Journal of Genetic and Environmental Resources Conservation, 2022, 10(1):49-59.
www.gercj.com Print ISSN: 2306-8663, Online ISSN: 2306 – 8280

The physiological contribution of the main stem and the three primary tillers to some components of wheat yield

Jamal Waleed Mahmood* and Mohammed Fawzi Hamza Al- Hassan
Dept. of Field crops, College of Agricultural Engineering Sciences, University of Baghdad, Iraq.
***Corresponding author: jamalwaleed016@gmail.com**
Received: September 23th 2021; Accepted: November 22nd 2021

Abstract

A factorial experiment was conducted at the Experimental Station (A) of the Field Crops Department / College of Agricultural Engineering Sciences, University of Baghdad (Jadiria) during the winter season of 2014-2015.The study aimed to investigate the role of seeding rates and nitrogen levels in regulating tillering in wheat and its relationship to grain yield and its components. Treatments were distributed in the factorial experiment within Randomized Complete Black Design with three Replicates and four seeding rates 60, 80, 100 and 120 kg ha^{-1} and fertilized with four nitrogen levels 50,100,150 and 200 kg N. ha^{-1}. The results showed that the interaction was differed significant into the effect on biological yield ton.ha^{-1} and harvest index% during the growing season, as the main stem MS was superior in giving average highest of biological yield value 0.257 ton.ha^{-1} and harvest index of 0.879% compared to the three primary tillers (the first tiller T1, the second tiller T2 and the third tiller T3), Concerning seeding rates 100 kg. ha^{-1} resulted in the highest average of total biological yield of 13.84 kg. ha^{-1}. compared to other seed rates. The nitrogen levels have exceeded 150 kg N. ha^{-1}. gave the highest average biological yield of 16.365 kg. ha^{-1}. compared to the other levels. The proportions of the contribution of the main stem differed from the three primary tillers in the biological yield and harvest index by the influence of the within two study factors. The percentage of the main stem contribution amounted to 57.59 and 37.21%, respectively, compared to the three primary tillers (T3, T2, T1), which amounted to 23.59, 12.21 and 3.81, respectively, for the biological yield of 33.66, 18.23 and 7.94%, respectively, for the harvest index within the two study factors. We concluded that the ratio of the contribution of the lower (older) tillers in the formation (location) is the highest compared to the higher (late) tillers in the formation within the two study factors.

Keywords: Harvest index, Biological yield, Physiological contribution , Main stem, Three primary tillers.
Part. of M.Sc. thesis of the first author

Introduction

Little is known regarding the physiological contribution of differences in the main stem and the three primary tillers. Tillering production is an important trait in many cereal plants, such as wheat, because of its ability to capture the upper limit of total light and the production of grain through some processes such as breaking buds dormancy, tiller development and tiller aging, as they greatly affect the characteristics of tillers (Lafarge and Hammer, 2002 and Evers et al., 2004. Depends the emergence and development of tillers and continue with life on the intensity of competition within a plant community (Almeida,etc,2004). Usually the main stem emerges before the rest of the tillers being the former in composition. As well as having a greater chance or opportunity to stay alive compared to other tillers it to the main stem of great importance since through it to know the number of seeds growing from the total number of cultivated plants, as well as having the highest weight and number grain spike thus higher than of other tillers. (Hucl and Baker, 1989). Suggested Klepper, etc. (1982and 1983a) the main axis scale, which uses the leave diameters and main stem in harming tillers. The first stem that emerges from the seed is the main stem (m.s. and the subsequent). Stems can be considered primary, secondary and tertiary tillers, depending on the main stem. The tillers that leave from the axillary buds of the main stem leaves are indicated by the letter and then by the number. The number of the initial section is composed of single number indicating. The number of the leave to which the original bud is associated. For example, the tiller (T1) of the first leaf on the main stem is given and secondary tillers are given a two number, or including the first tiller and the second number refers to the number law, for example: tiller (T21) it is the tiller of the apparent first leave for the first tiller (T2). This system continues to the three tillers, and the number, then, consists of three numbers and so on. The second source of the tillers is the coleoptile tiller which appears under the surface of the soil at the base of the coleoptile tiller it symbolizes either (TO) or (TC), (Gulnaz,etc., 2011). Thiry, etc. (2002) Defined it as the growth of the buds in the leaves of the plant, while nitrogen constitutes only a small part of the total plant weight, yet it plays an essential role in plant metabolism because more than 90% of plant nitrogen is protein. Nitrogen is present in the ground in large quantities, but the plant can only use certain forms of it, which are not ready in the soil except in limited quantities during the growing season, and accordingly nitrogen can be considered the main factor determining the expected outcome in many wheat cultivation sites in the world. In addition, it is an integral part of chlorophyll, which is essential for the absorption of light energy by photosynthesis (Satorre and Gustavo, 2000).

Al Hassan, (2011) concluded that the gradual availability of nitrogen at the sometime led to an increase in photosynthesis that may have reduced the competition between the main stem which started with its rapid acceleration and between the tillers themselves to provide food support necessary for the growth and the emergence of the largest number of tillers produced until the end of the season and give the tillers with the ears. Which reflected positively in increasing the number of years. The precise tillers between the amount of nitrogen and the date of the addition of the plant is necessary to achieve the highest granular content with the main stem amount of added nitrogen. (Al-Hassan, 2011) to know the pattern and the possibility of subdivision of several varieties by the reach the best varieties and linked to the need of fertilizer sec the turning capacity. The aim of this research organization in active influence wheat tillering to main seeding rate and nitrogen levels to know the contribution of primary tillers (tiller1, tiller2 and tiller3) on in biological yield and harvest index.

