ISSN NO: 2771-8840
Date of Publication: 28-06-2022

Efficiency of Yara Complex mineral fertilizer in improving growth characteristics and yield for cultivars of wheat (*Triticum aestivum*)

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Abstract: The experiment was carried out at the horticultural station in Hawija district / Kirkuk governorate during the winter agricultural season (2019-2020), with the aim of evaluating the efficiency of the Yara Complex fertilizer in improving the growth characteristics and yield of the wheat crop. The experiment included the use of two factors, the first: ground fertilization with two concentrations of the Yara complex fertilizer, which are 40 and 60 kg / du, and DAP fertilizer at a level of 80 kg / du, and the second, six genotypes of bread wheat (Dijla, Ibaa 99, chad Germany, chihan, Buro and Bohouth22). The experiment was carried out according to the split-plot system within the Randomized Complete Blocks Design (R.C.B.D). The study included some growth and yield characteristics, which are (germination percentage, plant height, number of leaves per plant, number of stems per plant, number of spikes per square meter, number of grains per spike, weight of 1000 grains and grain yield in dus). The results showed the superiority of Yara fertilization treatment of 60 kg/du in the characteristics of germination percentage, number of spikes and grain yield with means of 88.78% and 343.52 spikes/m^2 and 1332.89 kg/du, The Buro cultivar excelled in the characteristics of germination percentage, number of leaves, number of tillers, number of spikes, and yield with means of 89.33%, 6.67 leaves/plant, 9.11 tillers/plant, 351.9 spikes/m^2 and 1449.22 kg/du. The interaction of Yara fertilization treatment 60 kg/du with Boro cultivar was superior in the characteristics of germination percentage, number of leaves, number of spikes and grain yield with means of 90%, 6.67 leaves/plant, 386.27 spikes/m2 and 1520.7 kg/du.

Key words: Yara Complex, fertilization, cultivars, wheat, *Triticum aestivum*.

Introduction

The wheat crop, *Triticum aestivum* L., is one of the most important cereal crops in the world, which belongs to the Poaceae family because of its strategic role in achieving food security and the capacity of its exchanges in the international market. This is prompted many developing and developed countries to adopt economic policies aimed at developing the crop and reducing its import with the aim of achieving Self-sufficiency in it, and its importance lies in the fact that its grains are used to produce the indispensable loaf of bread for most peoples of the world (Al-Maarouf *et al*. 2012). The realized material returns in addition to providing humans with about 25% of calories and protein, so it is a major food crop for more than 1.5 billion people living in 40 countries and occupying 35% of the world's population (Mohammed, 2021). Iraq is considered one of the first places for the emergence of wheat in addition to the availability of the main production factors in it such as soil, water and climatic conditions, but the productivity of this crop is still low compared to the global level of production in developed countries (Mohammed *et al.*, 2016). Wheat ranks first in Iraq and the world in terms of the cultivated area and the quantity of production. The total area of wheat planted in Iraq reached 9.464 million dus, for the year 2021, with a production quantity of 4.234 million tons (Directorate of Agricultural Statistics, 2021).

Nitrogen, phosphorous and potassium are necessary and important nutrients for the growth and production of wheat, and fertilization accompanies several problems, especially in Iraqi soils, as they are characterized by their high content of calcium carbonate and relatively high pH values, in addition to low organic matter, as nitrogen is subjected to loss in the form of gases. The two processes of ammonia volatilization and reversal of nitrification, and these soils have a high ability to fix phosphorous in the form of calcium phosphate, and therefore most of the mineral phosphorous added as phosphate fertilizers and

ISSN NO: 2771-8840
Date of Publication: 28-06-2022

originally present in the soil turns into phosphorus that is not ready and installed in the soil, and this negatively affects growth and production (Juber and Taban, 2016).

There are many factors that contribute significantly to increasing the productivity of the crop, and the most important of these factors are the good genetic structures adapted to the conditions of the region, which contribute significantly to increasing the productivity of the crop, as wheat varieties vary in their productivity, and this is a natural thing due to the genetic nature. New genotypes with high productivity, in addition to agricultural processes that affect increasing production, improving quality, reducing costs, and preserving the environment is the basis for increasing the agricultural area of the crop (Al-Abbar, 2021).

