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The effect of different tillage systems and fertilizer combinations on wheat (*Triticum aestivum* L.) growth and some of yield components and its weed Competition

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Abstract

A field experiment was conducted during the agricultural season 2020-2021, at the agricultural extension station in Al-Najmi district, 43 km northeast of the , the center of Al-Muthanna Governorate, to determine the effect of tillage depths and different fertilizer combinations on some traits of wheat (*Triticum aestivum* L.) and its weed competition. The experiment was applied according to the arrangement of the split block by two factors using the (RCBD) design and with three replicates. The first factor; four treatments of the tillage systems (0, 10, 20 and 30 cm). The second factor; fertilizer combinations with the control treatment (P_0 K_0 ,P_{25} K_{30} ,P_{50} K_{60},, P_{75} K_{90},$P_{100}K_{120}$ kg ha-1). The results of the study showed a significant difference for the treatments of tillage systems in most of the studied traits, weed decreased. The treatment of tillage depth of 10 cm was superior in giving the highest average concentration of nitrogen and phosphorous in the plant. The results also showed the superiority of the fertilizer combination F4 in giving the highest average concentration of nitrogen, phosphorous and potassium in the plant.

Key words: tillage system, fertilizer combinations, wheat (*Triticum aestivum* L.), weed competition.

Introduction

Wheat (*Triticum aestivum* L.) is the most important strategic and food crop for most of the world's population, it ranks first in terms of cultivated area and production. Wheat is an essential source of human nutrition, because of what it contains of proteins, carbohydrates, amino acids, vitamins, and dietary fiber, wheat occupied the first place in the list of consumer food commodities, where it secures more than 50% of the calories that enter the human diet (Saudi, 2013). The cultivated area in Iraq in 2020 amounted to about 8574 thousand dunums, with a productivity of 6,238 thousand tons (Directorate of Agricultural Statistics, 2020).

The productive capacity of any crop, regardless of its specifications, depends on the service operations applied according to the correct foundations, from these processes were the tillage systems that affect the physical and chemical properties of the soil. Tillage is an important field practice because of its role in improving soil management, by breaking up the soil and mixing it to change some of its physical properties, maintaining a fertile content suitable for plant growth and raising agricultural production. The plowing also depends on the type of plow used, the depth of the plowing and the nature of the treated soil, the optimal choice of the appropriate plowing depth is of great importance in improving the physical properties of the soil, reflected on the growth and spread of roots, which results in an increase in plant productivity (Ati et al., 2015).

Repeated plowing is a major cause of agricultural land degradation, the occurrence of some negative changes in the surface layers of the soil, because of its effect on soil qualities such as soil compaction, stability of soil pools, its porosity, and the lack of a suitable seedbed, as well as the spread of salts in the root zone, in addition to the problem of the weed, which compete with the crop and exploit nutrients and moisture from the soil and thus cause low productivity, therefore, many countries of the world have adopted the technology of no-till farming, because of its benefits, maintaining soil moisture, improving seedling growth, and facilitating agricultural operations, in addition to the increase in production during the seasons of scarce rain in the rainy areas (Antar, 2013). The importance of the no-till farming system is shown in improving the productivity of the wheat crop, preserving resources and increasing the income of the farmer, the no-till farming system achieves good productivity in dry seasons and reduces traditional tillage operations, this leads to the breaking of the solid soil layers and the penetration of water into the depths of the soil and the plants not benefiting from it (Qatni, 2009).

The addition of various fertilizer combinations, such as phosphorous and potassium fertilizers

Adding these fertilizers inaccurately to the soil is accompanied by some problems

that cause an imbalance in the environment,

The addition of phosphorous to the plant plays an important role in regulating the vital processes within the plant

Including photosynthesis, respiration, cell formation and division, seed formation, root growth and development, its contribution to the synthesis of energy compounds (ATP and ADP), and its entry into the synthesis of cellular membranes and nucleic acids (DNA and RNA) (Majeed and Jabbar, 2015). The addition of potassium also plays an important role in the growth and completion of the plant's life cycle, does not form any organic compound, as it is found in a free ionic form within plant tissues, where it performs multiple physiological functions in the cells of higher plants, stimulates the process of photosynthesis, cell division, cellulose, lignin, and its resistance to retraction, it also directly or indirectly affects the activation of more than 80 enzymes, such as proteinases, kinases, dehydrogenases and redox enzymes (Ali and Shaker, 2014).

