

EFFECT OF SOWING DATE AND IRRIGATION INTERVALS ON GROWTH CHARACTERS OF SOME WHEAT CULTIVARS.

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ABSTRACT :

The Field experiments were conducted out during the two successive winter seasons of 2012/2013 and 2013/2014 at the Experimental Farm (Demo) of the Faculty of Agriculture, at Fayoum University , Egypt .The aim of these experiments was to evaluate growth character of some wheat cultivars under different sowing dates and different irrigation intervals . The experiment was laid out in split - split plot design with four replicates and comprised of three dates of sowing, namely 1st November, 15th November and 30th November in main plots and three irrigation intervals, namely, Irrigation every 21(I₁) days, Irrigation every 28 (I₂)days, Irrigation every 35(I₃)days, in sub- plots and three wheat cultivars namely, Sakha 93, Sakha 94, and Sids 12 in sub-sub-plots. Results showed that the Wheat cultivars significantly differed in all growth characters. Sids 12 cultivar surpassed the other varieties in all characters under this study. On the other hand, significant differences were observed among irrigation intervals for plant height and number of leaf per plant at ripping stage, while dry weight per plant and leaves area /plant at two growth stages. Moreover the greatest value were obtained by irrigation every 21 days. sowing dates shown significant effect on plant height, number of leaf per plant, dry weight per plant, leaves area /plant at flowering and ripping stages as well as crop growth rate and relative growth rate. Late sowing date (30th November) gave higher values from dry weight/plant and leaf area/plant at flowering stage and highest number of leaves/plant at two growth stages also high crop growth rate and relative growth rate while moderate sowing date (15th November) gave the highest values from plant height at two growth stages, big leaf area per plant and dry weight per plant at ripping stage only. Significant differences were observed among sowing dates with irrigation intervals, sowing dates with wheat varieties, irrigation intervals with wheat varieties and sowing date x irrigation intervals x wheat variety interactions on most growth traits. The results showed that early sowing date followed by moderate sowing date under irrigation every 21 or 28 days with Sids 12 variety gave the highest values for most growth characters.

Key words: Sowing date , Cultivars, Irrigation intervals , Growth characters

INTRODUCTION :

Wheat (*Triticum aestivum L.*) is a member of the family Poaceae. Wheat is the main staple food for 35% of the world's population. It is grown on about 100 million hectares in the developing world (UN, 2007). Global wheat production is concentrated mainly in Australia, Canada, China, India, Pakistan, Russia, Turkey, Ukraine, France, Germany, United State and United kingdom accounting for over 70% of the world wheat production (FAO, 2014). Wheat has the largest cultivated area among the various crops plant (Ferrar *et.al.* 1994). In 2015 the wheat world production is about 729 million tons, making it the second most-produced cereal after maize (1016 million tons).

Under Egypt condition, increasing wheat production is considered as one of the most important strategic goals in order to decrease the great gap between production and human consumption especially under the yearly increase in the population with a more rate than production. Solving these problems needs pressing hard to increase wheat yield. It can happen through some ways. One of that can go through planting highly productive varieties, other way the recommended sowing date and managing irrigation. The limited share of the Nile water that Egypt receives is not expected to increase in the future. Taking into account the population growth and the expected negative effect of climate change on rain in Ethiopia, Egypt will face a problem to allocate water to agriculture to maintain in food security. Wheat varieties effect was studied by several investigators; it appears a great response since specific one surpassed other significantly in growth characters of wheat (Sarker 2003; Ouda *et al* 2007 and Alam *et al* 2013). The response of wheat varieties was shown to differ greatly to the delay in sowing date ; growth characters of wheat responded negatively due to the delay in sowing date (Tammam and Abdel-Rady,2010; Munsif *et al* 2013, and Swelam and Atta 2015 and Rahman *et al* 2006) evaluated the effect of irrigation on plant growth and yield of wheat . Found that total dry matter (TDM),and CGR increased with increasing number irrigation .

The objectives of the present study was calculated to determine the effect of various sowing date and irrigation intervals on growth traits of wheat varieties.