Materials and Methods

This experience is applied in a test Station (A), College of Agricultural Engineering Sciences - University of Baghdad –Jadiria during the winter season (2014-2015) to study the effect of seeding rates and nitrogen levels and the contribution of each of the main stem and primary tillers (T1, T2 and T3) in the grain of wheat. Random samples of soil analysis were taken at a depth of (0-30) cm before planting. And analyzed of the college of Agriculture, University of Baghdad and the results of the analysis as shown in table (1). The design of Random Complete Block Design (R.C.B.D) according to the order of the global experiment using three replicates. The study included two factors seeding rates of four seed rates. (60 , 80 , 100 and 120) kg/ha. The nitrogen fertilizer at four levels is (50 , 100 , 150 and 200) kg N ha-1. Soil preparation and soil service prior to planting were carried out by cleaning and removing the residues of the previous crop and plowing the soil. The two plots were perpendicular to the plow, and the soil was softened by disk activity. Nitrogen levels between experimental units. The total area of each experimental unit is 4 square meters (2*2) square meters .Each experimental unit consisted of 10 lies with a length of 2 meters and length of cultivation between the lines 20cm and a depth of planting 5 cm. It was equipped with 480 bags of seeds of the Iraq variety were prepared. Seeding rates each line has its own seed quantity by one (2.4 , 3.2 , 4.0 and 4.8) gram of seeds , respectively, within seed rates. The soil of the experiment was submerged with superphosphate fertilizer P_2O_5 (P48%) before planting at a rate of 100 kg. ha-1. Add one batch of 200g per experimental unit (Jaddoa, 1995). Use urea fertilizer (N 46%) was used, and the share of a unit of experimental unit was calculated by the levels of the students (10.869 , 21.739, 32.68 and 43.478) by a gram of each level. It was added in accordance with the evolutionary criterion of the plant in first four batches at the planting ZGS: 01 (Zadoks Growth stage) and the second in the stage of the growth of (ZGS: 13) (of the plants, possession for three full leaves on the main stem) and the third at (ZGS:32) (at the elongation phase the emergence of two nodes on the main stem) and fourth ZGS: 40 (of the booting stage) level on a scale (Zadoks etc. 1974). The date of sowing 25/11/2014. The first reason was given, and after the completion of the germination process for all experimental units within the study percentage of 100%, which ranged between 7-10 days and after the plant possession of two leaves (full Expanded) (ZGS:12) on the main stem. One line of each experimental unit was observed from the four sides, corresponding to one sample in all experimental units, 5 randomly selected plants were selected from the four sides to study the growth characteristics of each of the main stem and first tillers and second tillers and the third tillers. As each plant was thought to distinguish from the other plant (non-index) with an or rye rubber table with 1-inch diameter.

Tillering were Tiller1, Tiller2 and Tiller3 (T1, T2 and T3) taught when each of them appeared on the plant were also marked with rubber marks of 0.5 on in different colors and shapes (white mark is open – A black checkered mark- Unsweetened black mark). The ground of the experiment was irrigated according to need and the control of the high weeds with the chevalier was within the optimum time for spraying (Ahmed, 2005).

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

Characteristics	Season
Soil separation of soil. GM. Kg^{-1}	
Sand	272
Clay	388
Silt	340
Soil tissue	Clay loom
(PH)	7.24
ECe ($dS.m^{-1}$)	2.37
Nitrogen ready mg. Kg^{-1}	20.1
Phosphorus ready mg. Kg^{-1}	14.33
Potassium ready mg. Kg^{-1}	85.0
Organic matter %	0.86

Result and Discussion

Biological yield ton. ha-1: The biological yield is a measure of the total dry matter produced by the plant from all its parts above the soil surface during the growing season, resulting from the difference between the processes of photosynthesis and respiration (Jaddoa and Al hassan, 2019). The analysis of variance and the data in Table (2) indicates that the biological yield of each of the main stem M.S. The first tiller T1, the second tiller T2 and the third tiller T3, were significantly affected by seeding rates and nitrogen levels and the interaction between them.

Biological yield of the main stem ton. ha-1: It is noted from the analysis of variance in Appendix and Table (2) that the biological yield of M.S. increased significantly with the increase in seeding rates, and this is confirmed by Figure (1), as the seeding rate of 120 kg ha-1 was significantly superior by giving the highest average biological yield of 8.794 ton. ha-1, with an increase of 91.20, 35.96 and 12.07%, compared to the seeding rates of 60, 80 and 100 kg. ha-1 respectively, which gave an average of 5.631, 7.732 and 8.442 tons ha-1 respectively. This may be attributed to the ability of the main stem to compete in high plant densities, being the first in formation compared to other tillers, as well as the superiority of this rate by giving the highest average number of spikes and grain yield of the main stem (Mahmood and Al hassan , 2017). Table (4) show that the highest contribution rate of M.S. was achieved at the seeding rate of 120 kg ha-1 amounted to 68.97%, while the seed rate of 60 kg ha-1 gave the lowest contribution rate of M.S which amounted to 44.42%.

As for the effect of nitrogen on the biological yield of M.S., the level of 150 kg N ha-1 gave the highest average biological yield of 8.697 ton. ha-1, significantly superior to the other levels. The lowest average for this trait was recorded at the level of 50 kg N ha-1 amounting to 7.072 tons N ha-1, with a decrease rate of 18.68%, from the level of 150 kg N ha-1, but it did not significantly differ from the level of 100 kg N ha-1, which gave the average for this characteristic was 7.182 tons ha-1, and this is clearly shown in Figure (2). This may be due to the important effect of nitrogen when available in sufficient quantities in increasing the green area of the plant, as well as the superiority of this level in giving the highest average number of spikes and grain yield of the main stem (Mahmood and Al hassan, 2017), and the highest contribution rate of M.S. to the total biological yield was achieved at the level of 50 kg N ha-1 amounting to 58.48%, while the lowest contribution rate was achieved at the level of 100 kg N ha-1 amounting to 56.21% (Table 4).