The weed is one of the problems that compete with the production of the wheat crop and exploit the nutrients and moisture from the soil and affect the productivity of the crop, tillage systems affect the pattern of density and distribution of weed (Bhattacharyya et al., 2006).

The current study aims to determine the optimal tillage system to improve the growth and yield of wheat and increase its ability to compete with the companion weed. Determining the optimal fertilizer combination to increase the available of the elements phosphorous and potassium and thus improve the growth and production of wheat and increase its ability to compete with the weed.

Material and methods

Experiment location:

A field experiment was carried out during the winter season (2020-2021) in Al-Najmi District, 43 km northeast of AL-Samawah city at the Agricultural Extension Station of the Directorate of Al-Muthanna Agriculture Governorate. The soil texture of the experiement field was silty loam.

Physical and chemical properties of the soil used in the experiment:

Soil analyzes before planting:

The degree of soil reaction: The soil pH was measured in a 1:1 water-soil suspension, using a PH-meter, as described in (Page et al., 1982).

Electrical conductivity (ECe): The electrical conductivity (EC) was measured in the saturated soil pulp extract, using an electrical conductivity device (EC-meter) as described in Richards (1954).

Soil texture: Soil texture was estimated by the pipette method mentioned in (Black, 1965).

Bulk density: It was estimated by (Core method) by taking a known volume of soil (100) cm3, drying it and calculating the dry weight using a sensitive scale.

The true density: It was estimated by the pycnometer, according to what was mentioned in (Blake and Hartge, 1986).

Soil porosity: its values were estimated, after knowing the values of both the apparent density and the real density, according to what was mentioned in (Hassan et al., 1990).

Organic matter: It was estimated according to (Walkely and Black) method, and according to what was stated in (Black, 1965).

Available Nitrogen: (aluminum and nitrate) extracted with potassium chloride solution, and estimated using a (microcondole) according to the method described in (Blak, 1965).

Available phosphorous: The prepared phosphorous was extracted by a solution of 5.0 molar sodium bicarbonate and PH 8.5, and the color was developed by a solution of ammonium molybdate and ascorbic acid according to the Olsen method, it was estimated using a spectrophotometer at a wavelength of 882 nm as mentioned in (Page et al., 1982).

Available potassium: Potassium was measured with ammonium acetate (N1) solution, and then measured with a flame-photometer, according to what was mentioned in (Black, 1965).

Table (1): Some physical and chemical properties of soil before planting.

Properties	**Unit**	**Volume**
EC	dsm^{-1}	4.60
pH	-	7.70
Sant	g kg^{-1}	11.00
Silt		67.00
Clay		22.00
Soil texture	Silty loam	
Bulk density	mg m^{-3}	1.14

The true density		2.30
Porosity	%	52.00
Organic matter	g kg^{-1}	1.01
Available Nitrogen	mg kg^{-1}	17.90
Available phosphorous		169.70
Available potassium		11.03

Experiment factors

The experiment included a study of two factors:

The first factor: It included four treatments of different tillage systems and they were placed in the main plots: were 0, 10, 20 and 30 cm.

The second factor: adding a fertilizer mixture of mineral fertilizer (P-k) and it included four treatments and was placed in the secondary plots.

First: Phosphate fertilizer batches and five levels, were 0, 25, 50, 75 and 100 kg k.ha-1, were symbol P0, P1, P2, P3 and P4.

Second: batches of potassium fertilizer in five levels, were 0, 30, 60, 90 and 120 kg k.ha-1, were symbol K0, K1, K2, K3 and K4.

