The effect of sowing dates and seed rates on new inputs of Durum Wheat under drought conditions

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Abstract

A field experiment was carried out during the season 2019/2020 in Mosul /Tilkaif district, the experiment included three factors, the first is sowing dates, early (10 November), medium (25 November) and late (10 December), the second, seeding rates (200, 250 And 300 seeds. m^{-2}), and the third is six new genotypes of Durum Wheat (Nano, Uramy, Miki3, Ouhassan and Atlhagy) in addition to the local variety Svivo for control. The R.C.B.D randomized complete block design was applied according to the split-split plots system with three Blocks. The results indicated to significantly superiority of the early date only in traits of biological yield and the grain yield. and this date did not differ significantly from the average date in the traits of the number of grains per spike and the weight of 1000 grain while the sowing dates did not significantly affect the traits of the number of tillers.m^{-2}. The seed rates did not significantly affect the number of seeds per spike and the weight of 1000 grains However, the seeding rate 300 seeds. m^{-2} significantly exceeded in the number of tillers. m^{-2}, but not significantly different from 250 seeds. m^{-2} rate. Whereas, the seeding rate 250 seeds. m^{-2} significantly superior in traits (biological yield and grain yield. Compared to 300 and 200 seeds.m^{-2}. Recording to genotypes, Ouhassan, Atlhagy, and Nano showed exceed in the number of grains per spike, Atlhagy outperformed in the biological yield and Ouhassan in the grain yield, while the Uramy exceeded in the weight of 1000 grains. The interactions of early and medium sowing date with different seeding rates outperformed all trait. All the interactions were significant in effecting the studied trait.

Key words: Durum wheat, sowing dates, seeding rates, Durum wheat genotypes

تاثير مواعيد الزراعة ومعدلات البذار على مدخلات جديدة من الحنطة الخشنة تحت الظروف الديمية

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الخلاصة

نفذت تجربة حقلية خلال الموسم 2020/2019 في الموصل/ قضاء تلكيف, تضمنت التجربة ثلاثة عوامل, الاول مواعيد الزراعة, مبكر(10 تشرين الثاني), متوسط (25 تشرين الثاني) ومتأخر (10 كانون الاول), الثاني معدلات بذار (200 , 250 و 300 بذرة/م^2), و الثالث خمسة تراكيب وراثية مدخلة من الحنطة الخشنة Ouhassan , Miki3 , Uramy , Nano و Atlhagy اضافةً الى الصنف المحلي سفيفو بهدف المقارنة. طبق تصميم القطاعات العشوائية الكاملة R.C.B.D حسب نظام التجربة العاملية في القطع المنشقة وبثلاث مكررات. اشارت النتائج الى تفوق الموعد المبكر في الحاصل الحيوي و حاصل الحبوب, ولم يختلف هذا الموعد عن الموعد المتوسط معنوياً في صفة عدد الحبوب بالسنبلة ووزن 1000 حبة, في حين لم تؤثر مواعيد الزراعة في صفة عدد الاشطاء.م$^{-2}$. معدلات البذار لم تؤثر معنوياً في عدد الحبوب بالسنبلة ووزن 1000 حبة, بينما تفوق معدل البذار 300 بذرة.م$^{-2}$ في عدد الاشطاء.م$^{-2}$ ولم يختلف معنوياً عن 250 بذرة.م$^{-2}$, كما تفوق معدل بذار 250 بذرة.م$^{-2}$ في الحاصل الحيوي وحاصل الحبوب. اظهرت التراكيب الوراثية Ouhassan و Atlhagy و Nano تفوقاً معنوياً في عدد الحبوب بالسنبلة, بينما تفوق التركيب Atlhagy في الحاصل الحيوي وتفوق التركيب Ouhassan في حاصل الحبوب و تفوق التركيب Uramy في ووزن 1000 حبة. اظهر التداخل بين الموعد المبكر والمتوسط مع مختلف معدلات البذار تفوقاً معنوياً في جميع الصفات. وكانت جميع التداخلات معنوية في التأثير للصفات المدروسة.