Regarding the interaction between seeding rates and nitrogen levels, the combination of 120 kg of seeds with 150 kg of N fertilizer was significantly superior by giving the highest average biological yield of M.S of 10,599 tons ha-1, while the combination of 60 kg of seeds with 50 kg of N fertilizer gave the lowest average biological yield of 4.746 tons ha-1, with a decrease of 55.22%. That correlation analysis shows a positive significant correlation with several characteristics, namely plant height of the main stem, the number of spikes of the main and total stem, grain yield of the main and total stem, and the total biological yield. The value of the correlation coefficient was 0.396 - 0.845 - 0.568 - 0.878 - 0.454 - 0.598 , respectively.

Biological yield of the first tiller. ton. ha-1: Table (2) and Figure (1) shows that the biological yield of the first tiller T1 has decreased for each increase in seeding rates. The seeding rate of 60 kg ha-1 gave the highest average biological yield of T1 amounting to 3.821 tons ha-1, significantly superior, with an increase of 7.5 and 26% compared to the seeding rates of 100 and 120 kg ha-1, respectively, which gave an average of 3.535 and 2.828 for this trait. ton. ha-1 , respectively, but it did not differ significantly from the rate of 80 kg ha-1, which gave an average of 3.820 ton. ha-1. Table (4) indicates that the highest contribution rate of T1 to the total biological yield was achieved at the seeding of 60 kg ha-1 amounted to 30.14%, while the lowest contribution rate was achieved at the rate of 120 kg ha-1 amounted to 22.18%.

As for nitrogen levels, the biological yield increased when nitrogen levels were increased from 50-150 kg N ha-1, then the biological yield decreased when the nitrogen level was increased to 200 kg N ha-1. It can be seen from Figure (2) that the level of 150 kg N ha-1 was superior by giving the highest average for this trait amounting to 3.757 tons ha-1, with an increase of 15.75%, compared to the level of 50 kg N ha-1, which gave the lowest average for this characteristic amounted to 3.165 tons ha-1. Table (4) shows that the highest contribution rate of T1 to the total biological yield within nitrogen levels was achieved at the level of 100 kg N ha-1 amounted to 28.68%, while the lowest contribution rate was 25.16% at the level of 150 kg. N. ha-1. As for the interaction between the two factors of the study, the combination of 60 kg of seeds with 200 kg of N fertilizer gave the highest average biological yield of 4.683 tons. ha-1 with an increase of 56.99 compared to the combination of 120 kg of seeds with 200 kg N fertilizer, which gave an average of 2,014 tons ha-1 and Correlation analysis confirm the existence of a positive significant correlation with other traits, and the highest correlation value was recorded with the dry weight trait of the third, as the correlation coefficient value was (0.680).

Biological yield of the second tiller. ton. ha-1: The analysis of variance in Appendix and Table (2) shows that the biological yield of T2 has decreased for each increase in seeding rates. Figure (1) shows that the seeding rate of 60 kg ha-1 was significantly superior by giving the highest average for this trait amounted to 2.323 tons ha-1, with an increase of 23.28, 35.34 and 62.03%, compared to the rest of the seeding rates of 80, 100 and 120 kg ha-1, respectively, which gave the averages 1.782, 1.502 and 0.882 ton. ha-1 , respectively. Table (4) indicates that the highest contribution rate of T2 to the total biological yield within the seeding rates was 18.32% at 60 kg ha-1, while the lowest contribution was achieved at 120 kg ha-1, which amounted to 6.92%.

With regard to nitrogen levels, it was observed from Figure (2) that the level of 150 kg N ha-1 was significantly superior by giving the highest average biological yield of T2 amounted to 1.926 ton. ha-1 compared to the rest of the levels under study, as the lowest average for this trait was recorded at the level of 50 kg N ha-1 amounted to 1.428 tons. ha-1, but it did not differ significantly from the level of 100 kg N ha-1, which gave an average of 1.454 tons.ha-1. Table (4) shows the superiority of the level of 150 kg N ha-1 in giving it the highest contribution rate of T2 in the total biological yield amounted to 12.90%, while the lowest contribution was recorded at the level of 100 kg N ha-1 amounting to 11.38%.

As for the interaction between the two factors of the study, the combination of 60 kg of seeds with 150 kg of N fertilizer was significantly superior by giving the highest average biological yield of T2 which amounted to 2.727 tons ha-1 with an increase of 83.31%, than the combination of 120 kg of seed with 50 kg of N fertilizer which gave least average for this trait was 0.455 tons ha-1. Annex (6) indicates a significant positive correlation for this trait with other traits. The highest correlation value was recorded with the trait of the total number of tillers, as the correlation coefficient value was (0.895).

Biological yield of the third Tiller. Ton. ha-1: It is clear from the analysis of variance in Annex and Table (2) that the effect of seeding rates on the biological yield of T3 was similar to its effect on the biological yield of T1 and T2, as the biological yield decreased significantly with increasing seeding rates. Figure (1) confirms that the seeding rate of 60 kg ha-1 was significantly superior by giving the highest average for this trait amounting to 0.902 t ha-1, compared to the rest of the seeding rates of 80, 100 and 120 kg ha-1, whose averages decreased by 44.56, 59.53 and 72.61%, respectively. Table (4) indicates that the highest contribution rate of T3 to the total biological yield was 7.12% at the rate of 60 kg ha-1, while the lowest contribution rate was 1.94% at the rate of 120 kg ha-1.