The current study aims to evaluate the efficiency of the Yara Complex fertilizer newly introduced to the local market (Yara Complex is a granular compound fertilizer, homogeneous in its granular size, free of chlorine and its derivatives. It is a mixture of nitrogen, phosphorous and potassium (12: 11: 18), designed to achieve The highest yield of crops and the best quality. Yara fertilizer uses a balanced source of nitrogen, provides a unique phosphorous formula that facilitates its absorption by the plant, and ensures an effective release of nutrients due to the distinct granule. With the aim of improving the growth and yield of cultivars of wheat and comparing it with DAP (Di ammonium phosphate) manure.

Materials and methods

1-The location and implementation of the experiment: The experiment was carried out at the horticultural station in Hawija district / Kirkuk governorate during the winter agricultural season (2019-2020), in the soil whose properties are shown in Table (1).

Table (1) Some physical and chemical properties of field soil.

Tests	sand	silt	clay	texture	N	P	K	O.M.	pH	E.C.
Unit	gm/k	gm/k	gm/k	-	mg/K	mg/K	mg/K	%	-	Ds/m
Result	462	309	234	sandy mixture	21.15	4.88	110.87	7.02	7.60	33.1

2- Experiment design: The experiment was carried out according to the split-plot system within the design of Randomized Completely Blocks Completely (R.C.B.D) with three replications. The cultivation was conducted on 20/11/2019. Each block contained (18) experimental units, to which the resulting coefficients were distributed among the harmonic coefficients between the study factors were harvested on 20/5/2020.

3- The treatments used: The experiment included the use of two factors, the first: the ground fertilization with two concentrations of the compound fertilizer Yara Complex (N=12%: P=11%: K=18%), which are 40 and 60 kg/dunam, and DAP (P2O5=18%: N=46%) at a level of 80 kg/du when plowing the land. The second factor: It included (6) genotypes of bread wheat, namely (Dijla, Ibaa 99, Chad Germany, CHihan, Buro and Bohuth 22).

4- Execution of the experiment: The experimental land was plowed, smoothed and leveled, and then the land was divided into three replicates. Fertilization treatments were placed in the main plots, while the secondary plots included genotypes (6 varieties of bread wheat). Cultivation was done by the line method, as the land contained 18 experimental units, and each experimental unit contained 3 lines of length of 3 m, and the distance between one line and another was 0.25 m, using a seeding rate of 280 grains/m^2 for each line. The service operations were carried out after planting by adding (200) kg of urea (N46%) in two batches, the first one month after planting and the second in the branching stage.

5- Studied traits: The study included some growth and yield traits, which are (germination percentage, plant height, number of leaves per plant, number of tillers per plant, number of spikes per square meter, number of grains per spike, weight of 1000 grains, and grain yield in dunam).

6- Statistical analysis: The statistical analysis was conducted according to the split plot system within the design of the Randomized Completely Blocks Completely (R.C.B.D) to find out the differences between the fertilization treatments and varieties and the interaction between them according to what is between them (Al-Zubaidi and Al-Jubouri, 2016), and Excel was used to tabulate the data, and the data was analyzed by a program Statistical Analysis System (SAS).

ISSN NO: 2771-8840
Date of Publication: 28-06-2022

Results and discussion

Results

1-Fertilization Effect

The results presented in Table (2) showed a significant effect of the studied fertilization treatments on the characteristics of germination percentage, plant height, number of spikes per square meter, weight of 1000 grains, number of grains per spike and yield. As for the percentage of germination of wheat seeds, it is noted that the highest mean significantly reached 88.78% when fertilizing Yara 60 kg / du without significant difference compared to the treatment of Yara fertilization 40 kg / du, which achieved a germination rate of 88.28%, while the lowest percentage of germination was 87.89% at Fertilize with DAP fertilizer.

For the plant height characteristic, the Yara fertilization treatment of 40 kg/du was significantly superior with an average of 74.28 cm without a difference than the treatment of 60 kg/du of fertilization which recorded 73.89 cm, while the lowest averages were 73 cm when the DAP fertilization treatment.

The characteristic of the number of leaves per plant showed that there were no significant differences between the studied fertilization treatments, and their averages ranged between 6.01 and 5.89 cm for the two treatments with DAP and 60 kg/ du fertilization, respectively.

The results showed that there were no significant differences between the three fertilization treatments under study with regard to the number of tillers in the plant, while the averages of this trait ranged between 8.17 - 7.78 tiller/plant when the two treatments Yara 40 kg/du and Yara 60 kg/du, respectively.