الكلمات المفتاحية: الحنطة الخشنة, مواعيد الزراعة, معدلات البذار, تراكيب الحنطة الخشنة

Introduction

Durum Wheat (*Triticum durum* Desf.) Constitutes 8% of the cultivated area worldwide. The Mediterranean region is the largest production area of Durum Wheat in the world (1). The cultivated area in Iraq is estimated according to the last statistics obtained about 70 thousand hectares (2). The cultivation of Durum Wheat is concentrated in the rain-secured area of Iraq, especially in the areas surrounding Nineveh Governorate, and this is due to the reliance of a large number of the residents of these areas on it for food

The research is based on the doctoral thesis of the first researcher.

in the work of grain, macaroni, bulgur and sabkati. This type of wheat contains two types of chromosomes, namely A and B, in which the binary number of chromosomes 2n = 28. The use of appropriate planting dates and promising varieties is a very important factor to increase the production of wheat yield because the final yield is the result of the interaction of environmental and genetic factors and agricultural processes, and it is possible to increase the grain yield by 10% to 80% when choosing sowing dates, suitable quantities of seeds and promising varieties under appropriate environmental conditions Her (3). (4) stated that the values of all the studied traits, including (number of tillers per square meter, number of seeds per spike, weight of 1000 grains, biological yield and grain yield) were significant and the highest possible when at the optimal sowing date compared to early and late sowing dates. (5) mentioned that the sowing dates exceeded 10 November in the description of a number of tillers of 411 tillers. m^{-2}, the number of grains in a spike is 52 grains, the weight of 1000 grains is 43 g, the biological yield is 12327 kg. ha^{-1} and the grain yield is 5587 kg. Hectare $^{-1}$. (6) also indicated that the 10 November deadline exceeded the number of grains per spike by 48.92, the weight of 1000 grains was 44.81 gm, the number of tillers per square meter was 377.10, and the grain yield of bread wheat over the remaining dates. (7) found that the seed volume of 125 kg. ha^{-1} gave the highest grain yield 4228 kg. ha^{-1}, and the seeding rate exceeded 100 kg. ha^{-1} in a trait of 1000 grains weight, while the seeding rate exceeded 150 kg. ha^{-1} per The description of the number of grains in the spike 46.16. (8) reported that the seed rate of 115 kg. ha^{-1} achieved the highest values in the traits of the number of grains per spike 42 grains and the grain yield 3573 kg. ha^{-1}, while the seeding rate of 175 kg. ha^{-1} achieved the highest biological yield, which reached 10348 kg. ha^{-1}. (9) found that the seed rate exceeded 140 kg . ha^{-1}, with the highest grain yield being recorded at 4.95 t. ha^{-1}. The study aimed to determine the optimum from each sowing dates and the seeding rates in selecting the superior genotype in the grain yield and its components.

Research materials and methods

The experiment was carried out in the agricultural season 2019-2020 in an almost guaranteed rainy area (Mosul/ Telkif district), the experiment included three factors, the first sowing dates where included three agricultural dates, early date on 11/10 and the average date on 11/25 and the date late on 12/10. The second Factor included three levels of seed rates of 200 seeds . m^{-2}, 250 seeds . m^{-2}, and 300 seeds . m^{-2}, and factor three included six input genotypes sourced from ICARDA (Nano, Uramy, Miki3, Ouhassan and Atlhagy) in addition to a local variety (Svivo) for control Plants were tested randomly within the experimental unit and the traits of the number of tillers. m^{-2}, the number of seeds per spike, the biological yield, the grain yield and the weight of 1000 grains were studied. The experiment was carried out according to the R.C.B.D design, with three factors and the Factorial experiment within split plots system,. the sowing dates were placed in the main plots, seed rates and genotypes in the secondary plots by three replications. One replicate included 54 experimental units in which the genotypes were distributed randomly according to the sowing and seed rates. Each experimental unit contained four

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lines of one meter length. The experiment was fertilized with urea fertilizer at a concentration of 45% at a rate of 20 kg / dunum (10), in two batches, the first at planting day and the second before expelling the spikes. SAS and Microsoft Office Excel were used in implementing all statistical procedures. Comparisons between the means of traits were made using the Duncan test.

