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EVALUATION OF THE VIGOR AND VIABILITY OF MAIZE (*ZEA MAYS* L.) SEEDS WHICH RESULTANT FROM PLANTING DATE AND PLANT DENSITY ON YIELD CHARACTER

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Abstract

This study including two field experiments one of them was carried outin an agricultural experiment and research station which belongs to AL-Muthanna University, Agriculture College, that located in Albandardist (3 km Southwest from Al-Muthanna city) and the other experiment was conducted at postgraduate studies laboratory during Autumn season 2017. In order to study to the effect of the three planting dates (15 July, 25 July, 4 August) with four plant densities (88888, 66666, 53333, 44444) a thousand plant^{-1} on the vigor and viability of maize seeds. the experiment was applied by Spilt–Plot design by using Randomized Complete Block Design (R.C.B.D) with three replicates, were the planting dates occupied the main plots while the plant densities occupied the subplots, whereas the laboratory experiment was conducted with (C.R.D) design to the factorial experiments. The result showed that almost yield characteristics were affected by the planting date, (4 August) date significantly exceeded in number of ear rows (15.6), number of ear grains (420.5), total grain yield (7.374) Ton H^{-1} and harvest index (40.44%) whilst there was no significant effecting to planting date on character of single plant yield and weight of 500 grain. Plant density was significantly affected in almost yield character, the lowest plant density was gave (44444) a thousand plant H^{-1}, the highest rate for the number of ear rows (16.06), the number of ear grains (454.9), yield of single plant (130.6gm) and harvest index (40.24%), while the highest plant density significantly exceeded (88888) a thousand plant H^{-1} in two categories weight of 500 grain (130.88 gm) and total grains yield (7.729 Ton H^{-1}). The result of laboratory experiment showed the seeds which resultant from the third planting date (4 August) in the first count test (%81.69) , the standard planting (89.31%). The length of Radical (17.876) cm , The length of Plumule (17.17)cm and the dry weight of Seedling (0.407)gm . Whereas the seeds which resultant from the lowest plant density (44444) a thousand plant H^{-1} under the study condition was significantly exceeded in the first count test (75.50%), the standard planting (%89.90) , The length of Radical(18.926)cm ,The length of Plumule (17.73) cm and the dryweight of seedling (0.421gm) and the interaction was no significant in almost studies characters.

Key words : Vigor, Viability, Maize (*Zea mays* L.), Plantdensity, Yield character.

Introduction

Maize (*Zea mays* L.) is the most economically important graincrops andthe widespread in all the world and It is described by a miracle and the queen of the crops because of its high production and adaptation to different environmental conditions as compared with Poaceae (Subramania and Subbarama, 2010), as well as its nutritional and industrial usesin many regions of the world, its grain contain a highest ratio from carbohydrates (81%), crude protein (10.6%), oil (4.6%), ash (2%) and B1, B2, E vitamins, whereas its stems and leaves used for paper making (Mahantesh, 2006; Misra Sachin, 2009). In spite of the an importance of the crop ,but it is still suffering from a large shortage in planting areas where the autumn season production was estimated approximately 1.2 Tan H^{-1} as comparing with global production that attained 5.5 Ton H^{-1} (FAO, 2013), the planting area with maize in Iraq attained more than (76000 Ha) with a production rate amount to 3.416 Ton H^{-1} (Central Organization of Statistics, 2016). There is a belief that the gap between Iraq's production rate and the global production belongs to not exploitation of growth inputs in

a way which reflected on maize production and not compliance with the optimum date of planting.Planting date is the most importantfactors that affecting on maize productivity and the early planting exposure the plant to decreasing of temperature during the first phase from plant age while the delay in the planting date exposure the plant at flowering phase to increasing of temperature that resulting to weakness of pollination and fertilization and reduce temperature increasing from full grains that resulted in decreasing the yield (Bruns and Abbas, 2006). The plant density is the most affecting factors on the growth and yield of maize because of the different on their Competitive ability on the different densities and balanced growth and its increasing in plant required to optimum plant density making it benefit from nutrients and water in soil with better intercept of light with availability of other growth factors which affecting in plant growth (Gobeze *et al*, 2012). The vigor and viability of seed an important indicating factor to seeds quality their types and their next affecting in the field establishing and the latent yield. The attempt of field emergence through testing the vigor andviability of seed, it is an attempt to expected the quantity of seeds that we needed to planting to avoiding the weak field establishing at field emergence decreasing because of their corresponding with yield later (Hamza, 2006). The vigor and viability of seeds affected with field process as planting date and the style of plants distribution in field, so this study aimed to knowing the affecting of planting dates and plant densities on the vigor andviability of maize and determining the suitable date and plant density to get the higher yield of grain quality and quantity.