As for the role of nitrogen levels, Figure (2) confirms that the level of 150 kg N ha-1 was significantly superior by giving the highest average for this trait amounted to 0.555 tons ha-1, compared to the levels 50 and 100 kg N ha-1, which gave the averages of 0.429 and 0.477 tons ha- 1 , respectively, and they did not differ significantly between them, and the levels 150 and 200 kg N ha-1 did not differ significantly between them. Table (4) shows that the highest contribution rate of T3 to the total biological yield within nitrogen levels was 4.16% at the level of 200 kg N ha-1, while the level of 50 kg N ha-1 gave the lowest contribution rate of T3 to the total biological yield, which amounted to 3.55 % .With regard to the interaction between the two factors of the study, the combination of 60 kg of seeds with 150 kg of N fertilizer was significantly superior by giving it the highest average biological yield of T3 of 1.025 ton ha-1 with an increase of 93.46%, than the combination of 120 kg of seeds with 200 kg of N fertilizer, which gave The lowest mean for this trait was 0.067 ton ha-1. That correlation analysis shows the existence of a positive significant correlation with other traits, and the highest correlation value was recorded with the biological yield of the second tiller, as the correlation coefficient value was (0.883).

In light of the foregoing results, it is noticeable that the lowest seeding rate of 60 kg.ha-1 was significantly superior in giving the highest average biological yield for the tillers T1, T2 and T3, and this may be attributed to the lack of competition among plants in the low densities, in addition to the fact that the lower plant densities led it leads to an increase in the emergence and survival of tillers and an increase in their contribution to the accumulation of dry matter and grain yield, which significantly increased the biological yield of each of them, Table (3) confirms this, as the lower rate exceeded by giving the highest average of fertile tillers m-2.

As for nitrogen levels, it was found that the level of 150 kg ha-1 was significantly superior in giving it the highest average biological yield for the tillers T1, T2 and T3, and this may be due to the important effect of nitrogen in increasing the green area by increasing the fertile tillers. m-2 ears and grain yield, which increases the biological yield.

The total biological yield of M. S. T1, T2, and T3. Show results Table (3) that the total biological yield was significantly affected by the seeding rates. The rate of 100 kg ha-1 was significantly superior by giving the highest average for this trait amounted to 13,843 tons ha-1, with an increase of 91.57% over the rate of 60 kg ha-1, which gave the lowest average for this trait amounted to 12,677 tons ha-1, but it was not Significantly different from the average of 80 kg. ha-1, which gave an average of 13,835 tons. ha-1. Table (4) shows that the superiority of the seeding rate of 100 kg ha-1 was as a result of the contribution of M.S. T1, T2, and T3 by 60.98, 25.54, 10.85 and 2.64%, respectively, while each of them contributed 44.42, 30.14, 18.32 and 7.12% sequentially on average 60 kg ha-1.

As for nitrogen levels, the level of 150 kg N ha-1 gave the highest average for this trait amounting to 14.934 tons ha-1, with an increase of 19.02, 14.44 and 10.92% over the levels 50, 100 and 200 kg N ha-1, respectively, which gave the averages 12,093 and 12,777 and 13,302 tons ha-1. It is noted from Table (4) that the contribution of M.S., T1, T2 and T3 to the seeding rate of 150 kg.N ha-1 was 58.24, 25.16, 12.90 and 3.72%, respectively, while each of them contributed at the rate of 50 kg.N ha-1. Which gave the lowest average for this trait with 58.48, 26.17, 11.81 and 3.55%, respectively.

As for the interaction between seed rates and nitrogen levels, it was observed that the combination of 120 kg of seeds with 150 kg of N fertilizer was significantly superior by giving the highest average for this trait amounted to 16.365 ton. ha-1, with an increase of 41.71%, compared to the combination of 60 kg of seeds with 50 kg N fertilizer that gave The lowest average for this trait was 9,539 tons ha-1. And correlation analysis show that this trait was significantly associated with a positive relationship with other traits, and the highest correlation value was recorded with the trait of the total number of spikes, as the value of the correlation coefficient was (0.736).

Harvest index %: The harvest index is a method of measuring the ratio of grain to dry matter above the soil surface (Jaddoa et al, 2017). Table (5) shows the data that the harvest index of each of the main stem M.S, the first tiller T1, the second tiller T2 and the third tiller T3 were significantly affected by seeding rates and nitrogen levels and the interaction between them.

Harvest index Main Stem %: Table (5) shows that the increase in seeding rates led to a decrease in the harvest index for M.S. and this is evident in Figure (3) which shows the superiority of the seeding rate of 60 kg ha^{-1} by giving the highest average for this trait amounting to 39.49% While 120 kg ha^{-1} gave the lowest average for this trait, which was 34.75%.

As for nitrogen levels, the level of 100 kg N ha^{-1} gave the highest mean of harvest index for M.S. that reached 38.71%, while the level of 150 kg N ha^{-1} gave the lowest average for this trait amounting to 35.26%. As for the levels 50 and 200 kg N ha^{-1}, they did not differ significantly between them, as they gave the averages 37.76 and 37.10%, respectively.

Table (2): The effect of the study factors on the biological yield ton. ha^{-1} of the main stem and tillers.