MATERIALS AND METHODS:

Two field experiments were conducted during 2012/ 2013 and 2013/ 2014 growing seasons at the Experimental Farm, Faculty of Agriculture, at Demo, Fayoum University, Fayoum, Egypt. Each experiment included 27 treatments (arranged in a split-split-plot design with 4 replicates) which were the combinations of :

1) Three wheat cultivars, i.e. Sakha 93(V₁), Sakha 94 (V₂) and Sids 12(V₃) were allocated in the sub –sub –plots.

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2) Three irrigation intervals, i.e. 21(I₁), 28(I₂) and 35(I₃) days from the beginning of the second irrigation were randomly allocated in sub-plots.

3) Three sowing dates, i.e. 1st November(S₁), 15th November (S₂) and 30th November(S₃), arranged in the main plots.

The experimental plot area was 7 m² (2.0 × 3.5 m). The soil texture of the sites was sandy loam in both seasons, with PH of 7.7, EC4.01, contained organic matter of about 0.76% and CaCo₃ of 4.5 %.

With the exception of the applied treatments other recommended practices of growing wheat were performed.

Data recorded:

At flowering and rippling stages a random sample of five plants in each sub-sub plots was taken to determine average of the following growth characters.

1-Plant height (cm).

2-Number of leaves per plant.

3-Leaves area per plant (cm²).

4-Dry weight per plant(gm) (The plant fractions were oven – dried at 105C⁰ until a constant weight). The growth analysis criteria calculated by the basic formulas according to **Radford(1967)** as follow:-

A- Crop growth rate (CGR)

$$CGR = \frac{W_2 - W_1}{T_2 - T_1} (\text{g/day})$$

B- Relative growth rate (RGR)

$$RGR = \frac{\log W_2 - \log W_1}{T_2 - T_1} (\text{g/g/day})$$

Where: Log=natural logarithm, T₁ =time one (in days), T₂ =time two (in days) , W₁ = Dry weight of plant at time one (in grams) , W₂= Dry weight of plant at time two (in grams)

STATISTICAL ANALYSIS:-

All collected data were subjected to statistical analysis of split –split plot design and combined analysis for the data of two seasons was conducted as described by **Gomez and Gomez (1984)**. Treatment means were compared using the least significant differences test (L.S.D).

Results and Discussion

Effect of wheat cultivar:

The analysis of variance revealed that wheat cultivars significantly differed in plant height, number of leaf per plant, dry weight per plant, leaves area per plant, at flowering and rippling stage as well as crop growth rate and relative growth rate. Sids 12 variety(V₃) surpassed the other varieties in all characters under this study. Several investigators reported varietal differences in growth characters **El- Kalla et al 2010, Sarwar et al 2010, Abdelmula et al 2011, Alam et al 2013 and Abusfyan et al 2013.**

Effect of irrigation intervals:

A highly significant differences among irrigation intervals of plant

height and number of leaf per plant at ripping stage, dry weight per plant and leaves area/plant in two stages also, crop growth rate. The greatest value was obtained by irrigation every 21 days. These results are in the same trend of the results obtained by **Rahman et al (2006)**, **Sarwar et al (2010)**, **Kumar et al (2012)** and **Ali et al (2013)**.

Effect of sowing date:

According to the statistical analysis of obtained data as effect of sowing date, significant differences were detected in plant height, number of leaves per plant, dry weight per plant, leaves area per plant at flowering and ripping stage also, crop growth rate and relative growth rate. The late sowing gave the greatest values of dry weight per plant and leaves area per plant at flowering stage . Also the same date gave the biggest number of leaves per plant in two growth stages and crop growth rate and relative growth rate. While the moderate sowing date (15th November) gave the tallest plants at two growth stages. At ripping stage normal sowing date (15th November) gave the highest value of dry weight per plant , and leaf area per plant . These results stand in harmony with those obtained by **Tammam and Abd El-Rady (2010)**, **Abdelmula et al (2011)**, **Abu- Sufyan et al (2013)** and **El-Temsah et al (2014)** .

