area (Table 2), which means that there is little competition between the spike-bearing ripples (source) for Growth factors, which increased its ability to produce and store dry matter and then transport it to the estuaries during the period of filling the bean and this was reflected on its weight, and this result agreed with[10-18] they found when add levels of potassium there are different response in weight of 1000 seeds.

It was observed from the results in Table (4) that the genotype V2 give the highest mean for the trait of weight 1000 seed with means of 46.25 gm and without significant difference from the genotypes V1, V3 and V4 whose averages reached 45.04, 44.71 and 44.50 g, while the genotype gave V5, the lowest average for this trait was 42.16 g. The reason for this may be due to the fact that the genotype V2 gave the lowest average No. of spike seed (Table 3), Which reduced the state of competition between the seed within one spike over the producer and source of representative materials, which increased the weight of the seeds. This result was in agreement with [19-25], they found a difference in the number of grains of the spike according to the studied varieties.
Table 3. Effect of potassium levels and genotypes and the interaction between them in the No. of seed per in a spike.

| Genetics | Potassium levels | Middle compositions |
|----------|------------------|---------------------|
|          | K0               | K1                  | K2      | K3      | K4      |        |
| V1       | 42.50            | 55.80               | 47.80   | 54.20   | 63.80   | 52.82  |
| V2       | 39.97            | 60.93               | 55.00   | 50.33   | 49.93   | 51.23  |
| V3       | 48.37            | 51.77               | 48.60   | 60.17   | 59.23   | 53.63  |
| V4       | 50.53            | 58.83               | 51.90   | 53.13   | 47.50   | 52.38  |
| V5       | 46.60            | 57.87               | 50.73   | 52.80   | 49.30   | 51.46  |
| Potassium means | 45.59 | 57.04 | 50.81 | 54.13 | 53.95 |  |
| Values L.S.D (0.05) | Genetics | Potassium levels | Interaction |
|          | (N.S)            | (1.89)              | (6.49)  |

Table 4. Effect of potassium levels and genotypes and the interaction between them on the weight of 1000 seeds (gm).

| Genetics | Potassium levels | Middle compositions |
|----------|------------------|---------------------|
|          | K0               | K1                  | K2      | K3      | K4      |        |
| V1       | 42.04            | 47.97               | 46.04   | 46.31   | 42.83   | 45.04  |
| V2       | 45.86            | 46.87               | 45.79   | 46.91   | 45.81   | 46.25  |
| V3       | 43.82            | 45.94               | 43.22   | 43.74   | 46.85   | 44.71  |
| V4       | 42.31            | 45.73               | 42.94   | 44.28   | 47.23   | 44.50  |
| V5       | 42.32            | 46.48               | 40.06   | 39.09   | 42.87   | 42.16  |
| Potassium means | 43.27 | 46.60 | 43.61 | 44.07 | 45.12 |  |
| Values L.S.D (0.05) | Genetics | Potassium levels | Interaction |
|          | (2.00)           | (1.58)              | (N.S)   |

3.4 Seed yield (ton ha⁻¹)

It was noticed from the results in Table (5) that the treatment of potassium fertilizer K1 was significantly superior to all other levels in terms of grain yield, which averaged 8.03 tons ha⁻¹, followed by levels K4, then K3 and K2 with averages of 7.07, 6.97 and 6.60 tons ha⁻¹ sequentially while the give K0 (comparison) The lowest average grain yield was 5.72 tons ha⁻¹. The reason for the superiority of the potassium K1 is attributed to its original superiority in the No. of spike grains (Table 3) and the weight of one thousand grains (Table 4), in a way that made the increase achieved from the increase of these two components exceeded the decrease caused by The relative decrease in the third yield component (the No. of fertile ears per square meter), and this result agreed with [2]. [20], who showed a difference in the character of the grain yield with the difference in the quantities added from potassium. As for the results of the interaction between the genotypes and potassium treatments, they reflected two very important things, the first of which is the great feasibility in general of the technology of packaging potassium fertilizer at all levels and for all the studied genotypes except for synthesis V1, which showed clear fluctuation in all its results, and the second is what this technology provided on the face Especially from the quantities of added fertilizers that are lost due to the stabilization process to which the potassium fertilizer is exposed, and because of which most of the researchers’ recommendations came to add it as a supplement (ground + spray), as the genotypes recorded the best results for them with the treatment of coated potassium K1 (30 kg K ha⁻¹). What confirms this is the superiority of the two combinations (V5 × K1 and V4 × K1), which means 9.11 and 9.06 tons ha⁻¹ on the and without a significant difference for a number of combinations, while the combination gave (V1 × K0) was the lowest mean grain yield, it give 4.54 tons ha⁻¹, without significant difference from the number of combinations, most of which were with the K0 fertilizer treatment (Table 4). (Table 2) and the No. of spike grains (Table 3) with a clear increase in the weight of the 1000 seed (Table 4), although it was not significant, since the relationship between these components is based on the principle of compensation among them, which led in total to creating cumulative increases that led to increasing the seed yield.
Table 5. Effect of potassium levels and genotypes and the interaction between them on seed yield (tons ha\(^{-1}\)).

