

THE CONTRIBUTION OF THE MAIN STEM AND BRANCHES OF THE APPROVED CULTIVAR KM5180 TO THE GROWTH CHARACTERISTICS BY THE EFFECT OF THE NUMBER OF SEEDS PER SQUARE METER

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ABSTRACT

A field experiment conduct during winter season 2022-2023. This study was aimed to investigate effect number of seeds.m² to two wheat varieties. The results showed the superiority of V1 in most main stem growth traits (biological yield, number of ears .In square meters, plant height, spike length, spikelets number / ear and chlorophyll content (1.87 t. ha, 20.0 seed. m² , 113.90 cm , 18.40 cm, 26.37 spikelets/ ear and 75.92 (SPAD) respectively. V1 also excelled in all the traits of branch growth (biological yield, number of peduncles /m², plant height, spike length and spikelets number / ear, (16.71 tons .Ha⁻¹, 259.17 ear /m² ,104.57 cm, 16.83 cm and 23.63 spikelets / ear) respectively . comparative to V2. for the seeding rates per square meter; S₂ produced the highest main stem growth traits of biological yield, plant height and chlorophyll content, (16.71 ton. ha⁻¹ , 103.63 cm and 83.99 SPAD) respectively .in compare to (S₁ and S₃ seeding rates), even more; S₂ produced the highest biological yield in tillers No. (14.56 ton .ha⁻¹) which was significantly higher than seeding rates ((S₁ and S₃)], while S₃ produced the highest ears number. (265.00 ear.m²) compared to other seeding rates.

Keywords: food security, yield optimization .light trapping, strategic crop, climate change

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مجلة العلوم الزراعية العراقية -2023: 54(6):1794-1801

مساهمة الساق الرئيس والفروع لصنف الحنطة المعتمد (KM5180) في صفات النمو بتأثير عدد البذور بالمتر المربع

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المستخلص

اجريت تجربة حقلية في محطة ابحاث المحاصيل الحقلية - كلية علوم الهندسة الزراعية - جامعة بغداد اثناء موسم شتاء 2022-2023. بهدف معرفة وظيفة الساق الرئيس والفروع الاولية لصنف الحنطة المعتمد KM 5180 في صفات النمو من طريق معدل عدد البذور في المتر المربع. استعمل تصميم R.C.B.D. . اظهرت النتائج تفوق الصنف V1 في اغلب صفات نمو الساق الرئيس (الحاصل البيولوجي، عدد السنابل م²، ارتفاع النبات، وطول السنبله وعدد السنيبلات/سنبله و محتوى الكلوروفيل (SPAD) (1.87 طن. هـ⁻¹ ، 20.0 سنبله م²، 113.90 سم ، 18.40 سم ، 26.37 سنبله/ سنبله و 75.92 (SPAD)) على التتابع . كذلك تفوق الصنف V1 في جميع صفات نمو الفروع (الحاصل البيولوجي طن. هـ⁻¹، وعدد السنابل / م² وارتفاع النبات سم وطول السنبله سم وعدد السنيبلات/ سنبله والتي بلغت (16.71 طن .هكتار ، 259.17 سنبله م²، 104.57 سم ، 16.83 سم و 23.63 السنيبلات / سنبله) بالتتابع . قياسا بالصنف V2 . اما فيما يخص معدلات البذار م²، فقد تفوقت معاملة S₂ في اعطاء اعلى متوسط في صفات نمو الساق الرئيس (الحاصل البيولوجي وارتفاع النبات ومحتوى الكلوروفيل (16.71 طن. هـ⁻¹، 103.63 سم و 83.99 SPAD) بالتتابع . قياسا بمعدلات البذار (10 و 30) بذرة . ايضا تفوقت معاملة S₂ في اعطاء اعلى متوسط للحاصل البيولوجي للفروع (14.56 طن .هـ⁻¹ على معاملات (S₁ و S₃) بذرة /م² ، بينما تفوقت معاملة S₃ في اعطاء اعلى متوسط لعدد السنابل/ م² (265.00 سنبله / م²) قياسا ببقية معدلات البذار.