Interaction effect:

Sowing dates × Irrigation intervals interaction, showed significant differences in all traits in two growth stages except leaves number at flowering stage. Irrigation every 21 days (I₁) followed by every 28 days (I₂) at both early sowing (S₁) and normal sowing dates gave the highest value for plant height at two growth stages and dry weight and leaf area per plant at ripping stage.

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Table (1): Plant height, in cm, at flowering and ripping stages as affected by sowing date, irrigation intervals, wheat varieties and their interactions (combined analysis for 2012/013 and 2013/014 seasons).

Sowing dates (S)	Irrigation intervals (I)	Flowering stage				Ripping stage			
		Varieties (V)			mean	Varieties (V)			mean
		V ₁	V ₂	V ₃		V ₁	V ₂	V ₃	
S ₁	I ₁	59.90*	54.53	64.60	59.68**	82.73*	90.13	100.83	91.23**
	I ₂	60.90	51.08	62.07	58.02	85.80	89.63	101.47	92.30
	I ₃	60.65	49.10	61.63	57.13	79.07	85.20	91.83	85.37
	mean	60.48**	51.57	62.77	58.27**	82.53**	88.32	98.04	89.63**
S ₂	I ₁	61.55	57.63	68.15	62.44	85.43	91.73	95.93	91.03
	I ₂	57.13	61.40	61.70	60.08	82.77	92.50	97.05	90.77
	I ₃	57.63	58.70	61.30	59.21	81.17	88.23	93.40	87.60
	mean	58.77	59.24	63.72	60.58	83.12	90.82	95.46	89.80
S ₃	I ₁	54.23	51.00	57.43	54.22	79.40	84.33	86.87	83.53
	I ₂	61.10	49.93	61.87	57.63	72.37	84.17	86.17	80.90
	I ₃	58.33	51.40	60.77	56.83	76.47	83.03	87.98	82.49
	mean	57.89	50.78	60.02	56.23	76.08	83.84	87.01	82.31
Mean of irrigation intervals	I ₁	58.56	54.39	63.39	58.78	82.52	88.73	94.54	88.60**
	I ₂	59.71	54.14	61.88	58.58	80.31	88.77	94.89	87.99
	I ₃	58.87	53.07	61.23	57.72	78.90	85.49	91.07	85.15
Mean of varieties		59.05**	53.86	62.17	58.36	80.58**	87.66	93.50	93.50

L.S.D at 5% level for :

Sowing date (S)	0.98	S X I	1.60	S x I x V	2.62	Sowing date (S)	0.94	S X I	2.68	S x I x V	3.54
Irrigation (I)	NS	S x V	1.51			Irrigation (I)	1.55	S x V	2.05		
Varieties (V)	0.87	I x V	NS			Varieties (V)	1.18	I x V	NS		

Table (2): Mean number of leaves per plant, at flowering and ripping stages as affected by sowing dates, irrigation intervals, wheat varieties and their interactions (combined analysis for 2012/013and 2013/014 seasons).

Sowing dates (S)	Irrigation intervals (I)	Flowering stage				Ripping stage			
		Varieties (V)			mean	Varieties (V)			mean
		V ₁	V ₂	V ₃		V ₁	V ₂	V ₃	
S ₁	I ₁	32.17	37.67	36.00	35.28	31.33	36.50	32.00	33.28**
	I ₂	32.33	33.83	38.50	34.89	28.83	33.83	33.50	32.06
	I ₃	32.00	33.83	38.50	34.78	29.67	30.83	32.33	30.94
	Mean	32.17	35.11	37.67	34.98**	29.94**	33.72	32.61	32.09**
S ₂	I ₁	31.00	37.83	33.50	34.11	34.67	36.33	39.67	36.89
	I ₂	31.33	35.50	35.33	34.06	32.33	33.50	41.33	35.72
	I ₃	32.33	33.67	36.83	34.28	30.67	32.83	39.50	34.33
	mean	31.56	35.67	35.22	34.15	32.56	34.22	40.17	35.65
S ₃	I ₁	38.83	42.00	40.67	40.50	35.50	38.33	38.83	37.56
	I ₂	36.50	40.00	42.33	39.61	35.17	37.17	37.50	36.61
	I ₃	36.00	40.50	41.00	39.17	35.33	39.00	40.17	38.17
	mean	37.11	40.83	41.33	39.76	35.33	38.17	38.83	37.44
Mean of irrigation intervals	I ₁	34.00**	39.17	36.72	36.63	33.83**	37.06	36.83	35.91**
	I ₂	33.39	36.44	38.72	36.19	32.11	34.83	37.44	34.80
	I ₃	33.44	36.00	38.78	36.07	31.89	34.22	37.33	34.48
Mean of varieties		33.61**	37.20	38.07	36.30	32.61**	35.37	37.20	35.06