As for the characteristic of the number of spikes per square meter, the Yara fertilization treatment of 60 kg / du excelled in achieving the highest mean, which amounted to 343.52 spikes / m^2, while the lowest averages reached 297.02 spikes / m^2 when fertilizing with DAP fertilizer.

The results of the 1000-grain weight trait showed that the treatment of Yara fertilization of 40 kg/du was significantly superior with an average of 56.91 gm without a significant difference than the treatment of Yara fertilization of 60 kg/du, which gave 55.82 gm, while the treatment of fertilization with DAP fertilizer recorded the lowest average, which amounted to 54.27 gm.

As for the number of grains in the spike, the results showed the superiority of the DAP fertilization treatment in achieving the highest mean, which amounted to 31.08 grains/spike, while the Yara fertilization treatment recorded 60 kg/du of the lowest average, which amounted to 28.81 grains/spike.

Table (2): Effect of Fertilization Treatments on Growth Traits and Yield of Wheat Crop

Traits / Fertilisers	Germination (%)	Plant height	Leaves No.	Tillers No.	Spikes No./m^2	We.1000 grain	Grains No/spike	Yield (kg/du)
DAP	87.89 b	73 b	6.01 a	7.78 a	297.02 c	54.27 b	31.08 a	1160.61 c
Yara 40 kg/du	88.28 ab	74.28 a	5.94 a	8.17 a	329.04 b	56.91 a	29.65 b	1273.61 b
Yara 60 kg/du	88.78 a	73.89 ab	5.89 a	8.06 a	343.52 a	55.82 ab	28.81 c	1332.89 a

-The values followed by the same letter are not significantly different from each other.

The results of the yield trait showed the superiority of the Yara fertilization treatment 60 kg/du in achieving the highest mean, which amounted to 1332.89 kg/du, while the lowest averages reached 1160.61 kg/du when fertilizing with DAP fertilizer.

Cultivars effect

The results shown in Table (3) showed a significant effect of cultivars in all the characters under study. As for the percentage of germination of wheat seeds, it is noted that the highest mean significantly reached 89.33% for the cultivar Buro, without a significant difference from the two cultivars Ibaa99 and Bohouth 22, which achieved germination rates of 88.67 and 88.44%, respectively, while the lowest percentage of germination was 87.56% for the cultivar Chihan.

For the plant height trait, Chihan cultivar was significantly superior with an average of 77.22 cm, while the Buro cultivar recorded the lowest average for plant height, which was 72.78 cm.

ISSN NO: 2771-8840
Date of Publication: 28-06-2022

The trait of number of leaves per plant showed the superiority of Buro cultivar in achieving the highest mean, which amounted to 6.67 leaves/plant, while the cultivar Bohouth22 recorded the lowest average number of leaves per plant, which amounted to 5.56 leaves/plant.

The results showed that for the characteristic of the number of tillers per plant, the Buro cultivar excelled in achieving the highest average, which amounted to 9.11 tiller/plant, while the lowest average reached 7.44 tiller/plant for Chihan variety.

As for the characteristic of the number of spikes per square meter, the Buro variety excelled in achieving the highest mean, which was 351.9 spikes/m^2, while the lowest averages reached 305.35 spikes/m^2 for the chad variety.

The results of the 1000-grain weight trait showed that the chad variety was significantly superior with an average of 56.27 g, while the cultivar Dijla recorded the lowest average of 51.19 g.

Table (3): The effect of cultivar on growth characteristics and yield of wheat.

Traits / Cultivars	Germination (%)	Plant height	Leaves No.	Tillers No.	Spikes No./m^2	We.1000 grain	Grains No/spike	Yield (kg/du)
Dijla	**88.11 bc**	**71.67 cd**	**5.67 b**	**7.56 b**	**307.78 c**	**51.19 b**	**30.97 b**	**1167.33 d**
Ibaa99	**88.67 ab**	**74.44 b**	**5.89 b**	**8.56 a**	**315.23 bc**	**57.1 a**	**28.05 c**	**1215.78 c**
Chad	**87.78 bc**	**75.44 b**	**6 b**	**7.78 b**	**305.35 c**	**59.27 a**	**33.26 a**	**1190.78 cd**
Chihan	**87.56 c**	**77.22 a**	**5.89 b**	**7.44 b**	**330.79 b**	**56.88 a**	**27.81 c**	**1252.78 b**
Buro	**89.33 a**	**72.78 c**	**6.67 a**	**9.11 a**	**351.9 a**	**56.77 a**	**27.48 c**	**1449.22 a**
Bohouth22	**88.44 abc**	**70.78 d**	**5.56 b**	**7.56 b**	**328.1 b**	**52.77 b**	**31.5 b**	**1258.33 b**

-The values followed by the same letter are not significantly different from each other.