Results and discussion

The results in Table (1) indicate that the highest significant value for the number of tillers. m^{-2} was obtained when sowing dates at the early date 10November and 25November, which amounted to (398.43 and 373.37 tillers . m^{-2}), respectively, noting that the two dates did not significantly differ from each other. While the lowest average number of tillers was recorded when planting at the late date of 25December, which was (296.13 tillers . m^{-2}) The reason for this may be that the early dates for cultivation allow prolonging the stage of formation of strands and branches and increase the area of the flag leaf and thus increase the effectiveness of the process of photosynthesis and accumulation of dry matter, which led to an increase in the number of tillers per unit area. This result is consistent with what was mentioned by (11) and.(12). The seed rate 300 seeds. m^{-2} gave the highest value for spik.m^{-2}, which amounted to (396.06 tillers . m^{-2}), whereas the lowest number of tillers at the seed rate 200 seeds. m^{-2} was (309.89 tillers. m^{-2}). The reason for this increase may be due to the increase in the seed rate, It means an increase in the number of plants and branches per unit area and thus an increase in the number of tillers, and this is consistent with what (13) and (14). The trait of the number of tillers. m^{-2} was not affected significantly with the difference in genotypes in this study, as the values were close to each other. The largest number of tillers. m^{-2} was when interaction at the early sowing dates of 10November, with a seeding rate of 300 seeds. m^{-2}, which amounted to (455.56 tillers . m^{-2}), noting that it did not differ significantly with the seed rate of 250 seeds. m^{-2}, and it also did not significantly different from sowing dates at the average date regardless of the seeding rates. The early sowing dates of 10November and the average of 25November significantly outperformed the highest values for the number of tillers. m^{-2}, noting that there was no significant difference among genotypes. The overlap interaction between of the seed rate of 300 seeds. m^{-2} with the local variety Svivo in recording the largest number of tillers. m^{-2},was reaching (448.22 tillers . m^{-2}), noting that it did not significantly different with the rest of the seed rates of the same variety(Miki3 and Atlhagy), while the lowest values for this trait were when planting the Nano genotype at a seed rate of 250 seeds. m^{-2}, reached (271.22 tillers. m^{-2}). The highest value of the number of tillers. m^{-2} was when planting the genotype Ouhassan at the sowing dates of early 10October with seed rate of 250 seeds. m^{-2} was (551 tillers. m^{-2}), noting that it did not significantly different with most of the treatments at the early and middle sowing dates and some treatments. late.

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Table (1) The effect of sowing dates and seeding rates on the trait of number of spikes. m^{-2} of durum wheat genotypes.

Genotypes	Seed rate. m^{-2}	Sowing dates			Seed rate × Genotypes	Genotypes	Seed rate
		10 November	25 November	10 December			
Nano	200	424.33 a-g	311.33 a-g	219.67 fg	318.44 a-d		
	250	300.00 b-g	255.67 d-g	258.00 d-g	271.22 d		
	300	262.33 d-g	377.67 a-g	233.33 efg	291.11 cd		
Uramy	200	429.00 a-g	384.33 a-g	262.33 d-g	358.56 a-d		
	250	329.33 a-g	395.67 a-g	195.33 g	306.78bcd		
	300	255.67 d-g	382.00 a-g	302.00 b-g	313.22 a-d		
Miki3	200	404.33 a-g	464.33 a-f	184.33 g	351.00 a-d		
	250	371.00 a-g	291.33 c-g	467.00 a-e	376.44 a-d		
	300	471.33 a-e	322.67a-g	322.33 a-g	372.11 a-d		
Ouhassan	200	331.33 a-g	313.33 a-g	271.00 d-g	305.22 bcd		
	250	551.00 a	382.33a-g	319.67 a-g	417.67abc		
	300	308.67 a-g	473.00 a-e	266.67 d-g	349.44 a-d		
Atlhagy	200	415.67 a-g	406.67 a-g	306.67 a-g	376.33 a-d		
	250	346.67 a-g	293.33 c-g	315.33 a-g	318.44 a-d		
	300	518.00 abc	344.33 a-g	348.67 a-g	403.67 a-d		
Svivo	200	408.67 a-g	460.00 a-f	429.00 a-g	432.56 ab		
	250	500.00 a-d	404.67 a-g	286.67 c-g	397.11 a-d		
	300	342.33 a-g	458.00 a-f	342.33 a-g	448.22 a		
Sowing dates × Genotypes		414.78 a-d	394.11 a-e	236.89 f		348.59 a	
		339.22a-f	280.11 def	346.78 a-f		322.04 a	
		417.22 abc	348.22 a-f	301.44 c-f		355.63 a	
		389.67 a-e	385.89 a-e	320.78 b-f		365.44 a	
		460.11 a	394.22 a-e	267.22 e f		373.85 a	
		369.56 a-f	437.67 ab	303.67 b-f		370.30 a	
Sowing dates × Seed rate	200	333.44 bc	351.11 abc	245.11 c			309.89 b
	250	406.28 ab	374.50 ab	305.17 bc			361.98ab
	300	455.56 a	394.50 ab	338.11 bc			396.06a
Sowing dates		a 398.43	a 373.37	b296.13			