L.S.D at 5% level for

Sowing date (S)	1.57	S X I	NS	S x I x V	NS	Sowing date (S)	0.83	S X I	1.59	S x I x V	NS
Irrigation (I)	NS	S x V	NS			Irrigation (I)	0.92	S x V	1.44		
Varieties (V)	0.95	I x V	1.64			Varieties (V)	0.83	I x V	1.44		

Table (3): Mean leaf area per plant, in cm², at flowering and ripping stages as affected by sowing dates, irrigation intervals, wheat varieties and their interactions(combined analysis for 2012/013and 2013/014 seasons).

Sowing dates (S)	Irrigation intervals (I)	Flowering stage				Ripping stage			
		Varieties (V)			mean	Varieties (V)			mean
		V ₁	V ₂	V ₃		V ₁	V ₂	V ₃	
S ₁	I ₁	635.88**	802.66	792.40	743.65**	518.47**	864.78	565.03	649.43**
	I ₂	583.30	520.82	955.35	686.49	424.83	630.85	645.81	567.16
	I ₃	509.10	486.09	748.30	581.16	373.83	304.48	553.02	410.44
	mean	576.09**	603.19	832.02	670.43**	439.04**	600.04	587.95	542.35**
S ₂	I ₁	706.88	783.54	717.24	735.89	708.64	700.19	818.97	742.60
	I ₂	689.50	777.23	840.74	769.16	621.03	640.90	924.75	728.89
	I ₃	487.70	599.96	699.83	595.83	465.64	561.72	830.82	619.39
	mean	628.02	720.24	752.60	700.29	598.43	634.27	858.18	696.96
S ₃	I ₁	860.13	796.39	871.55	842.69	556.44	543.12	602.05	567.20
	I ₂	779.41	773.04	878.02	810.16	501.18	608.10	594.39	567.89
	I ₃	825.82	900.22	921.46	882.50	576.59	620.46	636.59	611.21
	mean	821.79	823.22	890.35	845.12	544.74	590.56	611.01	582.10
Mean of irrigation intervals	I ₁	734.29**	794.20	793.73	774.07**	594.52**	702.70	662.02	653.08**
	I ₂	684.07	690.36	891.37	755.27	515.68	626.62	721.65	621.32
	I ₃	607.54	662.09	789.86	686.50	472.02	495.55	673.47	547.01
Mean of varieties		675.30**	715.55	824.99	738.61	527.40**	608.29	685.71	607.14

L.S.D at 5% level for :

Sowing date (S)	27.61	S X I	46.37	S x I x V	89.73	Sowing date (S)	35.57	S X I	56.25	S x I x V	71.52
Irrigation (I)	28.25	S x V	51.81			Irrigation (I)	32.47	S x V	41.29		
Varieties (V)	29.91	I x V	51.81			Varieties (V)	23.84	I x V	41.29		

Table (4) :Mean dry weight per plant, ing, at flowering and ripping stages as affected by sowing dates, irrigation intervals, wheat varieties and their interactions (combined analysis for 2012/013and 2013/014 seasons).