	Seeding rates ($kg.h^{-1}$)	Nitrogen levels ($kg.h^{-1}$) 50	100	150	200	mean
M.S.	60	4.746	4.851	6.357	6.569	5.631
	80	6.107	7.630	10.542	6.651	7.732
	100	8.847	8.594	7.290	9.037	8.442
	120	8.587	7.653	10.599	8.335	8.794
	l.s.d.5 %		0.5141			0.2571
	mean	7.072	7.182	8.697	7.648	
	l.s.d.5 %		0.2571			
T1	60	60	2.573	3.615	4.412	4.683
	80	80	4.300	3.436	3.041	4.505
	100	100	3.345	4.226	4.096	2.475
	120	120	2.444	3.377	3.479	2.014
	l.s.d.5 %		0.3392			0.1696
	mean	3.165	3.664	3.757	3.419	
	l.s.d.5 %		0.1696			
T2	60	1.616	2.627	2.727	2.325	2.323
	80	1.670	1.111	2.113	2.236	1.782
	100	1.969	1.107	1.220	1.711	1.502
	120	0.455	0.972	1.643	0.456	0.882
	l.s.d.5 %		0.0873			0.0436
	mean	1.428	1.454	1.926	1.682	
	l.s.d.5 %		0.0436			
T3	60	0.605	1.021	1.025	0.957	0.902
	80	0.493	0.150	0.457	0.898	0.500
	100	0.543	0.533	0.092	0.290	0.365
	120	0.073	0.204	0.644	0.067	0.247
	l.s.d.5 %		0.0630			0.0315
	mean	0.429	0.477	0.555	0.553	
	l.s.d.5 %		0.0315			

Table (3): Total biological yield ton. ha^{-1} for each of (M.S, T1, T2, T3) Influenced by the study factors.

Study factors		total biological yield For the main stem and tillers ($ton.h^{-1}$)	Contribution M.S %	Contribution T1 %	Contribution T2 %	Contribution T3 %
Seeding rates ($kg.h^{-1}$)	60	12.677	44.42	30.14	18.32	7.12
	80	13.835	55.89	27.61	12.88	3.61
	100	13.843	60.98	25.54	10.85	2.64
	120	12.751	68.97	22.18	6.92	1.94
Nitrogen level ($kg.h^{-1}$)	50	12.093	58.48	26.17	11.81	3.55
	100	12.777	56.21	28.68	11.38	3.73
	150	14.934	58.24	25.16	12.90	3.72
	200	13.302	57.50	25.70	12.64	4.16
Overlap Among the study workers	50 X 60	9.539	49.75	26.97	16.94	6.34
	150 X120	16.365	64.77	21.26	10.04	3.94

Table (4): Contribution ratios of (M.S - T1 - T2 - T3) to the total biological yield ton.ha^{-1} by the influence of the study factors.

	Seeding rates (kg. h^{-1})	Nitrogen levels (kg.h^{-1})				mean
		50	100	150	200	
M.S. + T1 + T2 + T3	60	9.539	12.114	14.522	14.533	12.677
	80	12.570	12.327	16.152	14.290	13.835
	100	14.704	14.459	12.698	13.513	13.843
	120	11.559	12.207	16.365	10.872	12.751
	l.s.d.5 %		0.7655			0.3828
	mean	12.093	12.777	14.934	13.302	

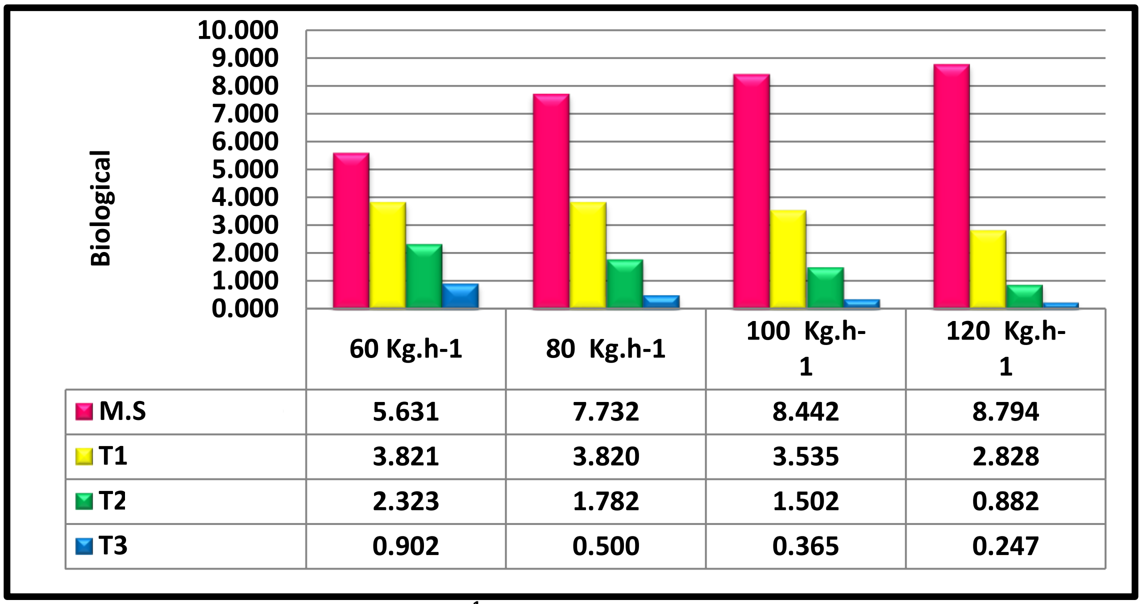


Figure (1): Biological yield, ton. h^{-1} of M.S. And T1, T2 and T3 within the seeding rates