الكلمات المفتاحية : الامن الغذائي ، تحسين الحاصل ، اصطباذ الضوء ، محصول استراتيجي، التغير المناخي

Received:15/8/2023 Accepted:12/11/2023

INTRODUCTION

Wheat (*Triticum aestivum* L.) is considered a dependable food source around the globe, including in Iraq. Consequently; numerous studies highlight the importance of increasing its productivity and quality (14, 25) and its economics (4, 13). Particularly in light of the dilemma of desertification, water scarcity and climate change in Iraq (20). The process of growing wheat during the life cycle of a plant is complex (6, 7). As there is a part of the plant emergence during emergence stage, while another part could be in a state of death. Wheat crop produces additional vegetative parts called tillers, some of which grow to form a spike. The tillers consist of buds at the base of the leaf to form the primary tillers. The emergence of these branches coincides with the growth of the leaves formed on the parent plant, and usually begins to appear with the full growth of the third leaf. Wheat plants need to enter the tillers stage at an accumulated (accumulated) temperature between (300-350) °C (21). The additional tillers are formed in a regular sequence, and as a result, subsequent branches emerge from the subsequent leaf on the stem of the mother. The study of Mahmoud and al-Hassan (17). showed that the average number of main stem spike 210.00 spikes/m² and the grain yield was 3.050 t/ha, compared to the primary tillers (the first tiller, the second tiller and the third tiller), as the average number of spikes of the tillers reached half the total number. While the main stem excelled in producing the highest average number of spikelet's/spike of 19.23 spikelet's and number of grains 46.82 grains. for the spike, and the weight of a thousand grains was 41.739g, compared to the primary tillers, as the percentage of the contribution of the primary tillers was higher than the contribution of the main stem, with an increase in the seeding rate reached (53.69, 38.03, and 41.56)%, respectively (16). While high densities resulted in seeds from 200 to 400 seeds/ m² resulted in an increase in plant height and number of spikes. m², but it significantly reduced the length of the spike, the number of spikelet's/spike, the number of grains/spike, the weight of 1000 grains, and the yield of the spike (12). While (15) found significant differences in plant height and

number of spikes/m² when using seeding rates of (50, 150, 250, 350, 450 and 550) seeds/m². with did not significant differences in some characteristics, including harvest index, number of grains/ear, and weight of 1000 grains. The effect of seeding rates is rarely chosen by square meter, so the current research was conducted to find out the best distances among plants within one line for wheat plants. What is the contribution percentage of the primary tillers bearing spikes and the main stem, and which is greater for both types? - What is the contribution of the primary tillers to the seed rates compared to the main stem for both varieties under the study- Do low or high seed rates contribute more to primary tillers, and which one contributes better to some growth characteristics?- Which is the positive contribution of the primary tillers or the stem to growth characteristics?- The most important question: How much did the tillers contribute, especially to the biological yield and number of spikes among the research factors?

MATERIALS AND METHODS

This research was conducted at Experiment Station A of the College of Agricultural Engineering Sciences - University of Baghdad (Al-Jadriya) during the winter season 2022-2023 with the aim of studying. The contribution of the main stem and tillers of the certified cultivar KM5180 to the growth traits by the effect of number of seeds per square meter. The experiment included planting two varieties, the first (V1). The second wheat variety (V2) = **Wafia**. Testing the varieties at three seed rates which symbolized (S1) = 10 seeds.m², (S2 = 20 seeds.m² (S3), = 30 seeds.m². The field seeding preparation and soil service processes were applied before. The area of the experimental unit was 2 x 2 = 4 m², and each experimental unit included ten lines. The distances between the planting lines was 20 cm for all experimental units and for all treatments. The distances between one plant and another within one planting according to seed rates was (50.25 and 15) cm. Sequentially, the distances between one seed and another within the line 1 meter in length for the seeding rates (10, 20 and 30) seed.m². The experiment was fertilized with urea fertilizer (46%N) in four stages. (29), Triple