Values followed by similar letters do not significantly different from each other at 5% Duncun test.

Table (2) indicates the superiority of early and intermediate sowing dates (10 and 25 November), which did not significantly different with each other in giving the highest values of the number of grains per spike, which amounted to (46.078 and 43.930 grains per spike) respectively, while this trait decreased significantly when planting At the late sowing dates, was (38.189 grain per spike). The reason for the superiority of early sowing dates may be due to favorable conditions, which allow the plant to have a greater opportunity to flower, pollinate, and fertilize well, and this helped increase the number of seeds in spikes at the early dates compared to the late sowing dates, and this is in agreement with. (15) and (16). There was no significant effect of seed rates on the trait of number of grains per spike. The genotype (Ouhassan) gave the highest significant value for this trait, which amounted to (47.748 grain per spike), noting that it did not significantly differnt with the genotypes (Nano and Atlhagy), where the values were (47.015 and 44.489 grain per spike), Whereas the number of grains per spike was significantly decreased

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of the genotypes (Uramy, Miki3, and the local variety Svivo), where its values were (38.630, 40.237 and 38.630 grains per spike), respectively, noting that they did not significantly different with each other. The reason for this variation may be due to the genetic factors of each genotype and their suitability to environmental conditions, and this is consistent with what (22) and (24). The early and medium sowing dates (10 and 25 November) outperformed the highest values for the number of grains per spike and for different seeding rates. The nano genotype exceeded the average date of 25November, noting that it did not significantly different with most of the treatments, reaching (52.556 grain per spike). While the lowest significant value of the number of grain per spike was when planting the genotype Miki3 at the late date of 10December, reached (32.978 grain per spike), noting that it did not significantly different with some other treatments, Uramy and Miki3 genotypes when planted at a seed rate of 200 seeds. m^{-2}, gave the highest values to the trait of the number of grains per spike, which amounted to (49.422 and 49.822 grains per spike) respectively, although they did not significantly different with some other treatments, While the lowest significant value for this trait was when cultivating each of the genotype, Nano and Atlhagy, with seed rate of 250 seeds. m^{-2}, reaching (36.289 and 36.867 grain per spike). The highest values for the number of grains per spike were obtained from the triple interaction that includes the genotype Uramy with the average sowing date of planting and the seed rate of 200 seeds. m^{-2}, which amounted (58.200 grains per spike), which did not significantly different with many treatments in the early and middle sowing date. Whereas, the lowest value of the number of grains per spike was when planting the genotype Atlhagy at the sowing date of late planting, with a seed rate of 250 seeds.m^{-2}, amounted (28.867 grains per spike), noting that it did not differ significantly with many other treatments.