| Genetics  | Potassium levels | Middle compositions |
|-----------|------------------|---------------------|
|           | K0   | K1   | K2   | K3   | K4   |        |
| V1        | 4.54 | 5.62 | 7.01 | 7.07 | 8.13 | 6.47   |
| V2        | 5.66 | 8.37 | 7.03 | 6.73 | 6.38 | 6.83   |
| V3        | 6.53 | 7.99 | 6.62 | 6.34 | 7.93 | 7.08   |
| V4        | 6.66 | 9.06 | 5.69 | 7.76 | 6.78 | 7.19   |
| V5        | 5.23 | 9.11 | 6.65 | 6.97 | 6.14 | 6.82   |
| Potassium means | 5.72 | 8.03 | 6.60 | 6.97 | 7.07 |
| Values L.S.D (0.05) |        | (N.S) | (0.74) |       | (1.60) |

3.5 Biological yield (ton ha\(^{-1}\))

The results in Table (6) showed the superiority of the potassium fertilizer K1 significantly over the rest of the potassium treatments, which averaged 18.33 tons ha\(^{-1}\), while the control K0 gave the lowest average for this trait amounted to 15.59 tons ha\(^{-1}\) without significant difference from the two levels K2 and K3 (Table 6), and this result agreed with [2,13,20] they showed a difference in biological yield with different levels of potassium added. The results also showed that genotype V4 was significantly superior to the rest of the genotypes in the trait of yield, with an of 18.15 tons ha\(^{-1}\), while genotype V2 gave the lowest of 15.42 tons hectare\(^{-1}\), and they agreed This result is with [16] who found the difference in the varieties in the characteristic of the product. As for the interaction between the genotypes and potassium fertilizer, the results in Table (6) indicate the superiority of the combination (V4 × K1) and without a significant difference from the combination (V3 × K4), with their averages reaching 21.27 and 20.54 tons ha\(^{-1}\) respectively, while the combination (V2 x K0) gave the lowest average of 14.08 tons ha\(^{-1}\) and without significant difference from a number of combinations. The biological yield is the result of dry matter production (straw + grain) before and after the refinement process. Therefore, the reason for the superiority of genotype V4 and treatment K1 and the interaction between them may be due to the large increases in grain yield (Table 5), which appears from the data to be the most influential component in Determining the biological yield with the mentioned treatments being among the group of treatments that recorded a high dry weight in the flowering stage.

Table 6. Effect of potassium levels and genotypes and the interaction between them on the biological yield (ton ha\(^{-1}\)).

| Genetics  | Potassium levels | Middle compositions |
|-----------|------------------|---------------------|
|           | K0   | K1   | K2   | K3   | K4   |        |
| V1        | 15.33 | 15.64 | 15.16 | 17.59 | 18.77 | 16.50   |
| V2        | 14.08 | 18.01 | 14.47 | 14.91 | 15.64 | 15.42   |
| V3        | 15.43 | 18.82 | 17.15 | 14.19 | 20.54 | 17.23   |
| V4        | 16.95 | 21.27 | 18.16 | 18.18 | 16.21 | 18.15   |
| V5        | 16.16 | 17.92 | 18.35 | 16.98 | 14.32 | 16.74   |
| Potassium means | 15.59 | 18.33 | 16.66 | 16.37 | 17.09 |
| Values L.S.D (0.05) |        | (0.98) | (1.09) |       | (2.18) |

