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

An experiment was carried out in the field during the winter of 2022–2023. Two wheat varieties were the focus of this investigation into the influence of seed density per square meter. The majority of the primary stem growth characteristics (biological yield, number of ears) were shown to be V1's strongest suit. The following values are given in square meters: 1.87 t. ha, 20.0 seed. m2, 113.90 cm, 18.40 cm, 26.37 spikelets/ear, and 75.92 (SPAD) for chlorophyll content. As for branch growth features, V1 was the best with a yield of 16.71 tons ha-1, a density of 259.17 ear/m2, a height of 104.57 cm, a spike length of 16.83 cm, and a number of 23.63 spikelets per ear. S2 outperformed V2 in terms of biological yield (16.71 ton. ha-1), plant height (103.63 cm), and chlorophyll content (83.99 SPAD) when comparing seeding rates per square meter. S2 had the largest biological yield in tillers per hectare at 14.56 tons, which was much greater than the seeding rates of (S1 and S3), and S3 had the highest ear number at 265.00 ears per square meter, when compared to the other seeding rates.

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

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 لصنفين من الحنطة في صفات النمو من طريق معدل عدد البذور في المتر المربع. اظهرت النتائج تفوق الصنف V1 في اغلب صفات نمو الساق الرئيس (الحاصل البيولوجي، عدد السنابل .م^2، ارتفاع النبات، وطول السنبلة وعدد السنيبلات/سنبلة و محتوى الكلوروفيل (SPAD) (1.87 طن. هـ$^{-1}$ ، 20.0 سنبلة .م^2، 113.90 سم ، 18.40 سم ، 26.37 سنيبلة/ سنبلة و75.92 (SPAD)) على التتابع . كذلك تفوق الصنف V1 في جميع صفات نمو الفروع (الحاصل البيولوجي طن. هـ$^{-1}$، وعدد السنابل / م^2 وارتفاع النبات سم وطول السنبلة سم وعدد السنيبلات/ سنبلة والتي بلغت (16.71 طن .هكتار ، 259.17 سنبلة . م^2 ،104.57 سم ،16.83 سم و 23.63 السنيبلات / سنبلة) بالتتابع . قياسا بالصنف V2 . اما فيما يخص معدلات البذار م^2، فقد تفوقت معاملة S_2 في اعطاء اعلى متوسط في صفات نمو الساق الرئيس (الحاصل البيولوجي وارتفاع النبات ومحتوى الكلوروفيل (16.71 طن. هـ$^{-1}$، 103.63 سم و83.99 SPAD) بالتتابع .قياسا بمعدلات البذار (10 و30) بذرة . ايضا تفوقت معاملة S_2 في اعطاء اعلى متوسط للحاصل البيولوجي للفروع (14.56 طن .هـ$^{-1}$) على معاملات (S_1 وS_3) بذرة /م^2 ، بينما تفوقت معاملة S_3 في اعطاء اعلى متوسط لعدد السنابل/ م^2 (265.00 سنبلة / م^2) قياسا ببقية معدلات البذار.

الكلمات المفتاحية : الحنطة، الامن الغذائي ، تحسين الحاصل ، اصطياد الضوء ، محصول استراتيجي، التغير المناخي.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) 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 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 spikes was 210.00 spikes/m^2 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 key stem, with a rise 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/ m^2 resulted in an increases in plant height and number of spikes. m^2, 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). In contrast, (15) discovered that different seeding rates resulted in significantly different plant heights and spike densities (50, 150, 250, 350, 450, and 550 seeds/m2). the harvest index, the quantity of grains per ear, and the weight of one thousand grains did not change significantly. This study set out to determine the optimal spacing for wheat plants inside a single line because square meter choices for seeding rates are uncommon. How much of an impact do the main stem and the major tillers carrying spikes have, and which one is more important? How much of an impact do the main stem and primary tillers have on seed rates for the two kinds being studied? Is it better for primary tillers to have low or high seed rates, and which one is more important for certain growth traits? Which part of the plant—the stem or the major tillers—makes a favorable impact on growth traits?- A First and foremost, we need to know how big of an impact the tillers had on the various research variables, particularly the biological yield and spike count.