Table (3) indicates that the early sowing date was significantly superior with the highest value for the biological yield, which amounted to (1545.61 g . m^{-2}), followed by the intermediate sowing date (1273.440 g. m^{-2}), then the lowest significant value for this trait was at the late sowing date (861.003 g. m^{-2}). The reason for this may be that the long period of vegetative growth when planting at the early sowing date leads to the highest exposure to sunlight and the largest absorption of nutrients and appropriate humidity, as these factors affect most of the physiological processes inside the plant, especially the process of photosynthesis, which leads to an increase in dry weight and biological yield and this Agrees with (17) and (18). The seeding rate of 250 seeds. m^{-2} exceeded the rest of the seeding rates in giving the highest biological yield, which amounted to (1303.233 g. m^{-2}). Vegetative and thus increased dry matter accumulation and sedimentation this is in agreement with (5) and (7). The genotype Atlhagy surpassed the rest of the genotypes which gave the highest significant value for the biological yield, reached (1396.736 g. m^{-2}), while the lowest significant value for this trait was at the local variety Svivo, amounted (1083.225 g. m^{-2}). The reason for this variation may be the difference in the genotype of each genotype from the other and its response and suitability to environmental conditions and it may differ in the efficiency of photosynthesis and the extent of accumulation and deposition of dry matter, and this is in agreement with (19) and (20). The early sowing date and when planting at seed rates (250 and 300 seeds. m^{-2}) outperformed the rest of the parameters in giving the highest significant values of the biological yield, were (1617.879 g. m^{-2} and 1630.511 g. m^{-2}) respectively. The Atlhagy genotype grown at the early sowing date of 10October in giving the largest biological yield significantly compared to the rest of the treatments, as it reached (2028.139 g. m^{-2}). While the lowest significant value for this trait was with the Nano genotype grown at the cultivation late sowing date, was (586.652 g. m^{-2}). The highest significant value of the biological yield was when planting the Ouhassan genotype, with a seed rate of 250

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seeds.m^{-2}, which was (1703.026 g. m^{-2}). The highest significant value of the biological yield was obtained from the triple interaction when planting the Ouhassan genotype at the early sowing date of 10November, at a seed rate of 250 seeds. m^{-2}, which was (2789.28 g. m^{-2}), while most of the treatments decreased when planting at the late sowing date.

Table (2) Effect of sowing dates and seeding rates on the trait of number of grains per spike for of durum wheat genotypes.

Genotypes	**Seed rate. m^{-2}**	**Sowing dates**			**Seed rate × Genotypes**	**genotypes**	**Seed rate**
		10 November	25 November	10 December			
Nano	200	47.53 a-h	49.53 a-g	42.86 a-j	46.64 abc		
	250	37.80 e-j	36.26 e-j	34.80 f-j	36.28 e		
	300	49.80 a-f	47.06 a-h	33.73 g-j	43.53 a-e		
Uramy	200	48.06 a-h	58.20 a	42.00 b-j	49.42 a		
	250	45.26 a-i	47.46 a-h	38.33 e-j	43.68 a-e		
	300	39.46 c-j	37.33 e-j	36.66 e-j	37.82 d e		
Miki3	200	55.13 abc	57.33 ab	37.00 e-j	49.82 a		
	250	43.00 a-j	38.33 e-j	43.66 a-j	41.66 a-e		
	300	47.93 a-h	36.46 e-j	30.86 ij	38.42 cde		
Ouhassan	200	48.73 a-h	49.40 a-g	44.33 a-j	47.48 ab		
	250	54.46 a-d	47.53 a-h	42.06 b-j	48.02 ab		
	300	38.26 e-j	43.00 a-j	32.93 hij	38.06 cde		
Atlhagy	200	45.60 a-i	50.80 a-e	37.33 e-j	44.57 a-e		
	250	40.06 c-j	41.66 b-j	28.86 j	36.86 e		
	300	44.06 a-j	37.86 e-j	34.33 f-j	38.75 cde		
Svivo	200	48.13 a-h	42.00 b-j	48.86 a-h	46.33 a-d		
	250	50.86 a-e	34.93 e-j	39.46 c-j	41.75 a-e		
	300	45.20 a-i	35.53 e-j	39.26 d-j	40.00 b-e		
Sowing dates × Genotypes		49.42 ab	52.55 a	39.06 d-g		47.01 a	
		40.28 c-g	38.75 d-g	35.77 fg		38.27 b	
		47.26 a-d	40.46 c-g	32.97 g		40.23 b	
		48.31 abc	49.86 ab	45.06 a-e		47.74 a	
		50.20 ab	43.31 b-f	39.95 c-g		44.48 a	
		40.98 c-g	38.62 efg	36.28 fg		38.63 b	
Sowing dates × Seed rate	200	44.65 abc	45.97 ab	38.06 c			42.90a
	250	47.92 a	45.34 abc	38.47 bc			43.91a
	300	45.65 abc	40.46 abc	38.02 c			41.38a
Sowing dates		46.07 a	43.93 a	38.18 b			