Sowing dates (S)	Irrigation intervals (I)	Flowering stage				Ripping stage			
		Varieties (V)			mean	Varieties (V)			mean
		V ₁	V ₂	V ₃		V ₁	V ₂	V ₃	
S ₁	I ₁	10.10**	8.65	11.03	9.93**	20.10**	21.85	23.73	21.89**
	I ₂	10.37	9.67	11.90	10.64	21.65	21.90	26.32	23.29
	I ₃	10.00	9.30	10.82	10.04	19.08	20.65	24.03	21.26
	mean	10.16	9.21	11.25	10.20**	20.28**	21.47	24.69	22.15**
S ₂	I ₁	11.65	11.60	13.03	12.09	23.75	23.47	28.00	25.07
	I ₂	11.50	9.45	12.28	11.08	24.62	22.15	26.08	24.28
	I ₃	10.20	9.13	10.72	10.02	22.85	21.48	23.48	22.61
	mean	11.12	10.06	12.01	11.06	23.74	22.37	25.86	23.99
S ₃	I ₁	12.23	9.77	14.50	12.17	22.65	19.95	27.80	23.47
	I ₂	10.93	10.55	10.75	10.74	19.22	19.13	20.07	19.47
	I ₃	12.67	12.20	12.60	12.49	23.87	20.68	24.55	23.03
	mean	11.94	10.84	12.62	11.80	21.91	19.92	24.14	21.99
Mean of irrigation intervals	I ₁	11.33**	10.01	12.86	11.40**	22.17**	21.76	26.51	23.48**
	I ₂	10.93	9.89	11.64	10.82	21.83	21.06	24.16	22.35
	I ₃	10.96	10.21	11.38	10.85	21.93	20.94	24.02	22.30
Mean of varieties		11.0**	10.04	11.96	11.02	21.98**	21.25	24.90	22.71

L.S.D at 5% level for :

Sowing date (S)	0.33	S X I	0.64	S x I x V	0.83	Sowing date (S)	0.51	S X I	0.62	S x I x V	1.24
Irrigation (I)	0.37	S x V	NS			Irrigation (I)	0.36	S x V	0.72		
Varieties (V)	0.28	I x V	0.48			Varieties (V)	0.41	I x V	0.72		

Table (5): Crop growth rate (CGR), g/day, as affected by sowing dates, irrigation intervals, wheat varieties and their interactions (combined analysis for 2012/013 and 2013/014 seasons).

Sowing dates (S)	Irrigation intervals (I)	Varieties (V)			mean
		V ₁	V ₂	V ₃	
S ₁	I ₁	0.400**	0.528	0.508	0.479**
	I ₂	0.451	0.489	0.577	0.506
	I ₃	0.363	0.454	0.529	0.449
	mean	0.405**	0.490	0.538	0.478**
S ₂	I ₁	0.432	0.424	0.534	0.463
	I ₂	0.468	0.454	0.493	0.472
	I ₃	0.452	0.441	0.456	0.450
	mean	0.451	0.440	0.494	0.462
S ₃	I ₁	0.613	0.599	0.781	0.664
	I ₂	0.487	0.505	0.548	0.513
	I ₃	0.659	0.499	0.703	0.620
	mean	0.586	0.534	0.677	0.599
Mean of irrigation intervals	I ₁	0.482	0.517	0.608	0.535**
	I ₂	0.469	0.483	0.539	0.497
	I ₃	0.491	0.465	0.563	0.506
Mean of varieties		0.481**	0.488	0.570	0.513

L.S.D at 5% level for :

Sowing date (S)	0.0182	S X I	0.0328	S x I x V	0.0675
Irrigation (I)	0.0189	S x V	0.0390		
Varieties (V)	0.0225	I x V	NS		

Table (6): Relative growth rate (RGR), g/g/day, as affected by sowing dates, irrigation intervals, wheat varieties and their interactions (combined analysis for 2012/013 and 2013/014 seasons).

Sowing dates (S)	Irrigation intervals (I)	Varieties (V)			mean
		V ₁	V ₂	V ₃	
S ₁	I ₁	0.012*	0.016	0.013	0.014*
	I ₂	0.013	0.014	0.014	0.014
	I ₃	0.011	0.014	0.014	0.013
	mean	0.012**	0.015	0.014	0.014**
S ₂	I ₁	0.011	0.011	0.012	0.011
	I ₂	0.011	0.013	0.011	0.012
	I ₃	0.013	0.013	0.012	0.013
	mean	0.012	0.012	0.012	0.012
S ₃	I ₁	0.016	0.018	0.016	0.017
	I ₂	0.015	0.015	0.016	0.015
	I ₃	0.017	0.014	0.018	0.016
	mean	0.016	0.016	0.017	0.016
Mean of irrigation intervals	I ₁	0.013*	0.015	0.014	0.014
	I ₂	0.013	0.014	0.014	0.014
	I ₃	0.014	0.014	0.015	0.014
Mean of varieties		0.013**	0.014	0.014	0.014