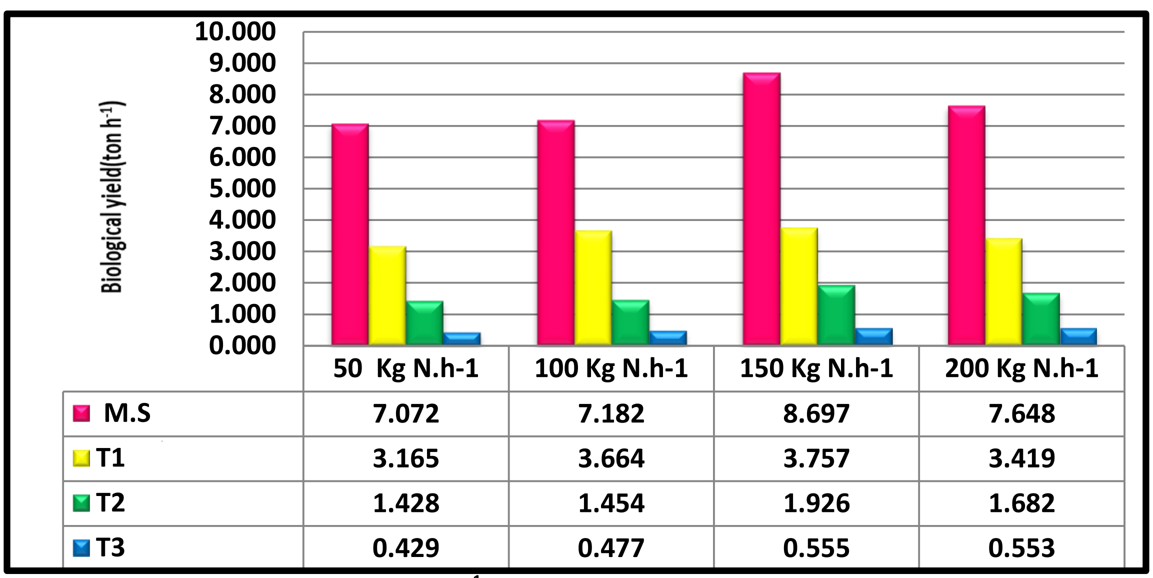


Figure (2): Biological yield of ton. h^{-1} for each of M.S. And T1, T2, and T3 are within nitrogen levels.

With regard to the interaction between the two factors of the study, the combination of 100 kg of seeds with 50 kg of N fertilizer was significantly superior by giving it the highest average for this trait amounting to 42.37%, compared to the combination of 100 kg of seeds with 150 kg of fertilizer which gave the lowest average for this trait of 29.31 and Correlation analysis shows There is a positive significant correlation for this trait with other traits, and the highest correlation value was recorded with the trait of weight of 1000 grains for the third tiller, where the value of the correlation coefficient was (0.701).

Harvest index first tiller %: Table (5) shows that the harvest index for T1 decreased significantly with increasing seeding rates. Figure (3) confirms this if the average is given 60 kg. h^{-1} had the highest mean for this trait that reached 36.16%, significantly superior to the rest of the rates 80, 100 and 150 kg ha^{-1}, which gave the averages 34.76 and 30.06%, respectively.

As for the role of nitrogen levels, it can be seen from Figure (4) that the level of 150 kg N ha^{-1} was significantly superior by giving the highest average for this trait amounted to 36.17%, compared to the level of 50 kg N ha^{-1}, which gave the lowest average for this trait amounted to 29.03%, while it was not The two levels of 100 and 200 kg N ha^{-1} differed significantly between them, as they gave the averages 34.77 and 34.67%, respectively.

With regard to the interaction between the two factors of the study, the combination of 80 kg of seeds with 150 kg of N fertilizer gave the highest average for this trait amounting to 55.92%, significantly superior to the combination of 100 kg of seeds with 100 kg of N fertilizer, which gave the lowest average for this trait amounted to 14.95% and correlation analysis shows that there is a significant positive correlation for this trait with other traits, and the highest correlation value was recorded with the trait of grain yield for the first tiller, as the value of the correlation coefficient was (0.786).

Harvest index second tiller %: The data of Table (5) indicates that the effect of seeding rates on the harvest index of T2 was similar to its effect on T1, as the harvest index of T2 decreased significantly for each increase in seeding rates. Figure (3) shows that the rate of 60 kg ha^{-1} was significantly superior by giving the highest mean of the harvest index amounted to 31.05%, compared to the rest of the rates 80, 100 and 120 kg ha^{-1}, which gave the averages 23.18, 12.08 and 10.68%, respectively.

As for nitrogen levels, it can be seen from Table (5) and Figure (4) that the level of 100 kg N h^{-1} exceeded it by giving it the highest average for this trait amounting to 21.45%, compared to the level of 150 kg N ha^{-1}, which gave the lowest average for this trait amounting to 19.58%. However, it did not differ significantly from the level of 50 kg N. ha^{-1}, which gave an average of 21.11% for this trait.

With regard to the interaction between the two factors of the study, the combination of 60 kg of seeds with 50 kg of N fertilizer was significantly superior by giving the highest average for this trait amounted to 40.98%, compared to the combination of 120 kg of seeds with 200 kg of N fertilizer which gave an average of only 0.00%. And Appendix (6) shows that there is a positive significant correlation with other traits, and the highest correlation value was recorded with the trait of grain yield for the second tiller, as the value of the correlation coefficient was (0.788).

Harvest index third Tiller %: It can be seen from Table (5) that the behavior of the seeding rates in the trait of harvest index for T3 is similar to its behavior in the harvest index for T1, as the harvest index decreased significantly with the increase in seeding rates and this is evident in Figure (3), which shows that the rate is superior to 60 kg ha^{-1} Significantly, giving the highest mean for this trait reached 16.60%, while 120 kg ha^{-1} gave the lowest mean for this trait that reached 0.86%.