MATERIALS AND METHODS

Experiment Station A of the College of Agricultural Engineering Sciences - University of Baghdad (Al-Jadriya) was the site of this research, which aimed to study, during the winter of 2022–2023. Certified cultivar KM5180's main stem and tillers responded differently to different seed densities per square meter. The experiment included two types of plants, the first of which was (V1). The second wheat variety is wafia (V2). We tested the types using three different seed rates in our trials: (S1) = 10 seeds.m^2, (S2) = 20 seeds.m^2, and (S3) = 30 seeds.m^2. It was historically used to prepare the soil and plant seeds in the field. With a total area of four square meters (2 x 2= 4 m^2), each experimental unit had ten lines. A distance of 20 cm was maintained between each planting line for each treatment and experimental unit. In a single planting, the seed rates produced plant spacing of 50.25 and 15 cm, respectively. For seeding rates of 10, 20, and 30 seeds per square meter, the distances between seeds are listed in a linear fashion along a 1-meter length. A four-stage fertilization process using urea fertilizer (46%N) was used in the experiment. (29). At one application just before thinning, 100 kg/ha of triple super phosphate fertilizer (P2O5%64) was applied,

and the plant received potassium fertilizer (K_2O) at two growth stages (5). Then, for each experimental unit, samples were randomly selected and protected from all four sides to measure the main stem's growth traits, including total biological yield, main stem biological yield, number of spikes per square meter, plant height, spike length, number of spikelets per spike, and chlorophyll content (SPAD).

Statistical analysis

The experiment 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):

While there were notable variations in the types (as shown in Table 1), the seeding rates and their interactions did not exhibit any major changes. The V1 cultivar, produced the highest average, outperformed the V2 cultivar, which produced the lowest average

No .of spikes/m^2

Table (1) displays that there are no significant differences between the individual factors and their interactions in number of spikes per square meter.

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). Note that each plant had enough room to grow due to the evenly distributed seeds, and that the fast-growing spike and other plant parts like leaves and roots had less competition for the photosynthetic products.

Number of spikelets / spike

Table (1) shows that there are significant differences. There are notable distinctions between the two research variables, as shown in Table (1), but no such differences were found in their interaction. 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:

Both the independent and dependent variables, as well as their interaction, differ significantly, as shown in Table (1). With a 29.99 percent increase, V1 produced the most biomass on average when contrasted with V2. 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.

Chlorophyll content (SPAD): There are notable distinctions between the two study variables and their interaction, as shown in Table (1). Perhaps as a result of differences in genetic makeup, the V1 cultivar outperformed the V2 cultivar by 38.68%. 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).

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

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)	Chlorophyll 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 m^2)							
(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) V×S	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**7.238**	**11.3278**	**37.591**

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

	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 (m^2)					
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) V×S	**N.S.**	**14.383**	**N.S.**	**N.S.**	**8.5907**

Tillers growth traits

Plant height (cm):

Table (2) indicates that there are potent differences 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/ m^2:

Table (2) shows that there are important changes between the two research influences and the interface between them. V1 cultivar exhibited superiority over V2 cultivar, with increases 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 increases of (43.39 and 5.28)% respectively. The interaction, V1S3 treatment is higher on average as a result of an increases in the number of seeds /m^2 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 important changes 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).

Biological yield t. ha^{-1}:
Table (2) reveals the presence of major differences between the two research factors and the interaction. 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 .m^2 (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).

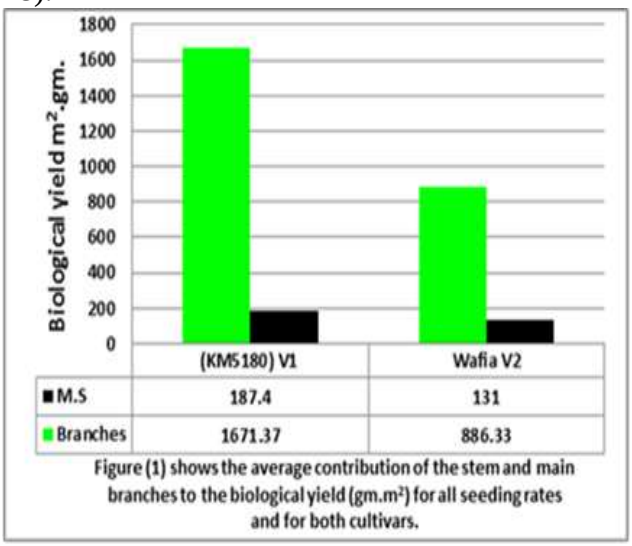

Figure (1) shows the average contribution of the stem and main branches to the biological yield (gm.m²) for all seeding rates and for both cultivars.