L.S.D at 5% level for :

Sowing date (S)	0.0005	S x I	0.0012	S x I x V	0.0019
Irrigation (I)	NS	S x V	0.0011		
Varieties (V)	0.0006	I x V	0.0011		

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تأثير مواعيد الزراعة وفترات الري على صفات النمو لبعض أصناف القمح

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اجريت هذه الدراسة من خلال اقامة تجربتان حقليتان بمزرعة التجارب بكلية الزراعة - جامعة الفيوم بناحية دمو وذلك خلال الموسمين ٢٠١٣/٢٠١٢، ٢٠١٤/٢٠١٣ لدراسة سلوك ثلاث أصناف من القمح (سحا ٩٣، سحا ٩٤، سدس ١٢) عند زراعتها فى الاراضى الجديدة المستصلحة حديثا فى ثلاث مواعيد زراعة (١ نوفمبر، ١٥ نوفمبر، ٣٠ نوفمبر) مع استخدام ثلاث فترات رى (٢١ يوم، ٢٨ يوم، ٣٥ يوم).

وقد استخدم تصميم القطع المنشقة مرتين لتنفيذ التجربة حيث وزعت المعاملات عشوائيا، وشغلت مواعيد الزراعة القطع الرئيسية وفترات الري القطع المنشقة الاولى بينما تم توزيع الأصناف فى القطع المنشقة الثانية، تم دراسة بعض الصفات الخضرية فى طور التزهير وطور النضج اللبني وذلك لتحديد أفضل ميعاد للزراعة مع افضل فترة للرى وافضل صنف ومنه يمكن الوقوف على افضل توليفة لزراعة القمح تحت ظروف الاراضى الجديده.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

- ١- وجدت فروق معنوية بين أصناف القمح على كل صفات النمو الخضرى وأيضا صفتى معدل النمو المحصولى ومعدل النمو النسبى وتفقو الصنف سدس ١٢ على الاصناف الاخرى فى جميع صفات النمو التى قيست فى هذه الدراسة.
- ٢- شوهدت فروق معنوية بين فترات الري على طول النبات وعدد الاوراق / نبات اثناء فترة النضج اللبني والوزن الجاف ومساحة اوراق النبات خلال فترتى التزهير والنضج اللبني وسجلتوايضا على صفة معدل النمو المحصولى اعلى القيم عند الري كل ٢١ يوم.
- ٣- أظهرت مواعيد الزراعة تأثيرا معنويا على صفات طول النبات وعدد الاوراق بالنبات والوزن الجاف للنبات ومساحة اوراق النبات فى فترتى التزهير والنضج اللبني وكذلك معدل النمو المحصولى ومعدل النمو النسبى. أعطى ميعاد الزراعة المتأخر أعلى القيم للوزن الجاف ومساحة اوراق النبات عند التزهير واعلى عدد للاوراق على النبات فى فترتى النمو وايضا أعلى معدل النمو المحصولى ومعدل النمو النسبى بينما اعطى ميعاد الزراعة المتوسط (١٥ نوفمبر) أطول النباتات خلال فترتى النمو وأكبر مساحة لأوراق النبات والوزن الجاف فى فترة النضج اللبني.
- ٤- لوحظت اختلافات معنوية بين التفاعلات المختلفة (مواعيد الزراعة وفترات الري، مواعيد الزراعة والأصناف، فترات الري والأصناف وايضا بين الثلاث معاملات) على معظم الصفات المدروسة وأعطى ميعاد الزراعة المبكر يليه الموعد المتوسط أو العادى مع الري كل ٢١ يوم أو ٢٨ يوم بأستخدام الصنف سدس ١٢ أعلى القيم فى أغلب صفات النمو.