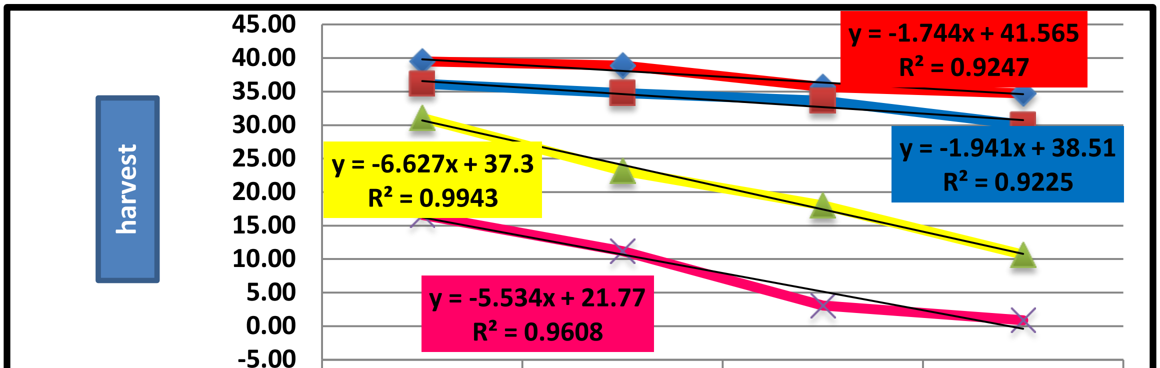
As for nitrogen levels, it is noted from Table (5) and Figure (4) that the level of 150 kg N ha^{-1} gave the highest mean for this trait amounting to 10.05%, significantly superior to the rest of the other levels 50, 100 and 200 kg N ha^{-1}, which gave an average for this trait. It reached 4.82, 8.05 and 8.81%, respectively.

As for the interaction between seeding rates and nitrogen levels, the combination of 60 kg seeds with 150 kg N fertilizer was significantly superior by giving the highest average for this trait amounted to 23.39%, compared to the combinations of 100 kg seeds with 100 kg N fertilizer and 100 kg seeds with 150 kg N fertilizer and 120 kg seeds with 50 kg N fertilizer and 120 kg seeds with 200 kg N fertilizer, which all gave the same mean for this trait of only 0.00% , and correlation analysis shows that there is a positive significant correlation with other traits, and the highest correlation value was recorded with the trait of grain yield for the third tiller, as the value of the correlation coefficient was (0.945).

In light of the foregoing, it is noticeable that the lowest seeding rate of 60 kg. ha^{-1} was significantly superior in giving the highest average harvest index % for each of the main stem and tillers T1, T2 and T3 and then began to decrease gradually until the highest seeding rate was 120 kg. ha^{-1}, which score the lowest average for this trait for each of them, this increase may be due to the balance in the plant between increasing the grain yield and increasing the biological yield in the plant as a result of changing seeding rates, as well as the balance between the main stem and tillers, as the main stem gave the highest grain yield (Mahmood and Al hassan,2017) and the highest biological yield (Table 2 and Fig. 1) in high seeding rates, in contrast to the rest of the tillers, which in turn gave the highest grain yield (Mahmood and Al hassan,2017) and the highest biological yield (Table 2 and Fig. 1) in low seeding rates, and this is evidence of the efficiency of the biological yield in increasing grain yield.

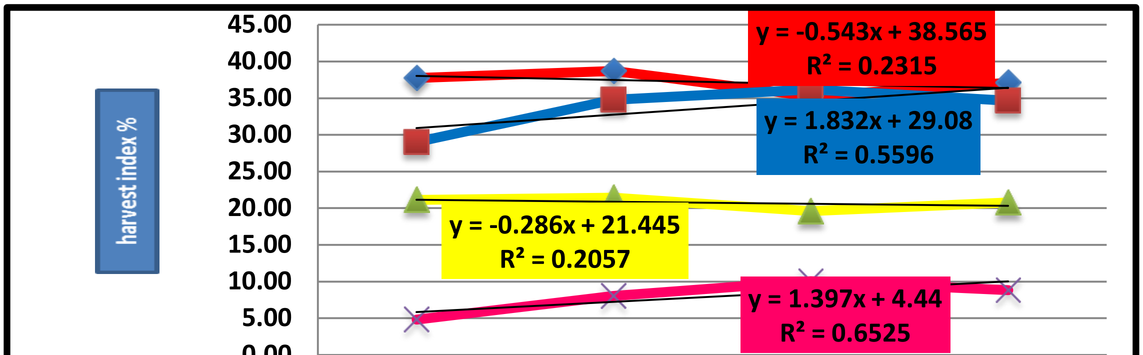
Table (5): Effect of study factors into harvest index % for main stem and tillers.

	Seeding rates ($kg.h^{-1}$)	Nitrogen levels ($kg.h^{-1}$)				mean
		50	100	150	200	
M.S.	60	38.72	39.53	38.73	40.99	39.49
	80	35.23	41.56	40.67	38.15	38.90
	100	42.37	38.42	29.31	32.62	35.68
	120	34.73	35.32	32.35	36.63	34.75
	l.s.d.5 %		1.759			0.879
	mean	mean	37.76	38.71	35.26	
	l.s.d.5 %		0.879			
T1	60	30.90	42.06	33.62	38.07	36.16
	80	14.95	42.02	55.92	26.15	34.76
	100	44.29	14.66	26.04	49.61	33.65
	120	25.99	40.32	29.09	24.85	30.06
	l.s.d.5 %		1.589			0.795
	mean	29.03	34.77	36.17	34.67	
	l.s.d.5 %		0.795			
T2	60	40.98	15.57	33.05	34.58	31.05
	80	10.47	28.35	23.50	30.39	23.18
	100	0.91	37.35	15.68	18.13	18.02
	120	32.09	4.52	6.11	0.00	10.68
	l.s.d.5 %		1.481			0.740
	mean	21.11	21.45	19.58	20.78	
	l.s.d.5 %		0.740			
T3	60	12.30	22.23	23.39	8.47	16.60
	80	0.67	7.61	15.73	20.78	11.20
	100	6.30	0.00	0.00	6.01	3.08
	120	0.00	2.36	1.07	0.00	0.86
	l.s.d.5 %		1.172			0.586
	mean	4.82	8.05	10.05	8.81	
	l.s.d.5 %		0.586			



	60 Kg.h-1	80 Kg.h-1	100 Kg.h-1	120 Kg.h-1
M.S	39.49	38.90	35.68	34.75
T1	36.16	34.76	33.65	30.06
T2	31.05	23.18	18.02	10.68
T3	16.60	11.20	3.08	0.86

Figure (3): The harvest index shows % of M.S. And T1, T2 and T3 within the seeding rates.