Values followed by similar letters do not significantly different from each other at 5% (ducun test).

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Table (3) Table of indicators of cultivation and growth rates in the trait of biological yield (g. m^{-2}) for of durum wheat genotypes.

Genotypes	Seed rate. m^{-2}	Sowing dates			Seed rate × Genotypes	Genotypes	Seed rate
		10 November	25 November	10 December			
Nano	200	1229.03 mn	1292.60 l	739.14 z	1086.92 j		
	250	1269.32 l	861.72 tu	844.54 uv	991.86 m		
	300	1007.94q r	1345.14 k	727.11 z	1026.73 l		
Uramy	200	1812.90 d	1735.44 e	755.15 yz	1434.49 d		
	250	1757.29 e	1437.07 i	552.08 b□	1248.81 g		
	300	1254.31 lm	884.42 s t	801.64w x	980.12 m		
Miki3	200	1263.85 lm	1855.76 c	426.54 c□	1182.04 h		
	250	1440.63 i	1288.66 l	1694.77 f	1474.68 c		
	300	1843.97 cd	1268.41 l	783.94 xy	1298.77 f		
Ouhassan	200	1344.75 k	1280.29 l	811.82 vwx	1145.61 i		
	250	2789.28 a	1340.67 k	979.12 r	1703.02 a		
	300	1024.79 q	1197.24 n	823.70 vw	1015.24 l		
Atlhagy	200	1464.82 i	1124.29 o	594.28 a□	1061.12 k		
	250	1061.74 p	1215.81 n	916.09 s	1064.54 k		
	300	2250.29 b	1146.91 o	729.38 z	1375.52 e		
Svivo	200	1628.03 g	1472.32 i	1394.09 j	1498.14 b		
	250	1537.85 h	1332.96 k	844.31 uv	1238.37 g		
	300	1840.34 cd	842.23 uv	1080.37 p	1254.31 g		
Sowing dates × Genotypes		1319.23 g	1424.21e	586.65 o		1110.03 e	
		1257.23 h	1122.06 j	1151.80 i		1177.03 d	
		1700.73 b	1253.48 h	746.81 n		1233.67 c	
		1595.22 c	1496.01 d	987.01 k		1359.42 b	
		2028.13 a	1370.23 f	791.83 m		1396.73 a	
		1373.14 f	974.62 k	901.90 l		1083.22 f	
Sowing dates × Seed rate	200	1388.46 b	1259.39 c	736.60 f			1128.15 c
	250	1617.87 a	1371.83 b	919.98 e			1303.23a
	300	1630.51 a	1189.08 d	926.41e			1248.67 b
Sowing dates		1545.61a	1273.44 b	861.00 c			

Values followed by similar letters do not differ significantly from each other at 5% duncun test. The values that are in bear the Prime sign are the lowest values and the beginnings of the alphabetical letters were taken because the letters did not cover all the values, so the SAS program re-gave them letters from the beginning.