Experiment design

The experiment was applied in a split block method, Randomized Complete Block Design (R.C.B.D) with three replicates. The tillage parameters were placed in the main plates, while the fertilizer parameters were placed in the secondary plates, the area of the experimental unit was 2 × 2 m2, it contains 8 lines, the As buffer between one plot and another was 1 m and between the main plot was 2 m2, to avoid treatments interaction,

Soil preparation and field operations:

for three depths including tillage, the first The grain of wheat (*Triticum aestivum* L.) Bohuth22 cultivar, was planted on 19/11/2020 with a seeding rate of 120 kg/ha (Brochure, 2012). The nitrogen fertilizer was added in three batches at the branching stage, elongation stage and flowering stage, at a rate of 200 kg. Phosphate fertilizer was added at different levels at once before planting. Potassium fertilizer was added at the specified levels and in two batches at the branching stage and flowering stage (Jadoua, 1995). The irrigation process was carried out using the surface irrigation method, and the irrigation water was determined for all the experimental units, depending on the mechanical irrigation meter,

Studied traits

Plant analysis

according to the method described by (Cresser and Parsons, 1979) and it was estimated that:

Nitrogen (%)

Nitrogen was estimated using the Kjeldahl apparatus according to the method (Page et al., 1982). The percentage of nitrogen was calculated.

Phosphorous (%)

Phosphorous was estimated using ammonium molybdate and ascorbic acid in a spectrophotometer with a wavelength of 882 nm, as stated in (Page et al., 1982), using the standard phosphorous curve, the phosphorous concentration was extracted, and then its percentage was estimated.

Potassium (%)

The potassium concentration was estimated using a Flame-Photometer and according to the method given in (block , 1965).

Weed growth traits

Table (2) Types of weedes found in each experimental unit (m-2)		
Weed name	Scientific name	Family
Wild beets	*vulgaris* L. *Beta*	Chenopodiaceae
Mallow	*Malva rotundifolia* L.	Malvaceae
Common sowthistle	*Sonchus oloraceus* L.	Compositae

The following attributes were calculated
The weight of the wet weed and the weight of the dry weed mentioned in Table (2), where the weed was air-dried, and the dry weight (m^{-2}) was calculated for each experimental unit using a sensitive scale.
Statistical Analysis
The data were analyzed using ANOVA, using the GenStat . program
Release 12.1, and the averages of the coefficients were tested according to the least significant difference (L.S.D), and under the probability level P < **0.05** (Al-Rawi and Khalaf Allah, 2000).

Results and Discussion

Elemental Concentration (NPK) in the Plant

Nitrogen Concentration (%)

The results of the statistical analysis indicate that there is a significant effect of the tillage systems and fertilizer combinations (PK)) on the nitrogen concentration in the plant (%), while the interaction between them did not show a significant effect for this trait.
Table (3) show that the significant effect of the tillage systems treatments, the tillage treatment T1 (depth of 10 cm) gave the highest mean for this trait, which was 1.296%, without a significant difference from the no-till treatment (T0), which gave an average of 1.289% with a significant difference from treatment T3 (depth of 30 cm), which averaged 1.274%, while the T2 plowing treatment (20 cm depth) gave the lowest average, 1.266%. The reason may be attributed to the fact that the cultivation is in soil that is not raised or raised at a shallow depth (10 cm), contribute to reducing the washing process of nitrogen added to the soil compared to other depths, where it was easy to wash the manure and go to a greater depth than the area of growth of wheat roots, contribute to the absorption of the largest amount of nitrogen and its accumulation in the tissues of the plant.
The results of the same table also indicate a significant increase when changing the levels of fertilizer combinations (PK) added to the soil,
The fertilizer combination F4 gave the highest average for this trait, which amounted to 1.423%, compared to the comparison treatment F0, which gave the lowest average of 1.148 %
The reason for the increase in nitrogen concentration may be due to the role of each of the two elements (PK) in improving the growth of the root system and increasing its branching, and then increasing the absorption sites, increase the absorption of nitrogen and then increase its concentration in the vegetative part of the plant, consistent with the findings of both Kubar (2019) and Al Hasnawi (2021), the increase in the addition of fertilizer (pk) leads to an increase in the nitrogen concentration in the plant.4