Materials and Methods

Field experiment

A field experiment was carried out during autumn season 2017 in agricultural experiment and research station which belongs to AL-Muthanna University, Agriculture College that located in Albandardist (3 km Southwest from Al-Muthanna city) to study the effect ofplant date and plant density on the vigor andviability of maize seeds.

Study factors

Planting dates : Planting conducted in three dates the first date at 15\7, the second date at 25\7, the third date at 4\8.

Plant density : The planting was carried out by four plant densities (44444, 53333, 66666 and 88888) a thousand plant Ha^{-1}.

Experiment design

The experiment was applied by using Randomized Complete Block Design (R.C.B.D) according to Spilt–Plot design with three replicates, planting date factor occupied the main plots while the plant density factor occupied the subplots, the plant density factor considering the important factor from planting date, the number of experimental units was (36) unit, distance of one of them (9) m, the treatment distributed on experimental units randomized to each block so each block contain (12) experimental units and the single experimental unit consist from (4) furrows at length (3) m to the single furrow , the distance between furrow and the other was constant about (75) cm, the planting carried out by putting (2-3) seed in each hole at depth (5) cm and the distance between hole and other changed according to plant density levels , each replicate spread from the other by runnel at width (1) m.

The Agricultural process

The process of soil and crop service has been initiated, the earth was cultivated by moldboard plow into two orthogonal plaques then the Smoothing and leveling processes carried out to the soil after that the earth divided into (36) experimental units , each experimental units including (4) furrows at length (3) m and then the adjustment irrigation was giving before two days from planting to each date, whereas the planting was conducted manually by putting three seeds in each hole then the plants thinning into single plant at the sixth leaf phase(Alousi, 2007) and its directlyirrigation after each planting date and then its irrigation according to as it needed, urea fertilizer used as nitrogen source (46% N) at rate 360 Kg H^{-1}, it added by two batch, a half quantity after four real leaves appeared and the other quantity before flowering phaseinswarm in a line at a distance (5) cm from planting line, tri super phosphate fertilizer was added (P_2O_5 46%) as one batch before planting at rate (220) Kg H^{-1}, Potassium sulfate fertilizer (41% K) was added as a source to potassium at rate (200) Kg H^{-1} as one batch at soil preparation processes (Agriculture Ministry, 2015). Weeding and irrigation processes were carry out as it needed. Insecticide Diazinon (10% active substance) at (6) Kg Ha^{-1} was used to protect from maize borer stalk (*Sesamia cretica*) fill in the growing peak of plants and with two batches, the first as preventive control after 20 day from planting at (4-5) leaves, the second after 15 day from the first preventive (Agriculture Ministry, 2015) and the weed was controlling manually as it needed.

Soil and climate factors analyzed

A randomly samples were taken from experiment soil at depth (0-30 cm) and the sample of each site was mixed together,grinding and air-dried at water and soil department laboratory in Agriculture College, AL-Muthanna university to study some physical and chemical characters as shown in the table 1.

Table 1 : Some physical and chemical characters of experiment soil before planting.

Character	Value	Unit
Electrical conductivity Ec	3.2	ds/m^{-1}
pH	7.3	—
Available nitrogen	11.7	Mg Kg^{-1}
Available phosphor	17.6	Mg Kg^{-1}
Available potassium	198.6	Mg Kg^{-1}
Organic matter	1.1	%
Soil separators		
Clay	52	%
Sand	4.9	%
Silt	43	%
Soil texture	silty clay	

*Soil samples were analyzed at water and soil department laboratory in Agriculture College, AL-Muthannauniversity.

The studying characters

Yield compounds as follows number of ear rows, single yield of the plant, total yield of the plant, weight of 500 grain and harvesting index.

Laboratory experiment

A laboratory experiment was carried out at postgraduate studies laboratory in Agriculture College, Al-Muthanna University by using the seeds, which produced from the first experiment. The studied characters at the laboratory experiment were first count testing, the standard laboratory germination (%), the length of Radical (cm), the length of plumule (cm) and the dry weight of seedling (gm).