super phosphate fertilizer ($P_2O_5\%$ 64) was added at a rate of 100 kg per hectare, given once before thinning, and potassium fertilizer (K_2O) was added to the plant at two growth stages (5). Then samples were taken with an area of one meter length for each experimental unit randomly and guarded from its four sides for the purpose of calculating the growth traits of the main stem (total biological yield, biological yield of the main stem only, the number of spikes.m², plant height (cm), spike length (cm), number of spikelets /spike, chlorophyll content (SPAD).

Statistical analysis

The experiments was carried out using Randomized Complete Block Design and the means were compared using LSD at 0.05 level (11).

RESULTS AND DISCUSSION

Main stem growth traits

Plant height (cm): Table (1) shows significant differences between the varieties ,while there were no significant differences between the seeding rates and then interaction between them . The V1 **cultivar**, produced the highest average, outperformed the V2 **cultivar**, which produced the lowest average

Number of spikelets / spike: Table (1) shows that there are significant differences between the two study factors, and there was no significant difference between the interaction between them. The V1 cultivar outperformed by producing the highest average for this trait (26.37 spikelets /ear) compared to the V2 cultivar, which produced the lowest average (19.55 spikelets /spike). While S1 has the highest average over sowing rates S2 and S3.

Spike length (cm): Table (1) indicates a significant superiority of the seeding rate and varieties, while the effect of interaction of the study factors did not reach the significance in their effect on the length of the spike. The V1 **cultivar** was superior by producing the highest average (18.40cm) compared to the V2 **cultivar**, which produced the lowest average (12.99 cm). as for seeding rates; S1 produced the highest average (16.88 cm) , and did not

differ significantly from S2 while S3 produced the lowest average (14.88 cm). We note that the regular the distribution of seeds provided the appropriate space for each plant and reduced the competition for photosynthetic products of the rapidly elongating spike and the growth of plant organs such as leaves and roots.

Number of spikelets / spike

Table (1) shows that there are significant differences between the two study factors, and there was no significant difference between the interaction between them. The V1 cultivar outperformed by producing the highest average for this trait (26.37 spikelets /ear) compared to the V2 cultivar, which produced the lowest average (19.55 spikelets /spike). While S1 has the highest average over sowing rates S2 and S3.

Biological yield of the main stem:

Table (1) shows significant differences for the two study factors and the interaction between them. V1 achieved the highest average biomass compared to V2, with an increases of 29.99 %. While S1 exhibits superiority on other seeding rates. As for the interaction, V1S1 produced the highest average.

Total biological yield

Table (1) shows the significant differences between the two factors and their interaction .The V1 cultivar superior by producing the higher average biomass production with an increase of 51.28% compared to the V2 cultivar. The reason for the increase could be due to an increases in all the characteristics of the growth traits of the main stem and tillers. This revealed that the largest percentage of the increases produced from the contribution of tillers to the biological yield. As for the seeding rates, S2 produced the highest percentage 9.6 % compared to the sowing rate of S1, which recorded a decrease of 11.67 % . There was no significant differences between S2 and S3. for the interaction, the combination V1S2 had the highest average biomass production.

Table 1. some growth traits of the main stem by the influence of cultivars and seeding rate