Table (3) The effect of tillage systems and fertilizer combinations (PK) and the interaction between them on the trait of Nitrogen Concentration (%)						
Fertilizer	**F0**	**F1**	**F2**	**F3**	**F4**	**Mean**

Tillage system						
T0	1.163	1.233	1.280	1.336	1.433	1.289
T1	1.150	1.250	1.290	1.340	1.450	1.296
T2	1.136	1.206	1.260	1.330	1.400	1.266
T3	1.143	1.223	1.260	1.333	1.410	1.274
Mean	1.148	1.228	1.272	1.335	1.423	
L.S.D$_{0.05}$	**F**		**T**		**F×T**	
	0.0123		0.0169		N.S	

Phosphorous concentration (%)

The results of the statistical analysis show that there is a significant effect of each of the tillage systems and fertilizer combinations (PK) and the interaction between them on the phosphorous concentration in plants (%).

Table (4) showed the superiority of the treatments of the two tillage systems (T1 and T0) without a significant difference between them, where they gave the highest averages for the trait, which amounted to 0.549 and 0.542%, respectively, with a significant difference from the treatment of T2 which gave an average of 0.526%, compared to the treatment of T3 tillage systems, which gave the lowest mean of the trait, which was 0.506%,

Perhaps the reason for the increase in the concentration of phosphorous in the plant with no-till treatment and ploughing at a depth of 10 cm is that phosphorus is a low-moving element, which means its accumulation in the surface layer in higher concentrations than other depths, increases its absorption and transmission to the plant tissue.

It is also noted from the results of Table (4) that the fertilizer combination F4 was significantly superior by giving it the highest average for this trait, which amounted to 0.663 %, with a significant difference from the fertilizer combinations F3, F2, and F1, with averages of 0.603, .542 0 and .4620%, respectively, compared to the comparison treatment, which recorded a significant decrease of 0.383%. The reason for the increase in the concentration of phosphorus in the plant can be attributed to the increase in the amount of phosphorous added to the soil, which increased its absorption and concentration in the plant, this result is in agreement with the findings of Kubar, S., K. A. Kubar and A. A. Kubar (2019) and Al-Hasnawi (2021).

The interaction between tillage systems and fertilizer combinations had a significant effect on the phosphorous concentration in plants. The combination (T1 x F4) was significantly superior and gave the highest mean of 0.680%, whereas, the interference treatment (T3x F0) gave the lowest average for this trait, which was 0.360% (Table 4). The reason for the superiority of the above-mentioned combination is due to the reasons mentioned in the discussion of the factors, which are singular.

Table (4) The effect of tillage systems and fertilizer combinations (PK) and the interaction between them on the phosphorous concentration (%)

Fertilizer / Tillage system	F0	F1	F2	F3	F4	Mean
T0	0.400	0.466	0.553	0.623	0.666	0.542

T1	0.410	0.486	0.566	0.603	0.680	0.549
T2	0.363	0.460	0.540	0.600	0.666	0.526
T3	0.360	0.436	0.510	0.586	0.640	0.506
Mean	0.383	0.462	0.542	0.603	0.663	
L.S.D$_{0.05}$	**F**		**T**		**F×T**	
	0.0114		0.0140		0.0202	