Statistical analysis

The data under the current study were analyzed according to variance analysis method with a randomized complete block design (R.C.B.D) by applied Spilt–Plot design to the data experiment and (C.R.D) design to the laboratory design by using the lest significant differences (L.S.D) to comparing with between means at probability 0.05 and by using analysis software Genstat (Al-Muhamadi, 2008).

Results and Discussion

Number of ear rows

The result in table 2 showed number of ear rows character significantly affected by planting date and plant density and there were no significant differences to the interaction between them, planting date (T3) recorded the highest rate attained (15.06) ear row^{-1} as comparing with two dates (T1, T2) which recorded the least mean to the character attained (14.6, 14.24) ear row^{-1} sequentially the reason maybe due to thesuitable of environment condition as temperature moderation increasing the relative humidity during flowering phase that led to non-drying pollen and falling them on stigmas that leads to succeeded the pollination and fertilization processes which significantly reflected on increasing number of ear rows. This result agreed with Aziz and Mohamed (2012), who pointed to increasing the numbers of ear rows at autumn dates, while the affecting of plant density, the result pointed to exceeding of lowest plant density by giving the highest rate to the character attained (15.22) ear row^{-1} as comparing the highest plant densities (D2, D3, D4), which recorded the least rates to the character (14.55, 14.22, 13.96 ear row^{-1}), the reason maybe due to the abundance of growth factors and lack of the competition on them from plant at lowest densities during first growth periods which increasing the plant ability to produced dry matter and converater it from the source and investiment it at reproductive parts building that postivily reflacting at increasing numbers of ear rows, this result agreed with what was found by Alhilfi *et al.* (2010) and Salim *et al.* (2005), who pointed to the highest plant density decreasing from numbers of ear rows.

Number of ear grains^{-1}

The result in table 3 showed the significant differences to planting date and plant density in number of ear grains density, there was no significant differences to the interaction between them, T3 significantly increasing y giving the highest rate to character attained (420.5) from other two dates (T1, T2), who recorded the least rate to the character attained (403.7-37.9) sequentially, who not differ significantly between them,the reason maybe due to theSuitable of environment condition that leaded to succeeded the pollination and fertilization processes, as well as exceeded the plants of this date in leaf area, leaf area index, length of ear and number of ear rows that positively reflected at increasing of fertilizers flowers which formatted in ear and increasing them grains this result not agreed with Alhadidi (2007) and Faleh and Alramdhani (2002) and (Al-Assafi, 2002), who founds that the lately autumn planting led to significant increasing

Table 2 : The effect of planting date and plant density and the interaction between them on the number of ear rows character.

Treatment	D4	D3	D2	D1	The rate
T1	13.86	14.13	14.23	14.73	14.24
T2	13.76	13.83	14.20	14.86	14.16
T3	14.26	14.70	15.23	16.06	15.06
	13.96	14.22	14.55	15.22	
The rate	T		D		T*D
L.S.D	0.4685		0.2516		N.S

Table 3 : The effect of planting date and plant density and the interaction between them on the number of ear grains character.

Treatment	D4	D3	D2	D1	The rate
T1	383.2	391.7	402.7	437.4	413.7
T2	338.0	349.0	379.4	437.7	375.9
T3	383.7	391.4	418.0	490.2	420.5
	368.7	377.0	400.0	454.9	
The rate	T		D		T*D
L.S.D	27.93		18.03		N.S

Table 4 : The effect of planting date and plant density and the interaction between them on the weight of 500 grain character.

Treatment	D4	D3	D2	D1	The rate
T1	131.70	131.50	130.07	130.47	130.93
T2	132.13	128.53	129.43	130.03	130.03
T3	128.80	130.87	130.40	129.67	129.93
	130.88	130.30	129.97	130.06	
The rate	T		D		T*D
L.S.D	1.568		N.S		N.S

in number of ear grains.Whilst the effect of plant density , the result showed to (D1) exceeded by giving the highest mean to character attained (454.9) grain ear^{-1}from other plant densities (D2, D3, D4), which significantly exceeded between them, its recorded the least mean attained (368.2, 377.1, 400.0 grain ear^{-1}) the reason maybe due to decreasing of number of ear grain at highly densities to the highest competition between plants on growth factors and decreasing of photosynthesis substances that leads to abortion of pollination grains resulted to reduced number of ear grains this result agreed with Ealak (2001), who found the number of ear grains decreasing at increasing of plant densities.