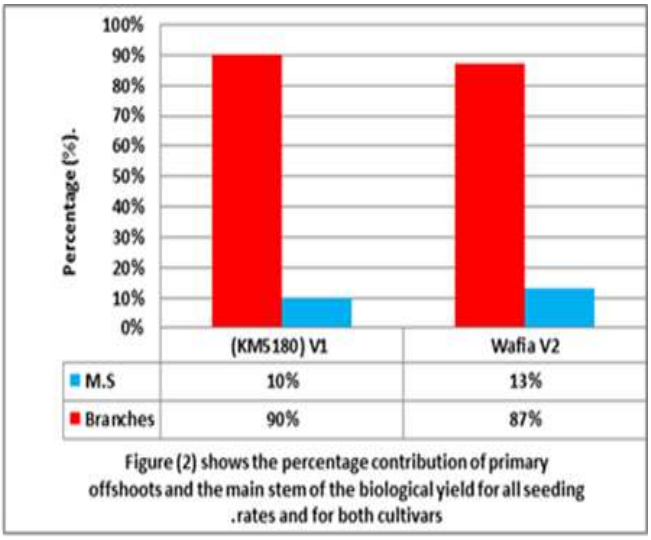

Figure (2) shows the percentage contribution of primary offshoots and the main stem of the biological yield for all seeding .rates and for both cultivars

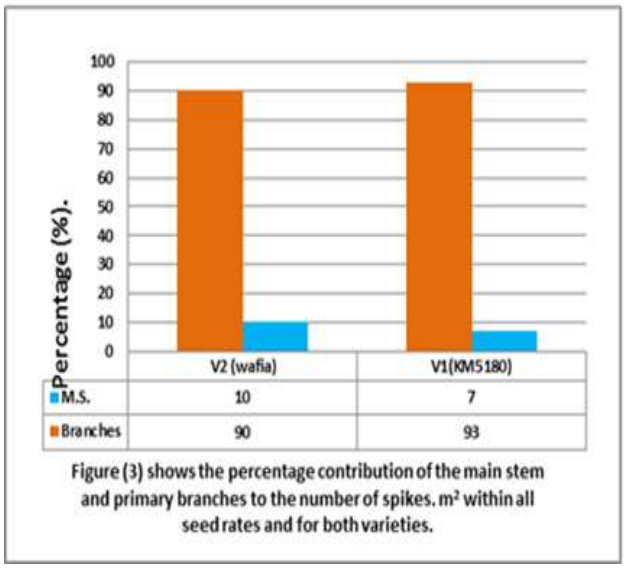

Figure (3) shows the percentage contribution of the main stem and primary branches to the number of spikes. m² within all seed rates and for both varieties.

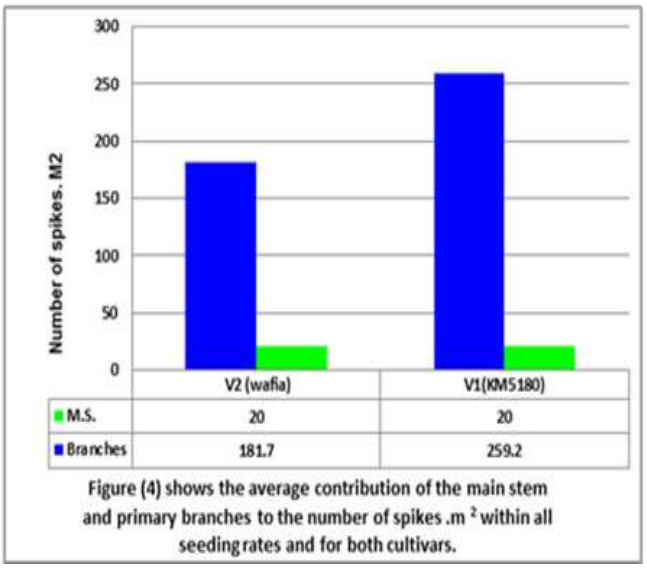

Figure (4) shows the average contribution of the main stem and primary branches to the number of spikes .m ² within all seeding rates and for both cultivars.

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 $g.m^2$, respectively, compared to the main stem, which had a lower percentage, amounting to 187.4 and 131.0 g/m^2 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 m^2, compared to the V2 variety, with 181.7 m^2.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 stem. 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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