Potassium concentration (%)
The results of the statistical analysis showed the significant effect of the fertilizer combinations (PK) and their interaction with the tillage systems on the potassium concentration in the plant (%), while the tillage systems did not show a significant effect for this trait.
Table (5) show the significant increase in potassium concentration with the increasing levels of fertilizer combinations gradually, as their averages reached 1.274, 1.242, 18,41, 1.056 and 1.056% for combinations F4, F3, F2, F1 and F0 Respectively, and the reason for the superiority of treatment F_4 may be attributed to Potassium concentration led to an increase in the added amount of potassium, which increased its readiness in the soil solution and then its absorption, transmission and accumulation in the plant parts, and this result agreed with what was reached by Al-Ugaili et al. (2011) and Kubar (2019).
As for the interaction, the results showed the significant effect of the interaction between the tillage systems and fertilizer combinations on the potassium concentration in the plant. (F0 x T2) and (F0 x T3) the lowest average for this trait was 1.040% (Table 5), and the reason for the increase in potassium concentration in the plant with the increase in the added quantity and surface cultivation may be due to the same reasons mentioned above related to the increase in the added quantity of the element and its accumulation in the layer surface, which increases its absorption.

Table (5) Effect of tillage systems and fertilizer combinations (PK) and the interaction between them on potassium concentration (%).

Fertilizer / Tillage system	**F0**	**F1**	**F2**	**F3**	**F4**	**Mean**
T0	1.093	1.150	1.180	1.240	1.280	1.188
T1	1.053	1.160	1.193	1.256	1.286	1.190
T2	1.040	1.163	1.173	1.230	1.266	1.174
T3	1.040	1.130	1.190	1.243	1.263	1.173
Mean	1.056	1.150	1.184	1.242	1.2742	
L.S.D$_{0.05}$	**F**		**T**		**F×T**	
	N.S		0.00668		0.02253	

The effect of tillage systems and fertilizer combinations (PK) on weed growth

Wild beets Dry Weight (gm)

The results of the statistical analysis show the significant effect of the tillage systems and their interaction with the fertilizer combinations (PK) on the dry weight of the silage, while the fertilizer combinations did not significantly affect this trait.

Results in Table (6) showed that the control treatment (no-till) exhibited a good efficiency in reducing dry weight, as it recorded the lowest average dry weight of silage amounted to 8.01 gm-1, while the Treatments of T3 and T2 gave the highest average for this trait amounting to 20.26 and 20 .22 gm-1 sequentially.

As for the interaction, it was noted that the highest dry weights of silage weedes were recorded with an increase in the depth of plowing and for all fertilizer combinations, and that the lowest of these weights were recorded with the interaction (F3 × T0, which amounted to 2.74 g m-1 while the interaction treatment (T3 × F0) gave the highest mean for this trait reached 25.74 gm m-1.

The increase in the dry weight of the silage weed is originally due to the increase in the wet weight of the weed) due to what plowing causes to provide better germination and growth conditions for the weed, in addition to its overlap with the role of phosphorous and potassium in improving growth, which is reflected on the weights of the weedes growing in the field.

Table (6) The effect of tillage systems and fertilizer combinations (PK) and their interaction on the dry weight of Wild beets (gm).

Fertilizer / Tillage system	**F0**	**F1**	**F2**	**F3**	**F4**	**Mean**
T0	6.33	16.43	11.56	2.74	3.00	8.01
T1	14.19	18.01	16.49	25.57	18.32	18.52
T2	20.26	21.10	18.18	25.57	21.00	20.22
T3	25.74	15.95	21.48	18.78	19.33	20.26
Mean	16.63	17.87	16.93	16.92	15.41	
$L.S.D_{0.05}$	**F**		**T**		**F×T**	
	N.S		4.030		6.876	

Mallow Dry Weight (gm)

The results of the statistical analysis indicate that the tillage systems had a significant effect on the dry weight of the Mallow, while the fertilizer combinations (PK) and their interaction with the tillage systems had no significant effect on this trait.

The results in Table (7) show that the comparison treatment (no-till farming system) recorded a significant decrease in the dry weight of the Mallow's weed with an average of 3.79 gm-1 , while the treatments of the T3 and T2 tillage systems gave the highest two average dry weight of the weed, reaching 8.59 and 8. 98 gm-1 sequentially, the reason for the difference in the dry weight of the weed is due to the difference in the fresh weight with the different tillage systems.