The weight of 500 grain (gm)

The result in table 4 indicate no significant differences in planting date the reason may be due to the phase of grais fill is the last phase in plant life and at this phase all parts of plant take the its final size with metabolizable sustances existing with never found other sinks which compete the grains in dry matter so there were no differences in grain weight from treatment to other (Alsahuki, 2002), this result differ with what found by Alhadidi (2007), who found significant differences between plant dates and plant density and the interaction between them in weight of 500 grain, whereas the plant density affecting, the result pointed to significant differences to the plant density to the weight of 500 grain character ,the plant density (D4) recorded the highest rate attained (130.88) gm as comparing with other plant densities, which not differ between them significantly (D1, D2, D3), which recorded the least rate to the character attained (129.97, 130.06, 130.30 gm) sequentially the reason to exceeded (D4) may be due to the a lot of highly shading and competition between plant on nutrients which leaded to reduced number of ear grains therefore the outputs of photosynthesis distributed on little numbers from grains that increased weight of grains, this result differ with Ealak (2001) and Alhadidi (2007), who found decreasing in seed weight by increasing plant density.

Single plant yield gm plant^{-1}

The result in table 5 indicate no significant differences to planting date in single plant yield character, whereas to plant density affecting the lowest density (D1) recorded the highest rate attained (130.6 gm plant^{-1}) as comparing with other plant densities (D, D3, D4), which recorded the least rate to the character attained (108.2,98.4,94.7) gm plant^{-1} sequentially and it not differ between them the reason maybe dueto to exceeded the plant that planting with low densities in leaf area and stem diameter that allow the higher and lowest leaves make the photosynthesis processes perfectly as well as its exceeded in length of ear and number of rows and the number of ear grains that leaded to increasing in single plant yield this results agreed with Salama *et al* (2007), El-Hendawy *et al* (2008), Hokmalipour *et al* (2010), who pointed to significantly increasing in single plant yield at lowest plant density, there was no significant between them in the interaction.

Grains yield Ton H^{-1}

The result in table 6 indicates to significant differences to planting date and plant density and the interaction between them total yield character, the date (T3) recorded the highest rate to the character attained (7.374) Tan H^{-1} exceeding on the two dates (T2, T1), who significantly different between them who recorded the least rate to the character attained (5.993, 6.358) Tan H^{-1}the reason

Table 5 : The effect of planting date and plant density and the interaction between them on the single yield of plant character.

Treatment	D4	D3	D2	D1	The rate
T1	82.7	92.7	98.00	118.00	97.8
T2	82.9	98.4	110.00	125.7	104.3
T3	118.7	104.2	116.7	148.00	121.9
	94.7	98.4	108.2	130.6	
The rate	T		D		T*D
L.S.D	N.S		12.00		N.S

Table 6 : The effect of planting date and plant density and the interaction between them on the total grains yield character.

Treatment	D4	D3	D2	D1	The rate
T1	7.340	6.173	5.220	5.240	5.993
T2	7.364	6.627	5.860	5.583	7.374
T3	8.483	7.287	6.580	7.147	7.374
	7.729	6.696	5.887	5.990	
The rate	T		D		T*D
L.S.D	0.611		0.1969		0.6071

Table 7 : The effect of planting date and plant density and the interaction between them on the harvesting index character.

Treatment	D4	D3	D2	D1	The rate
T1	34.67	36.70	37.57	38.90	36.96
T2	39.73	36.97	38.87	39.43	38.75
T3	39.03	39.73	40.63	42.40	40.44
	37.81	37.8	39.02	40.24	
The rate	T		D		T*D
L.S.D	0.970		0.755		N.S

maybe due to the suitable of environment condition as temperature moderation increasing the relative humidity during flowering phase, which increased the succeeded of the pollination and fertilization processes as long as exceeding the plants of this date significantly in basic yield ingredients, length of ear , number of rows, number ear grains and single plant yield that positively reflected on total grains yield, this result agreed with Aziz and Mohamed (2012), who found to significantly increasing in total gains yield at lately planting into autumn season because of temperature moderation increasing the relative humidity, as for the plant density affecting the result showed exceeding the highly plant density (D4) by giving the high rate attained (7.729)Tan H^{-1} on other densities (D1, D2, D3), which never differ significantly between them, the least rate to this character was recorded (5.887, 5.990, 6.696) Tan H^{-1} sequentially, the total grains yield maybe due to at high plant density to increasing the numbers of plants at area unit, but this increasing doesn't compensate the decreasing in single plant yield because increasing of plant density from the optimum limit, this result agreed with Arif *et al.* (2010), Rafiq *et al.* (2010), Dahmardeh (2011), Fanadzo *et al.* (2010), Salim *et al* (2005), who mentioned grain yield per unit area increasingly increasing by plant density, whilst the interaction, the result pointed to exceeded the combination (T3, D4), which recorded the highest rate attained (8.483) Tan H^{-1} as comparing with (T1D2) combination, which recorded the least rate attained (5.22) Tan H^{-1} the reason maybe due to suitable of environment condition at planting date (T3) and increasing the plant numbers in area unit at high plant density (D4) that reparation the decreasing at single plant yield down to optimum plant density.