	50 Kg N.h-1	100 Kg N.h-1	150 Kg N.h-1	200 Kg N.h-1
M.S	37.76	38.71	35.26	37.10
T1	29.03	34.77	36.17	34.67
T2	21.11	21.45	19.58	20.78
T3	4.82	8.05	10.05	8.81

Figure (4): The harvest index shows % of M.S. And T1, T2, and T3 are within nitrogen levels.

Conclusion

We concluded that the primary tillers have an important and effective role to the extent that the main stem contributes to the biological yield and harvest index and we have stimulated this research to adopt the seeding rate and nitrogen level based on the contribution of the tillers to the final yield. However ,the contribution of the three primary tillering decreased with increase in seeding rates. while the contribution of the main stem increased when the seeding rates were increased. the lower seeding rate gave the highest. accumulation of dry matter, the role of the third tiller (T3) was the least contribution of traits compared to the main stem and the first and second tiller within the two factors of the study. the seeding rates and nitrogen levels showed different behavior in their effect on the contribution of the main stem and tillers. And anyone wants to discuss this project will serve as the first thread to complete the scientific that from it . It is important that other studies provide information that is relevant to tillering capacity.

References

Ahmed, M. R. 2005. Responsive and Tolerance for some Varieties of Wheat to Different Rates of Herbicide Spraying Shiva Lear. M.Sc. Thesis. Coll. Of Agric. Baghdad Univ .Pp: 147.

Al-Hassan, M. F. H. 2011. Understanding the mechanism of tillering in several varieties of baking wheat (*Triticum aestivum* L) with the effect of the rate of sowing and nitrogen level and its relationship to the recipient of grain and its components. PhD thesis. College of Agriculture. Baghdad University.

Almeida, M. L. D., L. Sangoi, Jr., A. M., A. C Alves, I. C. Nava, and A. C. Knopp. 2004. Tiller emission and dry mass accumulation of wheat cultivars under stress. Sci. Agri. (Piracicaba, Braz.). 61(3): 266-270.

Evers, J.B., J. Vos , C. Fournier , B. Andrieu , M. Chelle , P. C. Struik .2004. A3D approach for modeling tillering in wheat (*Triticum aestivum* L.) . 4thnternational workshop on functional structural acterization of vegetative development in small cereal grains. Agron. J. 74: 789-792.

Gulnaz, S., M. Sajjad, I. Khaliq, A.S. Khan and S.H. Khan. 2011. Relationship among coleoptile length, plant height and tillering capacity for developing improved wheat varieties. Int. J. Agric & Biol. 13(1):130-133.

Hucl , P. and R.J. Baker. 1989. Tiller phenology and yield of spring wheat in a semiarid environment. Crop Sci. 29: 631-635.

Jaddoa, K. A. 1995. Wheat Facts and Guidelines. Publications of the Ministry of Agriculture. General Authority for Agricultural Cooperation and Extension.

Jadoua, K. A. and Mohammed Fawzi Al-Hassan. 2019. Tillering Physiology in Wheat. Arab Knowledge Bureau. Heliopolis, Cairo. Deposit No. 8928/2018 First Edition I.S,B.N: 978-977-812-266-4.

Jaddoa, K. A. and Al-Hassan M. F. H and Mahmood J.W. 2017. Wheat growth and development .Julie White and Jan Edwards(eds.).Bookshop and Documents in Baghdad 3505.First Edition Beirut – Lebannon (translated), Internationa; Numbering (I.S,B.N:978-992-290-728-4).

Klepper, B., Rickman, R.W. and Belford, R.K., 1983. Leaf and tiller identification on wheat plants. Crop Sci., 23: 1002-1004.

Klepper, B., Rickman, R.W. and Peterson, C.M., 1982. Quantitative characterization of vegetative development in small cereal grains. Agron. J. 74: 789-792.

Lafarge , T. A., and G. L. Hammer. 2002. Tillering in sorghum over a wide range of population densities :modeling dynamics of tiller fertility .Annals botany (90): 99-110.

Mahmood J.W. and AI-Hassan M.F.H. 2017. Regulation of tillering in wheat and its relationship wheat grain yield 1- contribution percentages of main stem and primary tillering the number of spikes and grain yield . The iraqi journal of agricultural Sciences 48(2): 528-539.

Satorre, E. H.and A. S. Gustavo. 2000. Wheat Ecology and Physiology of Yield Determination. Food Products Press An imprint of the Haworth Press, Inc. New York London Oxford p503.ISBN 1-56022-874-1.

Thiry, A.D., R.G. Sears, J.P. Shroyer and G.M. Paulsen. 2002. Relationship between tillering and grain yield of Kansas wheat varieties. Kansas University-Agricultural Experiment Station and cooperative extension service, USA. http://oznet. Ksu. Edu.

Zadoks, J.C. , T. T.T. Change , and C.F. Knozak . 1974. A decimal code for growth stages of cereals. Weed Res., 14 : 415-421.