Treatment	Plant height (cm)	No .of spikes/ m ²	Spike length (cm)	No .of spikelet' s / spike	Biological yield main stem (t/ha)	Total Biological yield (t/ha)	hlorophyll content (SPAD)
Cultivars							
V1(KM5180)	113.9	20.00	18.40	26.37	1.8779	21.0475	57.92
V2(Wafia)	88.40	20.00	12.99	19.55	1.3147	10.5246	46.55
LSD(0.05)	7.512	N.S.	1.272	0.960	4.179	6.540	21.703
Seed rate m²)							
(S1)10	96.64	10.00	16.88	24.12	9.000	14.8175	53.13
(S2)20	103.63	20.00	15.33	22.62	1.4297	16.3879	83.99
(S3)30	103.19	30.00	14.88	22.13	2.4593	16.1526	46.60
LSD(0.05)	N.S.	N.S.	1.558	1.175	5.118	8.010	26.581
V1S1	110.03	10.00	19.75	27.75	1.072	2.402	51.50
V1S2	116.50	20.00	18.00	26.00	1.677	2.050	128.77
V1S3	115.19	30.00	17.46	25.36	2.884	1.861	47.50
V2S1	83.25	10.00	14.00	20.50	7.280	5.614	54.75
V2S2	90.75	20.00	12.66	19.25	1.182	1.227	39.20
V2S3	91.20	30.00	12.30	18.90	2.034	1.368	45.70
LSD (0.05)	N.S.	N.S.	N.S.	N.S.	7.238	11.3278	37.591
V×S							

Table 2. some of growth traits of the tillers by the influence of the cultivars and seeding rates

	Plant height (cm)	No .of spike/m ²	Spike length (cm)	No .of spikelet's / spike	Biological yield tillers (t/ha)
Cultivars					
V1(KM5180)	104.57	259.17	16.83	23.63	16.7141
V2(Wafia)	77.50	179.17	11.30	17.67	8.8655
LSD(0.05)	6.311	8.304	1.377	1.663	4.9599
Seed rate (m²)					
S1)10(87.50	150.00	14.85	21.37	9.8835
(S2)20	93.82	242.50	13.83	20.40	14.5651
(S3)30	91.78	265.00	13.54	20.18	13.8208
LSD(0.05)	N.S.	10.170	N.S.	N.S.	6.0746
V1S1	101.75	207.50	18.40	24.88	1.519
V1S2	105.90	280.00	16.00	22.60	1.830
V1S3	106.07	290.00	16.14	23.43	1.663
V2S1	37.25	92.50	11.30	17.87	4.773
V2S2	81.75	205.00	11.65	18.20	1.082
V2S3	77.05	240.00	10.94	16.94	1.1002
LSD (0.05)	N.S.	14.383	N.S.	N.S.	8.5907
V×S					

Chlorophyll content (SPAD): Table (1) shows the presence of significant differences between the two research factors and the interaction between them. The V1 cultivar was superior, with an increase of 38.68% compared to the V2 cultivar, which could be due to the genetic structure of the cultivar . While the seeding rate S2 produced the highest average

for this trait with an increases of 44.52 % compared to the average of S3. This could be due to the appropriate spatial distribution of plants to intercept the largest amount of light and reach the bottom of the plant leaves to remain effective and contribute during the crop growth season. The results are consistent with (1, 14, 15, 16, 17, 22, 25).

Tillers growth traits

Plant height (cm): Table (2) indicates that there is a significant difference between the cultivars, and there was no significant difference between the seeding rates and the interaction between them. The V1 cultivar with the highest average of 104.57 cm exceeded the V2 cultivar, which produced the lowest average (77.5 cm).

Number of spikes/ m²:

Table (2) shows that there are significant differences between the two research factors and the interaction between them. V1 cultivar exhibited superiority over V2 cultivar, with an increase of 30.86%, and this could be due to the genetic ability of the cultivar to tillers. The seeding rates, S3 superior significant or the remaining seeding rates (S2 and S1) with an increase of (43.39 and 5.28)% respectively. The interaction, V1S3 treatment is higher on average as a result of an increase in the number of seeds /m² the number of stems per plant has increased.