Harvesting index

The result at table 7 pointed to a significant effect to the planting date and plant density in harvesting index character while there was no significant effect to the interaction between them, the date (T3) recorded the highest rate attained (40.44%) exceeding on other two dates (T1,T2) which recorded the least rate attained (36.96%, 38.75%) sequentially which significantly differ between them, the reason may be due to thesuitable of environment condition as temperature moderation and increasing the relative humidity that caused elongate the vegetation growth phase and increasing from produced dry matter from source to the sink during stage of grain filling that means increasing the economic and biology yields together that positively reflected at increasing harvesting index, this result not agreed with found by (Ahmed, 2001). As for the plant density the result pointed to plant density (D1) significantly exceeded which recorded the highest mean attained (40.24) exceeding on other plant densities (D2, D3, D4), which recorded the least mean attained (39.02, 37.81, 37.8%) sequentially the reason may be due to exceeded the plants of D1 in grains yield and biological yield as resulting of the shadinglack, abundance of dry matter and lack the competition on it from plants thus increase harvesting index this result agreed with Shuilia (2000).

The effect of planting date and plant density on vigor andviability of maize seeds

The first count testing

The results of table 8 showed a significant effect of the planting date and plant density and the interaction between them in the percentage of the first germination

Table 8 : The effect of planting date and plant density and the interaction between them on the percentage of first count character.

Treatment	D4	D3	D2	D1	The rate
T1	79.00	79.25	82.75	83.50	81.12
T2	77.25	79.50	80.25	81.00	79.50
T3	79.00	80.00	82.50	85.25	81.69
	78.42	79.58	81.83	75.50	
The rate	T		D		T*D
L.S.D	0.781		0.902		1.563

%, the result pointed to significant exceeding to the seeds that produced from third date (T3) which recorded the highest rate attained (81.69%) as comparing with the seeds which produced from the second date (D2) which recorded the least rate attained (79.50%) while the seeds which produced from first date not differ from others which produced from third date (T3) which gave a rate attained (81.12%) the reason may be due to suitable of environmental condition during flowering stage and grains filling stage and their positive effect on vigor and viability of seed which enhance their latent ability on germination well this result agreed with Hamza (2006), who pointed that the vigor and viability of seeds affected by planting date, whilst to plant density the seeds which produced from (D1), which recorded the highest rate attained (83.25%) as comparing with seeds which produced from other plant densities (D2, D3, D4), which gave the least rate attained (81.83,79.58,78.42%) sequentially the reason may be due to seeds effected by plant densities as well as what is caused by shading and computation between plants on outputs of photosynthesis, which negatively reflected on seed weight ,vigor and viability thus reduced from their germination ratio and this agreed with what found by Elliott (2003)and Cheyed (2008). They confirmed that the seeds the biggest weight having the highest vigor of seedling, whereas the interaction affect the combination (T3D1) significantly exceeding which record the highest rate attained (85.25%) as comparing with combination (T2D4) by giving the least rate attained (77.25%) the reason may be due to suitable of environment condition to planting plants at lowest plant density at grain fill period that caused to increasing the weight of seed thus own it highly vigor and viability positively reflected in germination ratio.