For the number of grains in the spike, the results showed the superiority of the Chad cultivar in achieving the highest mean, which amounted to 33.26 grains/spike, while the Buro cultivar recorded the lowest average, which amounted to 27.48 grains/spike.

The results of the trait of the yield showed the superiority of Buro cultivar in achieving the highest mean, which amounted to 1449.22 kg / du, while the lowest averages reached 1167.33 kg / du when treating the cultivar Dijla.

The effect of the interaction between fertilization and cultivars

The results shown in Table (4) showed a significant effect of the interaction between the fertilization treatments and the cultivars under study in all the tested traits. Regard of which to the percentage of germination of wheat seeds, it appears that the highest mean significantly reached 90% when the interaction between Yara fertilization treatment 60 kg/du and Boro cultivar, while the interaction between DAP fertilization treatment and Chad cultivar recorded the lowest germination rate of 87.89%.

For plant height trait, the interaction between Yara fertilization treatment 40 kg/du and Chihan cultivar was significantly superior, with an average of 78 cm, while the lowest averages reached 70.33 cm when the interaction between DAP fertilization treatment and Dijla cultivar.

The number of leaves in a plant showed that the interactions of Buro cultivar with the three fertilization treatments were superior in achieving the significantly higher mean, which amounted to 6.67 leaves/plant, while the interaction of the DAP fertilization treatment with Dijla and Bohouth22 cultivars recorded the lowest average number of leaves per plant, which amounted to 5.33 leaves/plant.

The results showed that with regard to the number of tillers in the plant, the interaction between Yara fertilization treatment 40 kg/du and Buro cultivar was superior in achieving the highest average, which amounted to 9.33 tiller/plant, while the lowest average reached 7.44 tiller/plant when DAP fertilization treatment was overlapped with Chihan cultivar.

As for the characteristic of the number of spikes per square meter, the interaction between Yara fertilization treatment 60 kg/du and Buro cultivar exceeded in achieving the significantly higher average,

ISSN NO: 2771-8840
Date of Publication: 28-06-2022

which amounted to 386.27 spikes/m^2, while the lowest averages reached 266.11 spikes/m^2 when the interaction between the fertilization treatment with DAP fertilizer and Chad variety.

The results of the 1000-grain weight trait showed the superiority of the interaction between Yara fertilization treatment 40 kg/du and the cultivar Chad significantly with an average of 61.03 g, while the interaction of Yara fertilization treatment 60 kg/du with the lowest average Dijla cultivar was 48.25 g.

For the number of grains in the spike, the results showed that the interaction of fertilization with DAP fertilizer with Chad cultivar was superior in achieving the significantly higher average, which amounted to 34.4 grains/spike, while the interaction of Yara fertilization treatment with 60 kg/du was recorded with the lowest average Buro cultivar, which amounted to 25.11 grains/spike.

The results of the yield trait showed the superiority of the interaction of the Yara fertilization treatment 60 kg/du with the Buro variety in achieving the significantly higher average, which amounted to 152.7 kg/du, while the lowest averages reached 1058.3 kg/du when interaction the DAP fertilization treatment with Chad cultivar.

Table (4): The effect of the interaction between fertilization treatments and cultivars on growth characteristics and yield of wheat.