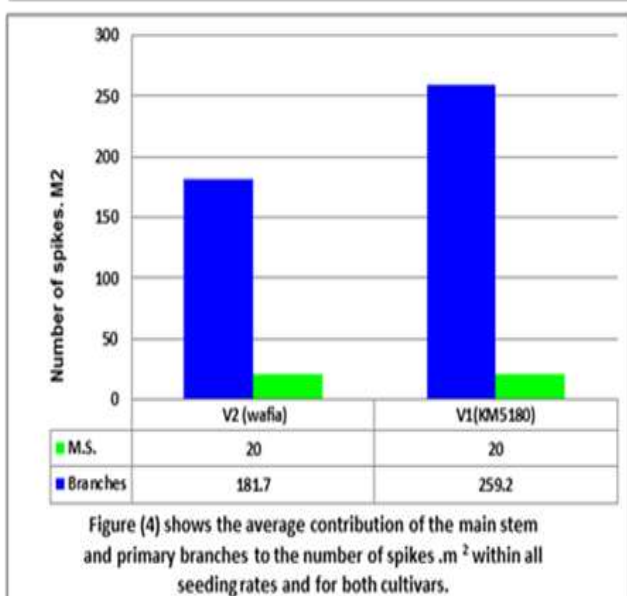
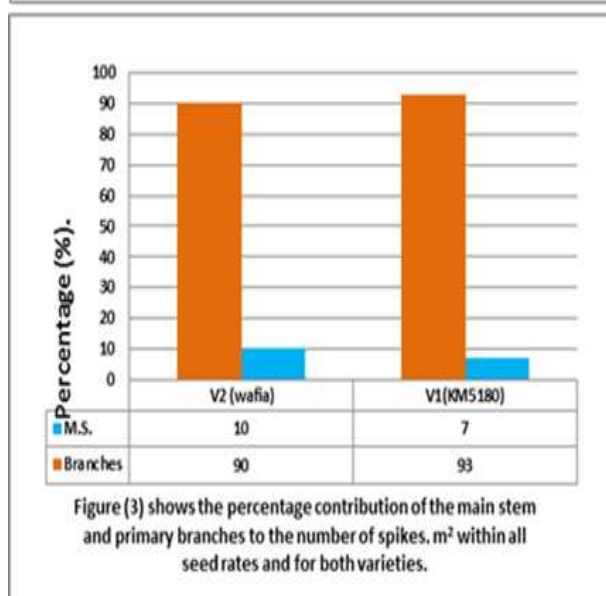
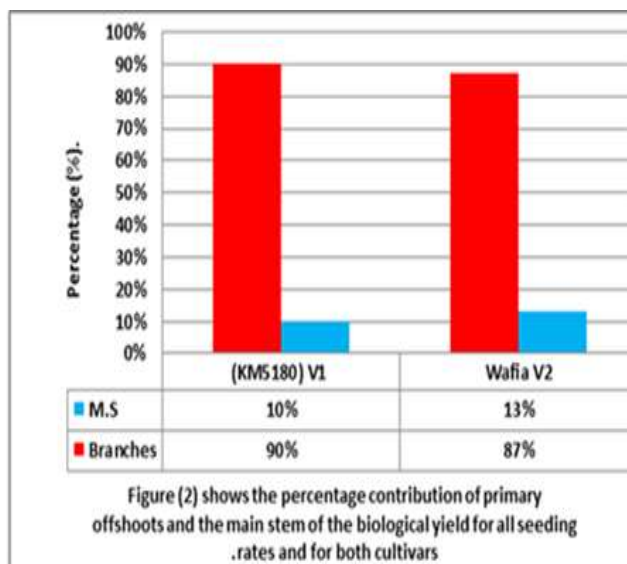
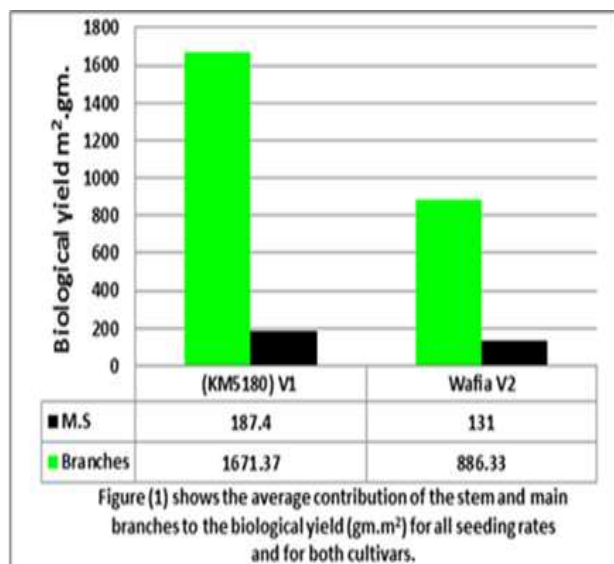
Spike length (cm):

