Effect of Irrigation Intervals on Soybean Yield and its Components

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ABSTRACT

This investigation was conducted at Etay El-Baroud Agriculture Research Station, Beheira Governorate during 2006 and 2007 summer seasons. The study aimed to investigate the effect of irrigation intervals on two soybean lines i.e., L_{117} and L_{127} compared with commercial cultivars Giza111 and DR101.

The obtained results showed that, plant height, number of branche per plant, days from sowing to 50% flowering and days from sowing to 95 % maturity were decreased under water deficit regime (3 irrigations).Nonsignificant and /or slight decreased was observed in 100- seed weight, seed weight per plant and seed yield / feddan Ton, under water deficit regime (3irr) compared with the other water regime (6irr) . Cultivar DR101 and L117 line had the highest yield and yield components under two water regimes followed by Giza 111cultivar.

INTRODUCTION

Soybean is one of the most important oil crops all over the world. In Egypt, shortage in edible oil represents about 80% of our consumption. Soybean was introduced to the Egyptian agriculture, hopefully, to contribute in reducing oil gap. So intensive efforts have been devoted to increase soybean production through growing high yielding genotypes with proper cultural practices. Regarding cultivar differences, several investigators showed marked varietal differences in the days to flowering, maturity and seed yield (Harb *et al.* 1994, Shukla and Vasuniya, 1998 and Weilenmann, *et al.*, 1999).Regarding number of irrigations, the time was reported to be more important than the quantity of water supplied (Niazi *et al.,* 1972 and Abdallah Hussein *et al.,* 1978). Therefore, this work was designed to investigate the effect of number of irrigations at different growth stages on yield and its components of some soybean genotypes. At the present time , there is a critical balance between water requirement and water consumption , thus saving water is becoming decisive factor for agricultural expansion particularly in arid and semi-arid regions where water is the main limiting factor to plant growth. Therefore, the irrigation water should receive closer attention because of the shortage in water resources in such regions.

Achieve this goal is to reduce the prodigaling in the water use, One way to achieve this goal is to reduce the prodigaling in the water use, choose the tolerant genotypes for drought and reduce the number of irrigations through season .

The objective of the present work was to study the response of some soybean genotypes to different irrigation intervals and its effect on the yield to reduce the prodigaling in water irrigation.

MATERIALS AND METHODS

A field experiment was carried out at Etay El-Baroud Agriculture Research Station during 2006 and 2007 seasons on two genotypes of soybean (Glycine max L.) ,L_{117} and L_{127} compared to two commercial soybean cultivars Giza 111 , and DR101 (Table 1). Under two irrigation intervals systems were as follow:

-First irrigation system (control): one irrigation every 15 days (6 irrigations = 6irr)

-Second irrigation system (water deficit): one irrigation every 30 days (3 irrigations =3 irr).

-Water table was 1.06 m.

The effect of these irrigation intervals on growth, yield and its components on all genotypes was investigated.

Table (1): Pedigree, maturity group, flower color, country of origin and Pubescence type of studied soybean genotypes.

Genotypes	pedigree	Maturity group	Country of origin	Flower color	Pubescence type
D R101	Selection from Elgin	V	USA	Purple	Heavy
Giza 111	Crawford * celest	IV	Egypt	Purple	Heavy
L_{117}	D89-8940 * Giza111	III	Etay El-Baroud	white	Heavy
L_{127}	D89-8940 * Giza 22	V	Etay El-Baroud	white	normal

III= third group IV= fourth group V= fifth group

The experimental design was a spilt-plot with three replications. The main plots were randomly allocated to the two water regimes, while the sub plots were randomly assigned to the four soybean genotypes. The experimental unit included four ridges, 60 cm apart and 4. m long (9.6 m^2) soybean seeds were inoculated with *Bradyrhizobium japonicum* and sown on 15 May in both seasons in hills 15cm. apart on two sides of the ridge. After complete emergence, the seedlings were thinned to two plants / hill. The cultural practices for growing soybean were conducted properly as recommended by the Ministry of Agriculture and Land Reclamation.

Days to 50% flowering and days to 95% maturity from sowing were recorded on ten randomly labeled plants in the second and third ridges of each sub-plot. At harvest, ten plants were randomly taken from each sub-plot to determine plant height (cm.), number of branches per plant, number of pods per plant, 100- seed weight in grams, seed weight /plant in gram. Seed
yield (ton/feddan) was calculated on the four ridges.

Data obtained were subjected to the proper statistical analysis. The treatment means were compared using the new Least Significant Difference test as out lined by Steel and torrie (1980).

RESULTS AND DISCUSSION

(a) Growth characters

1-Effect of irrigation regime:

Data recorded in table (2) show that, number of days from sowing to 50% flowering and number of days from sowing to 95% maturity was significantly decreased under water deficit regime (3irr) in both seasons. While, plant height and number of branches per plant increased significantly under normal water regime (6irr) in the first season only.