Table (4) indicates that the early sowing date of 10November was significantly higher which gave the highest grain yield, amounted (409.861 g. m^{-2}), then this value decreased whenever the sowing date was delayed. Such as temperature, lighting period, humidity during the growth and flowering stages, and the accumulation and precipitation of dry matter, which provided plants with a better opportunity to increase the values of growth traits and yield components, and this corresponds to what found (21) and (18). The seed rate exceeded 250 seeds. m^{-2} in giving the highest significant value of the grain yield, reached (386.707 g. m^{-2}). The reason may be that when the seeding rate is reduced below that, the number of spikes decreases, and because of the small number of plants, and when the seed rate exceeds the ideal limits, competition occurs Among plants, this is consistent with what (7) and (14). The genotype of Ouhassan was superior in giving the highest significant value of grain yield, which amounted to (419.573 $g.m^{-2}$), and this may be due to its superiority in the trait of the number of grains in the spike, table (2). The highest yield was obtained significantly when the early sowing date overlapped and the seeding rate was 250 seeds.

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m^{-2}, which was (439.197 g. m^{-2}). The interaction of the genotype Atlhagy with the early sowing date outperformed the greatest value for the grain yield, which amounted to (515.23 g.m^{-2}). The interaction between Miki3 genotype and seeding rate of 250 seeds. m^{-2} was also superior to the highest significant value of (479.221 g. m^{-2}). The highest significant value of grain yield was obtained at the triple interaction between the Miki3 genotype with the medium sowing date of 25November, with a seed rate of 200 seeds. m^{-2}, reaching (630.540 g. m^{-2}).

Table (4) Effect of sowing dates and seeding rates on the grain yield trait (g. m^{-2}) for of durum wheat genotypes.

Genotypes	Seed rate. m^{-2}	Sowing dates			Seed rate × Genotypes	Genotypes	Seed rate
		10 November	25 November	10 December			
Nano	200	312.60 z	348.39 u	193.11 l□	284.70 p		
	250	323.10 x	314.97y z	282.62 c□	306.90 n		
	300	262.58 f	307.43 a□	182.80 m □	250.94 q		
Uramy	200	418.02 n	592.28 b	250.70 g □	420.33 d		
	250	495.13 g	406.28 o	177.43n □	359.61 h		
	300	335.14 w	346.04 u	248.96 g □	310.05 m		
Miki3	200	407.87 o	630.54 a	202.87k □	413.76 e		
	250	485.69 h	433.41 m	518.55 d	479.22 a		
	300	383.56 r	227.34 j□	243.13 h □	284.74 p		
Ouhassan	200	508.48 e	377.36 s	236.53 i□	374.12 g		
	250	572.57 c	438.47 l	339.59 v	450.21 c		
	300	276.99 d□	395.66 p	281.88c□	318.17 l		
Atlhagy	200	467.30 k	280.99 c□	229.18j□	325.82 k		
	250	379.06 s	391.42 q	286.95 b□	352.48 i		
	300	416.92 n	271.85 e□	192.24l□	293.67 o		
Svivo	200	471.70 j	417.89 n	503.18 f	464.25 b		
	250	477.99 i	370.48 t	337.66 vw	395.38 f		
	300	382.74 r	325.25 x	317.40 y	341.80 j		
Sowing dates × Genotypes		395.92 f	419.97 d	208.39 n		341.43 d	
		395.95 f	379.93 g	362.71 h		379.53 c	
		354.35 i	268.87 m	206.11 o		276.45 f	
		466.06 b	462.51 c	330.13 j		419.57 a	
		515.23 a	405.08 e	284.89 k		401.73 b	
		331.62 j	355.65 i	282.75 l		323.34 e	
Sowing dates × Seed rate	200	357.76 e	385.90 d	222.60 i			322.09c
	250	439.19 a	417.13 c	303.79 h			386.70a
	300	432.62 b	342.98 f	311.10 g			362.23b
Sowing dates		409.86 a	382.00 b	279.16 c			

Values followed by similar letters do not differ significantly from each other at 5% duncun test. The values that are in bear the Prime sign are the lowest values and the beginnings of the alphabetical letters were taken because the letters did not cover all the values, so the SAS program re-gave them letters from the beginning.