The test of standard germination (%)

The result of table 9 showed a significant affecting to planting date and plant density on the test of standard germination character (%) while there was no significant effect to the interaction between them, the seeds which produced from third date (D3) recorded the highest rate attained (89.31%) as comparing with seeds which produced from other dates (T1,T2) that recorded the least rate attained (88.12%, 87.12%) sequentially this character behaved the similar behavior to the first count for the same reasons that mentioned at the first character , whereas to the plant density, the seeds which produced from lowest plant density (D1) significantly exceed which recorded the highest rate attained (89.92%) as comparing with other densities (D2, D3, D4), which recorded a rate to the character attained (88.92%, 87.42%, 86.50%) sequentially the reason may be due to the large size of seeds which produced from lowest plant densities and increasing their weight and highly nutrient storage unlike the seeds, which produced from highest plant densities and what is caused by shading and the lack of foodstuffs which transferred to grains this can be explained that the condition under which seeds can be created when it on the mother plant reflected on their vigor and viability later whenever the size of seed grow up and it weight increasing and it highly food storage the seedling being stronger and faster and appearing above soil surface faster than those having little storage (Jallow *et al*., 2009).

The length of Radical (cm)

The result of table 10 showed a significant affecting to planting date and plant density on the test to the length of radical character, while there was no significant effect on the interaction between them, the result pointed to exceeding the seeds, which produced from the date (T3) which recorded the highest rate attained (17.87cm) as comparing with seeds which producing from the other two dates (T1, T2), who recorded the least rate attained (17.12, 17.26cm) sequentially the reason may be due to growing up the size of seed and their nutrient storage and their specific weight as compared with seeds which produced from other two dates (T1, T2), which reflected on seeds vigor and viability and that affected on the length of radical and this agreed with what Rathod (2009) mentioned, whereas the affect of plant density the seed which produced from lowest plant density (D1) recorded the highest rate attained (18.92cm) as comparing with seeds which produced from other plant densities (D2, D3, D4), which gave the least rate attained (17.68, 17.00, 16.12 cm) sequentially the reason may be due to exceeding of the seeds which produced from lowest density (D1) in the first cont also on the test of standard germination this result agreed with what found by (Cheyed, 2008).

The dry weight of seedling

The result of table 12 showed a significant affecting

Table 9 : The effect of planting date and plant density and the interaction between them on the percentage of standard germination character.

Treatment	D4	D3	D2	D1	The rate
T1	85.00	86.50	88.25	88.75	87.12
T2	87.25	87.00	88.75	89.50	88.12
T3	87.25	88.75	89.75	91.50	89.31
	86.50	87.42	88.92	89.92	
The rate	T		D		T*D
L.S.D	0.777		0.897		N.S

Table 10 : The effect of planting date and plant density and the interaction between them on the percentage of standard germination character.

Treatment	D4	D3	D2	D1	The rate
T1	16.150	17.025	17.325	18.575	17.269
T2	15.825	16.900	17.450	18.450	17.156
T3	16.400	17.075	18.275	19.752	17.876
	16.125	17.00	17.683	18.926	
The rate	T		D		T*D
L.S.D	0.2944		0.3400		N.S

Table 11: The effect of planting date and plant density and the interaction between them on the seedling dry weight character (gm).

Treatment	D4	D3	D2	D1	The rate
T1	0.391	0.395	0.399	0.411	0.399
T2	0.360	0.392	0.405	0.424	0.395
T3	0.389	0.397	0.412	0.429	0.407
	0.380	0.395	0.405	0.421	
The rate	T		D		T*D
L.S.D	0.00612		0.00707		0.01224

to planting date and plant density on the dry weight of Seedling character the interaction between them, the result showed to exceeded the seeds which produced from (T3) which recorded the highest rate attained (0.407) gm as comparing with seeds which produced from other two dates (T1, T2) who recorded the least rate attained (0.395, 0.339) gm sequentially and they not different significantly between them, the reason may be due to exceeding the seeds which produced from (T3) in almost previous tests (first count, the test of standard germination, the length of radical, the length of furrow) that back to the high viability and vigor of the seeds which make its qualify to emergence later and giving normally and active seedling, which reflected positively on dry weight of seedling, this result agreed with Hamza (2006) as for plant density affecting the result indicated to exceeded the seeds, which produced from (D1) which recorded the highest rate attained (0.421) gm as comparing with other plant densities (D2, D3, D4) which recorded the least rates attained (0.405, 0.395, 0.308 gm) sequentially the reason may be due to exceeded the seeds which produced from (D1) in dry weight of seedling to it exceeded on the length of radical and furrow characters which positively reflected on the dry weight of seedling, this result agreed with Cheyed (2008) when he measure the dry weight of seedling in his experiment on sorghum crops , the result also indicated to significant interaction between planting date and plant density in the dry weight of seedling whereas the combination (T3D1) significantly exceeded by giving the highest rate attained (0.429) gm as compared with combination (T2D4), which recorded the least rate attained (0.360) gm.

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