Ferti.	Traits / Cultiv.	Germin. (%)	Plant height	Leaves No.	Tillers No.	Spikes No./m^2	We.1000 grain (gm)	Grains No/spike	Yield (kg/du)
DAP	Dijla	87.33 de	70.33 e	5.33 b	7.33 cd	278.82 fg	51.8 efg	31.99 bcd	1083 fg
	Ibaa99	88.33 a-e	73.33 cde	6.67 a	8.33 abc	297.3 efg	52.87 d-g	29.49 e-h	1130 f
	Chad	87 e	75.33 abc	6 ab	7.67 bcd	266.11 g	58.87 abc	34.4 a	1058.3 g
	Chihan	87.33 de	77 ab	6 ab	6.67 d	302.91 def	56.67 a-e	29.02 f-i	1122.3 f
	Buro	89.33 abc	71.33 de	6.67 a	9 ab	326.46 b-e	52.4 d-g	28.98 f-i	1355 b
	Bohouth22	88 b-e	70.67 e	5.33 b	7.67 bcd	310.5 c-f	53 d-g	32.58 abc	1215 e
Yara 40 kg/du	Dijla	88.67 a-e	73 cde	5.67 ab	7.67 bcd	303.15 def	53.53 c-g	30.77 c-f	1205.7 e
	Ibaa99	89 a-d	75.67 abc	5.67 ab	8.67 abc	318.38 b-e	58.87 abc	27.42 ij	1201.3 e
	Chad	88 b-e	75.33 abc	6.33 ab	7.67 bcd	315.23 cde	61.03 a	32.84 ab	1219.3 e
	Chihan	87.67 cde	78 a	5.67 ab	8 a-d	352.77 b	53.53 c-g	27.8 hij	1286.3 cd
	Buro	88.67 a-e	72.67 cde	6.67 a	9.33 a	342.96 bc	59.8 ab	28.34 g-j	1472 a
	Bohouth22	87.67 cde	71 e	5.67 ab	7.67 bcd	341.75 bc	54.67 b-f	30.71 c-f	1257 de
Yara 60 kg/du	Dijla	88.33 a-e	71.67 de	6 ab	7.67 bcd	341.39 bc	48.25 g	30.16 d-g	1213.3 e
	Ibaa99	88.67 a-e	74.33 bcd	5.33 b	8.67 abc	330 b-e	59.55 ab	27.23 ij	1316 bc
	Chad	88.33 a-e	75.67 abc	5.67 ab	8 a-d	334.7 bcd	57.9 a-d	32.53 abc	1294.7 cd
	Chihan	87.67 cde	76.67 ab	6 ab	7.67 bcd	336.7 bcd	60.45 ab	26.6 jk	1349.7 b
	Buro	90 a	74.33	6.67 a	9 ab	386.27	58.12 a-d	25.11 k	1520.7

ISSN NO: 2771-8840
Date of Publication: 28-06-2022

			bcd			a			a
	Bohouth22	89.67 ab	70.67 e	5.67 ab	7.33 cd	332.07 b-e	50.63 fg	31.21 b-e	1303 bcd

-The values followed by the same letter are not significantly different from each other.

Discussion

Good quality balanced nutrition is essential for good yield. Therefore, the added fertilizer is of great importance, and the plant needs nitrogen, phosphorous and potassium for better plant growth (Al-Kaisy and Al-Mgadami, 2014). Nitrogen enters the formation of important compounds such as NAD and NADP, nitrogenous bases, amino acids, the formation of protoplasm, chlorophyll, growth regulators and other compounds that enter into the building of the plant cell. ATP, GTP, etc. It has the ability to form important compounds such as proteins and participates in the metabolism of carbohydrates and other substances (Verm and Verm, 2008). Potassium controls the permeability of cytoplasmic membranes and has an important role in the process of closing and opening stomata, activates many enzymes such as catalase and invertase, reduces calcium toxicity, affects the formation of sugars, starches, fats and proteins, stimulates processes related to energy transfer and other vital processes (Al-Kaisy and Al-Mgadami, 2014).

The results of the current study showed the superiority of the Yara fertilization treatment of 60 kg/du in the characteristics of germination rate, number of spikes and grain yield, followed by the treatment of Yara fertilization of 40 kg/du in the characteristics of plant height and 1000-grain weight. As for the cultivars, the Buro cultivar excelled in the characteristics of the percentage of germination, the number of leaves, the number of tillers, the number of spikes and the yield, followed by the Chad cultivar, which excelled in the characteristics of the weight of 1000-grains and the number of grains per spike. And for the interaction between the fertilization treatments and cultivars, the interaction of Yara fertilization treatment 60 kg/du was superior to the Buro cultivar in the characteristics of germination percentage, number of leaves, number of spikes and grain yield, while the interaction of Yara fertilization treatment 40 kg/du was superior to Buro cultivar also in the characteristics of number of leaves and number of tillers.

One of the harmful effects of increasing the concentration of pesticides is raising the degree of soil salinity, which negatively affects seed germination due to raising the osmotic pressure in the surroundings of agriculture and reducing the degree of water impregnation as well as affecting physiological and biological processes (Eskandari and Kazemi, 2011), and from the results of the current study it was found that fertilizer Yara achieved the highest percentage of germination compared to Dab fertilizer, and this can be attributed to its unique composition and safe thawing stages, which achieve an optimum growth degree for the crop.