Table (2) reveals that there are significant differences between the cultivars and there was no significant difference between the

seeding rates and the interaction between them. The V1 cultivar had the highest average height of 16.83 cm compared to the V2 cultivar.

Number of spikelets / spike : Table (2) indicates that there are significant differences between the cultivars, and there is no significant differences between seeding rates and the interaction between them. The V1 cultivar has outperformed with an increase of 25.18%. The results agreed with (3, 15, 22, 23, 28).

The biological yield t. ha: Table (2) reveals the presence of significant differences between the two research factors and the interaction between them. The V1 cultivar demonstrates the highest average yield compared to the V2 cultivar with an increase of 46.98%. While the seeding rate 20 seeds .m² (S2) produced the highest average, in comparative with S1 with an increase of 32.14%, however; S2 did not differ significantly from the S3. The interaction between the study factors, had V1S2 treatment produced the highest average compared to other interactions. The mentioned results agreed with (2, 8, 9, 10, 18, 19, 27).



Here we can answer the first and second questions that were posed in the introduction to the research: The percentage of contribution of primary tiller exceeded the percentage of contribution of the main stem in all growth traits. The contribution rate of the primary tillers reached 90%, while the contribution of the main stem of the cultivar (V1) to the biological yield reached 10% compared to the variety (V2), which contribution rate of the primary branches bearing ears for the variety (V2) was 78%, superior to the contribution of the main stem, which It reached 13% (Figures 2, 3). As for the answer to the third question, we notice from Figure (5): It is clear that the contribution of the seed rates of the V1 variety to the primary branches was the highest contribution rate at the S2 seed rate, which amounted to 37%, while the lowest contribution rate at the lower seed rate, S1, amounted to 30%

compared to the V2 variety. The highest contribution rate of tillers was at the S2 seed rate, amounting to 41%, and it did not differ from the S3 seed rate, while the S1 seed rate recorded the lowest contribution rate, amounting to 18%, Figure (6). Here we can answer the question (Which is the positive contribution of the primary branches or the main stem to growth characteristics?). The contribution of the primary branches was more positive compared to the main stem, and this appears clear in Figures (2, 3). As for the answer to the last question, Figure (1) shows the contribution of the primary branches bearing ears to the biological yield characteristic for both varieties V1 and V2, amounting to 167.37 and 886.32 g.m², respectively, compared to the main stem, which had a lower percentage, amounting to 187.4 and 131.0 g/m² for varieties V1, V2, respectively. As for the contribution of the

branches bearing ears to the number of ears. m², Figure 4 shows the superior contribution of the V1 variety, amounting to 259.2 m², compared to the V2 variety, with 181.7 m². This research is reviewed to review and provide a comprehensive understanding that can be used for applied field and academic purposes. The results presented in this research were obtained during the season 2022-2023, a field experiment that took into account the general performance of different wheat cultivars. It is possible to manipulate the density of branches and spikes by changing the seeding rate per square meter, and the selected variety can change the density of branches. Among the factors that reduced the production of branches is the increases in seeding rates. In addition, the effect of the seeding rate caused a shift in the relative contribution of the yield of the different branches and the main stalk. The seeding rate is clearly the one that has the greatest impact on the number of branches without having a negative effect on the yield. The role of the stem and primary branches in growth of the positive indicators, which can be adopted in determining the seeding rate.

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