3.6 Harvest Index (%)

The results showed that K1 outperformed the harvesting factor with an average of 43.98% and without significant difference from the K3 and K4 levels, while the K0 gave a significant decrease in this trait with an average of 36.93% (Table 7), and the reason for this is due to the superiority of Potassium K1 in grain yield compared to the rest of the genotypes (Table 5), and this result is in agreement with[12] who noticed a difference in the harvest index with different levels of potassium added. The results also showed that genotype V2 gene significantly outperformed the rest of the studied genotypes in the trait of harvest index, which averaged 44.47%. The results also did not show significant differences between the two genotypes V3 and V5, which averaged 41.26 and 40.78%, while the V1 genotype recorded the lowest average for these The trait was 39.41% and without significant difference from the genotype V4 (Table 7), The reason for this is due to the high conversion efficiency of the dry matter from the vegetative part to the fruit part of genotype V2 compared to other genotypes. This result is in agreement with [5,6,10,23], who showed the different varieties studied in his description Harvest Guide.
The results of the interaction between the studied workers showed the superiority of the combination (V2 × K2) in recording the highest mean of the harvest index amounted to 48.75% and without significant difference from a number of combinations, while the combination (V1 × K0) recorded the lowest average for this trait amounting to 29.83% And without a significant difference from a number of mixtures as well (Table 7), the reason for the superiority of the mentioned mixture is due to its high conversion efficiency, as it was able to convert about half of the dry matter produced during the life of the crop despite the low of its vital yield (Table 6). It was able to produce a high grain yield (Table 5).

Table 7. Effect of potassium levels and genotypes and the interaction between them on the harvest index (%).

| Genetics | Potassium levels | Middle compositions |
|----------|------------------|---------------------|
|          | K0   | K1   | K2   | K3   | K4   | Genetics (2.51) | Potassium levels (2.49) | Interaction (5.44) |
| V1       | 29.83| 36.92| 46.46| 40.39| 43.44| 39.41          |                       |                   |
| V2       | 40.20| 46.79| 48.75| 45.59| 41.01| 44.47          |                       |                   |
| V3       | 42.25| 42.42| 38.61| 44.43| 38.62| 41.26          |                       |                   |
| V4       | 40.03| 42.53| 31.90| 42.85| 42.22| 39.91          |                       |                   |
| V5       | 32.37| 51.24| 36.46| 41.09| 42.75| 40.78          |                       |                   |
| Potassium means | 36.93 | 43.98 | 40.44 | 42.87 | 41.61 |                       |                   |
| Values L.S.D (0.05) | 13.30 | 13.37 | 13.50 | 13.10 | 13.07 |                       |                   |

3.7 Seed Protein (%)

The results of the statistical analysis indicated that there was no significant effect of the genotypes and potassium treatments, and the interaction between them on the protein content of cereals (Table 8).

Table 8. Effect of potassium levels and genotypes and the interaction between them on the percentage of protein in seeds (%).

| Genetics | Potassium levels | Middle compositions |
|----------|------------------|---------------------|
|          | K0   | K1   | K2   | K3   | K4   | Genetics (N.S) | Potassium levels (N.S) | Interaction (N.S) |
| V1       | 12.63| 13.60| 13.23| 13.53| 12.36| 13.07          |                       |                   |
| V2       | 13.00| 12.43| 12.93| 14.23| 13.10| 13.14          |                       |                   |
| V3       | 12.66| 12.43| 13.50| 12.96| 12.93| 12.90          |                       |                   |
| V4       | 13.30| 13.03| 13.20| 13.96| 13.00| 13.30          |                       |                   |
| V5       | 14.23| 12.93| 14.00| 12.80| 12.96| 13.38          |                       |                   |
| Potassium means | 13.16 | 12.88 | 13.37 | 13.50 | 12.87 |                       |                   |
| Values L.S.D (0.05) | 13.50 | 13.37 | 13.50 | 13.10 | 13.07 |                       |                   |

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