The increase in the number of spikes is due to the role of Yara compound fertilizer in encouraging growth in general, and this was reflected in the increase in the amount of plant yield. Yara fertilizer contains the necessary elements in the form or form that the plant can take easily, as these elements participate in the energy-related processes. Nutrients contribute to plant nutrition and encourage cell division, and potassium has a large and important role in increasing the number of dividing cells and increasing the mitotic index (Sheikh Hussein, 1988). The improvement of the physiological and morphological characteristics of wheat plant when treated with Yara fertilizer, such as the number of leaves, the number of rims, the number of spikes, 1000 grains, and the yield. This fertilizer is attributed to the efficiency of this fertilizer in plant growth, completing important biological reactions and encouraging enzymatic processes because nitrogen and phosphorous contribute to the formation of proteins, nitrogenous bases, RNA, energy compounds ATP, GTA, etc., while potassium participates in building proteins and the largest number of enzymes, and the three strengthening elements contribute It increases photosynthesis and works to transport water and nutrients and affects other metabolic reactions (Verm and Verm, 2012), and that fertilizing with phosphorous and nitrogen increases growth and efficiency of roots and helps absorb larger amounts of water and this increases plant growth (Ali and Ahmed, 1989). .

It is clear that the addition of DAP fertilizer had a significant effect on increasing the number of leaves per plant and the number of grains per spike, as it exceeded the highest rates for these two characteristics. Its elongation, by its contribution to the formation of RNA, which is important in the protein building process, which is the basis of plant cell construction and development. This is consistent with what was mentioned (Sial et al., 2018) that adding 90 kg / du of phosphorous as the highest level of fertilizer gave the highest averages for the number of leaves per plant and the number of grains per spike. It was also found

ISSN NO: 2771-8840
Date of Publication: 28-06-2022

(AL-Fahdawi and Almehemdi, 2017) that the addition of a high level of phosphate fertilizer 75 kg P2O5 / du gave the highest rates for the characteristics of the number of leaves per plant and the number of grains per spike, indicating that phosphorus is a reason for increasing growth and improving the growth characteristics of the crop.

Al-Fahdawi (2019) indicated that the addition of DAP fertilizer had a significant effect on increasing the grain yield, but the superior fertilizer level of 300 kg/ha did not differ significantly from the levels of 100 and 200 kg/ha, and they concluded that high levels of fertilizer addition are not feasible to increase the yield of The grains may be equal, so it can be said that the level of 200 kg/ha is sufficient for good growth and high production of wheat.

The success of cultivars in achieving the highest averages of yield and final yield traits during different conditions is attributed to genetics only (Al Maliky, 2017). As mentioned by Fathi et al. (2022) showed that the characteristics of plant height, number of tillers, number of grains per spike, and weight of one thousand grains were significantly affected by fertilization treatments and cultivar type, and they attributed the difference between wheat cultivars to genetic factors where genes control this trait. The number of hulls per unit area was higher for soft wheat cultivars compared to hard cultivars, and the number of hulls was the determining factor on which the final grain yield depended, as indicated by the results of correlation analysis, while Adana99 was superior to the rest of the wheat cultivars, and Yara fertilizer was superior to DAP and DAP fertilizers. Also, the interaction of Adana99 with DAP and YARA fertilizers produced the highest plants in growth and yield characteristics. Varieties variance in the traits under study is a natural thing because it is related to the genetic structure of each cultivar. The differentiation of the cultivars from each other in the characteristic of yield is due to their variation in most of the growth characteristics and components of the yield, especially the characteristics of the number of leaves and the number of spikes, as the leaves are responsible for transforming manufactured materials into spike grains, so it is one of the reasons for increasing the yield of grains in wheat (Al- Fahdawi, 2019).

Conclusion

We conclude from the above that Yara Complex fertilizer had an important role in improving growth and raising the values of the yield and its components, and that the concentration of 60 kg / du achieved the best results in growth and yield characteristics, and the Buro variety was distinguished over the rest of the varieties included in the study in the largest number of traits, while the combination of interaction between Yara fertilization treatment 60 kg/du and Buro cultivar achieved the best averages for growth characteristics and yield, thus this study recommends, under its conditions, to adopt the cultivation of Buro cultivar when fertilizing Yara Complex 60 kg/du.

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ISSN NO: 2771-8840
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