Table (7) The effect of tillage systems and fertilizer combinations (PK) and their interaction on the dry weight of the Mallow (gm).

Fertilizer / Tillage system	F0	F1	F2	F3	F4	Mean
T0	2.82	2.15	5.46	4.04	4.49	3.79
T1	7.55	7.60	7.68	8.37	9.67	8.17
T2	8.72	9.59	8.62	8.50	9.49	8.98
T3	6.48	8.80	7.72	10.18	9.77	8.59
Mean	6.39	7.03	7.37	7.77	8.36	
L.S.D$_{0.05}$	**F**		**T**		**F×T**	
	N.S		1.570		N.S	

dry weight of Common Sow thistle (gm)
The results of the statistical analysis showed a significant effect of the tillage systems on the dry weight of Common Sow thistle, while the fertilizer combinations and their interaction with the tillage systems did not show any significant effect in this trait.

It is noticed from the results in Table 8)) that there was a decrease in the dry weight of the Common Sow thistle with reducing the depth of ploughing to reach less for this trait with the comparison treatment (without tillage) which amounted to 1.36 gm-1, while the treatments of the T2 and T3 tillage systems recorded the highest averages For this trait, they reached 6.72 and 6.66 g m-1 respectively, and the reason for this is attributed to the efficiency of the no-till farming system in reducing the number of weeds and their weights as a result of not stirring the soil and stimulating the weed seeds compared to the traditional farming system that works to agitate the soil and break it up at the appropriate depth that It provides an environment for the growth and stimulation of weed seeds to germinate, grow and compete with the economic crop, as a result of breaking the dormancy phase of weed seeds and reproducing, and this agreed with what was reached (Kettler et al., 2000; Chauhant et al., 2006; Blackshaw et al., 2007; and Sultan and Antar, 2017).

Table (8) Effect of tillage systems and fertilizer combinations (PK) and the interaction between them on the dry weight of Common ،Sow thistle (gm).						
Fertilizer / **Tillage system**	**F0**	**F1**	**F2**	**F3**	**F4**	**Mean**
T0	0.81	2.25	0.74	1.69	1.32	1.36
T1	3.88	5.63	5.17	5.55	6.01	5.25
T2	5.58	7.86	7.20	6.79	7.69	6.66
T3	5.44	7.75	6.72	7.48	6.10	6.72
Mean	3.93	5.44	4.96	5.38	5.28	
L.S.D$_{0.05}$	**F**		**T**		**F×T**	
	N.S		1.098		N.S	

Conclusion

The no-till cultivation contributed to a significant reduction in bush growth, while the light tillage regime with a depth of 10 cm was superior in increasing the concentrations of nitrogen, phosphorous and potassium in the plant and increasing the proportion of protein in the grains. The difference in fertilizer combinations (PK) did not have any significant effect on grain yield, while the recommended combination of 100 kg P and 120 kg K ha1- (100% of the recommendation) gave the highest vital yield and protein content. Cultivation at a ploughing depth of 30 cm with the addition of the fertilizer combination 50 kg P and 60 kg K ha1- (50% of therecommendation) recorded the highest grain yield, although the results achieved by the cultivation without tillage with 100% of the fertilizer recommendation (PK) were Very important and without significant difference from the mixture that excelled in grain yield.

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References

Al-Hasnawi, **A.S.A**. (2021). Evaluation of the performance of cultivars of wheat (*Triticum aestivum* L.) Under the influence of potassium levels and harvest dates. PhD thesis, College of Agriculture. Al-Muthanna University.

Al-Rawi, K.M. and Khalaf Allah, A.M. (2000). Design and analysis of agricultural experiments, Dar Al-Kutub for printing and publishing. College of Agriculture and Forestry, University of Mosul, Ministry of Higher Education and Scientific Research. The Republic of Iraq.