The results of Table (5) show the superiority of the early sowing dates of 10November and the medium of 25November in giving the highest values for the weight of 1000 grains, reached (46.846 gm and 46.630 gm) respectively, which did not differ significantly between them, while these values decreased at the late sowing date. The delay may be due to the reason for this decrease due to the short period of plant growth, which led to the lack of dry matter accumulation due to the inadequate environmental conditions for each stage of plant growth, where the high temperatures lead to a negative effect on the

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plants as the speed of the physiological processes inside the plant increases at the expense of the accumulation of material Dryness thus reduces grain weight and this is consistent with (22) and (23). The difference in seeding rates did not significantly affect the weight of 1000 grains. The Uramy genotype outperformed in giving the largest significant value for the weight of 1000 grains compared to the other genotypes, which amounted to (49.786 g). This is because its genotypes respond differently to prevailing environmental conditions, and this is in agreement with (15) and (20). The interaction of the two sowing dates of early and middle sowing exceeded in giving the highest values for a 1000-grain weight, which did not differ significantly from its seed and regardless of the seed rates. The highest significant value for this trait, the interaction of the Uramy genotype with the early sowing date, was obtained (50.640 g). The highest significant value for this trait was also obtained when the Miki3 genotype overlapped with the seed rate of 250 seeds. m^{-2}, reaching (51.072 g). The highest significant values were obtained for the weight of 1000 grains when the Nano and Miki3 genotypes interaction with the early sowing date and the seed rate of 250 seeds. m^{-2}, where the values were (52.987 and 52.550 g) respectively.

Table (5) Effect of sowing dates and seeding rates on the 1000 grains (gm) weight trait of durum wheat genotypes.

Genotypes	**Seed rate. m^{-2}**	**sowing dates**			**Seed rate × Genotypes**	**Genotypes**	**Seed rate**
		10 November	25 November	10 December			
Nano	200	47.00 b-i	44.47 l-f	41.50 jkl	44.32 efg		
	250	52.98 a	47.95 g-a	48.81 a-g	49.91ab		
	300	46.93 b-i	47.21 i-b	41.83 i-l	45.32 def		
Uramy	200	44.66 e-l	44.63 l-e	41.11 kl	43.47fg		
	250	47.87 a-h	48.15 a-g	46.47 b-k	47.49 bcd		
	300	45.09 d-l	45.41 c-l	42.26 i-l	44.25 efg		
Miki3	200	44.28 f-l	47.03 b-i	41.10 kl	44.13 efg		
	250	52.55 a	51.35 ab	49.31 a-f	51.07 a		
	300	47.03 b-i	46.45 b-k	41.03 l	44.83 d-g		
Ouhassan	200	45.79 c-l	46.11 b-l	44.25 f-l	45.38 def		
	250	50.60 abc	47.94 a-g	42.41 i-l	46.98 cde		
	300	46.80 b-j	41.45 jkl	44.55 e-l	44.26 efg		
Atlhagy	200	41.53 jkl	43.50 g-l	41.05 l	42.02 g		
	250	46.38 b-l	48.50 a-g	50.21 a-d	48.36 bc		
	300	46.66 b-j	45.76 c-l	42.06 i-l	44.83 d-g		
Svivo	200	45.06 d-l	49.93 a-e	43.41 g-l	46.13 c-f		
	250	47.91 a-h	48.70 a-g	45.15 d-l	47.25 bcd		
	300	44.06 f-l	44.75 e-l	42.53 h-l	43.78 fg		
Sowing dates × Genotypes		44.27 d-g	45.00 def	41.21h		43.49 c	
		50.64 a	49.26 abc	49.45 ab		49.78 a	
		46.87 bcd	46.47 cde	41.64 gh		44.99 c	
		45.17 def	46.89 bcd	42.92 fgh		45.00 c	
		48.79 abc	48.26 abc	44.67 def		47.24 b	
		45.32 def	43.87 e-h	43.11 fgh		44.10 c	
Sowing dates × Seed rate	200	47.42 a	46.30 ab	43.66 c			45.79 a
	250	47.84 a	46.72 ab	43.77 c			46.11 a
	300	45.27 bc	46.85 ab	44.07 c			45.40a
Sowing dates		46.84 a	46.63 a	43.83 b			

Values followed by similar letters do not differ significantly from each other at 5% duncun test.

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