Certainly the increase in plant height could be attributed to the increase in the length and number of internodes (El-Noamani *et al* 1995 a). Shortening of plants and branches under low soil moisture level may be explained that water stress caused losses in tissue water, Which reduced turgor pressure in the cell, thereby inhibiting enlargement and division of cells (Gawish, 1992). Concerning the decreasing of number of days to 50% flowering and number of days to 95% maturity under water deficit, in this concern, Abdallah Hussein *et al*, (1978) reported that spike emergence was generally delayed with increasing irrigations number in wheat plants. Moursi *et al* (1978) noticed delayed flowering by heavy irrigation in cotton plants. Also, Mahmoud *et al*,(1995) indicated that less of water helped

some faba bean entries to mature early and allow to decrease facing period with diseases.

Table (2): Effect of water of regime and genotypes on some agronomic traits of soybean in 2006 and 2007 seasons.

Treatments	Days to 50% flowering		Days to 95% Maturity		Plant height (cm)		No of branches per plant	
	2006	2007	2006	2007	2006	2007	2006	2007
Water regime (I)								
Control (6 irr)	43.47	44.27	124.0	125.4	70.27	73.95	1.23	1.19
Drought (3irr)	38.95	38.97	115.3	117.2	65.95	49.24	0.97	1.04
L.S.D at 5%	2.48	1.43	3.10	2.27	0.92	N.S.	0.27	N.S.
Genotypes (G)								
DR 101	47.65	46.80	126.9	142.95	67.60	70.10	1.63	1.68
Giza 111	39.45	39.60	117.45	118.10	77.80	80.10	0.78	0.93
L_{117}	37.95	38.95	116.15	116.95	71.95	75.80	1.19	1.13
L_{127}	39.80	41.15	118.15	121.00	61.27	58.15	0.79	0.71
L.S.D at 5%	2.91	1.37	3.01	1.44	3.44	3.47	0.19	0.1

2-performance of genotypes:-

The results in table (2) marked differences among soybean cultivars in most of the studied characteristics. It is obvious to note that the latest genotype in flowering and maturity was DR101 followed by L_{127} , genotype, respectively, while the earliest one was L_{117} genotype. The tallest plants were for Giza111 and L_{117} genotypes, respectively. While the shortest plants were recorded for L_{127} followed by DR101 cultivar in both seasons. These results may be attributed to the interaction between cultivars genetic make up and environment that determines the relative length of vegetative and reproductive growth phases. Similar results were obtained by El-Atter and Sharaf, (1993), El-Karamity, (1998). It is of important to note that, DR101cultivar and L_{117} lines significantly surpassed all studied cultivars in number of branches per plant in the first and second seasons, respectively, while the lowest number of branches plant were recorded for L_{127} genotype.

b- Yield and its components:-

(1) Effect of irrigation regimes :

Data presented in table (3) indicate clearly that there is a slight and or no significant differences in 100-seed weight ,seed weight per plant as well as number of pods per plant and total yield per fedd., as water irrigations

increased (6irr).Similar results were obtained on snap bean by Moursi *et al* (1978) and Merghany (1999), how emphasized the idea that the availability and supply of soil moisture, not only, governed the rate and type of growth, but also commende the availability of plant nutrients. At the time, he emphasized the harmful effects of excessive irrigation, which resulted in more vegetative growth with no additional yield in Faba bean plants In this regard , Jaquiery and Keller (1980), who found that, irrigation favors vegetative growth at the expense of reproductive growth. Therefore, the flowering abscission increased under excessive irrigation condition.

(2)performance of genotypes :

It is of important to note that DR101cultivar and L_{117} lines significantly surpassed all studied genotypes in seed weight per plant and seed yield per feddan in both seasons(table 3). While, the lowest values of these traits were recorded for L_{127} line followed by Giza111 cultivar in both seasons .These findings could be attributed to differences among the studied genotypes regarding maturity group, therefore, the response of each one to environmental conditions prevailed during growing seasons were governed by genetics factors. This was clearly reflected on the growth characters; consequently yield components (Atta Allah, 2001).Drought tolerance is a complex agronomic trait with mutagenic components, which interact in a holistic manner in plant systems (Cushman and Bohnert, 2000).

Table (3): Effect of water regime and genotypes on some agronomic traits of soybean in 2006 and 2007 seasons.