Al-Ugaili, J.K., A. Khudair, A. Jarallah and B.H. Al-Amri (2011). Evaluation of the addition of potassium and magnesium fertilizers in the yield and nutrition of wheat plants. Babylon University Journal. Pure and Applied Sciences 3 (19).

Antar, **S.H**. (2013). Effect of tillage systems and seeding rates on the growth and yield of soft wheat and its accompanying weeds in rainy areas. Al-Rafidain Agriculture Journal, 41(4):247-255.

Ati, .A.S. ; S.A. Rawdhan; and S.S. Dawod (2015). Effect of tillage system on some machinery and soil physical properties, growth and yield of potato (*Solanum Tuberosum* L.) IOSR Journal Agriculture and Veterinary Science (IOSR –JAVS).Baghdad,8(4):63-65.

Black, C.A (1965) Methods of soil analysis, Amer. Soc. Of Agron.1nc.USA.

Black, G.R. and K.H. Hartge. (1986). Method of soil analysis part 1.physical and mineralogical method ,2nd ed., Edited by A. Klute, p.363-381.

Blackshaw, R.E,.R.j. Molnar ,.G.W.Clayton,.K.N.Harker and T.Entz(2007). Dry bean production in aero andconventional tillage. American society of Agronomy.99:122-126.

Brochure. (2012). Agricultural Extension Department. p. 36 Baghdad, Iraq.

Chauhlan, B.S ,.Gill and C. preston (2006).Factors affecting seed germination annual sow thistle (*sonchus oleraceus*) in southern Australia. Weed science.54(5):854-860.

Cresser, M.E.and G.W.parson (1979).Sulphuric, perchloric and digestion of plant material for determination Nitrogen, phosphorus, Potassium, Calcium and Magnesium, analytical chemical. Acta.109.431-436.

Directorate of Agricultural Statistics. 2020. Estimation of wheat and barley production. Ministry of Planning and Cooperation. Central Statistical Organization of Iraq.

Hassan, N.A.; H.Y. Al-Dulaimi and L. Abdel-Ethawi. (1990). Soil fertility and fertilizers, Ministry of Higher Education and Scientific Research, University of Baghdad.

Jadoua, K.A. (1995). Wheat Facts and Guidelines. Ministry of Agriculture Publications. General Authority.

Kettler, **T.A D.J.Lyon.,J.W.doran., W.W.Stroup**(2000). Soil Quality assessment after Weed Tillage in A no-till wheat- Fallow Cropping system. Soil Science. Society of America Journ aL65:339-346.

Kubar, S., K. A. Kubar and A. A. Kubar (2019). Effect of potassium (K+) on growth, yield components and macronutrient accumulation in Wheat crop.pure and Applied Biology, 8(1):248-255.

Majeed, H.R. and S.K. Jabbar. 2015. Effect of levels of phosphate on yield and its components for three additions of wheat crop *(Triticum aestivum* L.). Al-Muthanna Journal of Agricultural Sciences, 3 (2): 318-326.

Page, A.I.; R.H. Miller and D.R. Kenney.(1982). Methods of Soil Analysis, Part (2). 2nd ed. Agronomy 9 Am. Soc. Agron. Madison part(2). 2nd ed. Agronomy 9 Am. Soc. Agron. Madison. Wisconsin.

Qatni, K. (2009). No-Till Agriculture Technique in Grain Cultivation. Ministry of Information. Syrian Arab Republic. Agricultural Extension and Cooperation.

Richards, **L.A**. (1954). Diagnosis and improvement of saline and Alkali soils. U.S. Dept. Agr. H.B.No.60.

Saudi, A.H. (2013). Effect if temperature degree on germination and seed ling characters of seeds of four wheat (Triticum aestivum L.) cultivars. Thi-Qar.Univ.J.for Agric. Rese.2(1);81-99.

Sultan, A.M. and S. Antar (2017). Effect of tillage regimes and seed quantity on the growth and yield of coarse wheat (Durum L.) Triticum. And the accompanying bushes in the rainy areas. The Journal of Mesopotamia Agriculture, Vol. (45), No. (1).