Treatments	No. of pods Per plant		Seed weight Per plant(g)		100-seed weight(g)		Seed yield (ton/fedd.)	
	2006	**2007**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**
				Water Regime (W. R)				
Control (6 irr)	42.72	50.85	15.12	16.09	17.79	18.37	1.409	1.537
Drought (3irr)	40.94	42.28	12.52	13.76	16.49	17.25	1.273	1.598
L.S.D at 5%	N.S.	6.44	2.35	2.98	1.04	N.S.	N.S.	0.04
				Genotypes (G)				
DR 101	33.34	35.56	15.57	15.30	19.98	21.34	1.654	1.835
Giza 111	42.16	41.83	13.34	12.98	17.72	18.09	1.387	1.569
L_{117}	49.79	59.40	15.99	17.98	14.46	15.09	1.522	1.668
L_{127}	42.09	49.48	10.38	13.39	16.40	16.73	1.026	1.199
L.S.D at 5%	3.65	4.81	1.76	1.89	0.70	0.94	0.11	0.15

3- Genotypes * water regimes:

Results of tables 4 and 5 demonstrate that water regimes * genotypes interaction had significant effect on number of branches per plant in 2006 and 2007seasons, plant height, and number of pods per plant in the first season and days to 50% flowering in the second season. The highest value for plant height was produced for Giza111Cultivar, under normal water regime (6irr). The maximum number of branches in the first season were recorded for DR101 cultivar, followed by L_{117} line, respectively, with normal water regime (6irr). The lowest values for plant height and number of branches per plant were recorded for L_{127} line under water deficit regime (3irr).

In summary , it can be concluded that the genotypes DR101 and L_{117}had the highest seed yield per feddan under water deficit conditions in terms of saving water irrigation.

Table (4): Interaction between water of regime and genotypes on some agronomic traits of soybean in 2006 and 2007 seasons.

Treatments	days to 50% Flowering		days to 95% Maturity		Plant height (cm)		No of branches per plant	
	2006	2007	2006	2007	2006	2007	2006	2007
Control(6 irr)								
DR 101	50.0	50.6	132.2	133.6	70.6	72.6	1.80	1.86
Giza 111	42.3	41.6	121.6	122.6	80.6	84.6	0.93	1.00
L_{117}	39.3	40.6	120.0	120.6	73.3	78.3	1.33	1.13
L_{127}	42.3	44.3	122.3	125.0	56.6	60.3	0.86	0.80
Mean	43.47	44.27	124.0	125.4	70.27	73.95	1.23	1.19
Drought(3 irr)								
D R101	45.3	43.0	121.6	152.3	64.6	67.6	1.46	1.50
Giza 111	36.6	37.6	113.3	113.6	75.0	75.6	0.63	0.90
L_{117}	36.6	37.3	112.3	113.3	70.6	73.3	1.06	1.13
L_{127}	37.3	38.0	114.0	116.6	53.6	56.0	0.73	0.63
Mean	38.95	38.97	115.3	117.2	65.95	49.24	0.97	1.04
L.S.D at5%(I*G)	N.S.	1.94	N.S.	N.S.	4.87	N.S.	0.26	0.15

W.R = Water Regime G = Genotypes

Table (5): Effect of water regime , genotypes and their interaction on some agronomic traits of soybean in 2006/ 2007 seasons.

Treatments	No. of pods Per plant		Seed weight per plant(g)		100-seed weight (g)		Seed yield (ton/fedd.)	
	2006	2007	2006	2007	2006	2007	2006	2007
Control(6irr)								
DR 101	33.86	37.13	16.32	15.43	20.45	21.89	1.699	1.841
Giza 111	39.66	47.53	15.09	14.99	18.95	19.31	1.365	1.496
L_{117}	54.63	66.40	17.83	20.18	14.75	15.18	1.487	1.624
L_{127}	42.75	52.37	11.24	13.77	17.04	17.13	1.086	1.189
Mean	42.72	50.85	15.12	16.09	17.79	18.37	1.409	1.537
Drought(3irr)								
DR101	32.83	34.0	14.83	15.27	19.52	20.79	1.610	1.829
Giza111	44.66	36.13	11.59	10.98	16.50	16.88	1.409	1.643
L_{117}	44.86	52.40	14.16	15.78	14.18	15.01	1.557	1.713
L_{127}	41.43	46.60	9.53	13.02	15.76	16.34	0.967	1.209
Mean	40.94	42.28	12.52	13.76	16.49	17.25	1.273	1.598
L.S.D at 5% (W.R*G)	5.18	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

W.R = Water Regime G = genotypes

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الملخص العربى

تأثيرفترات الرى على محصول فول الصويا و مكوناته

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أجرى هذا البحث بمزرعة محطة البحوث الزراعية بإيتاى البارود محافظة البحيرة خلال موسمى٢٠٠٦ /٢٠٠٧ بهدف دراسة إستجابة صنفين من فول الصويا هما : جيزة ١١١،DR101 بالإضافة لسلالاتين جديدتين هماL_1 L_{117}، L_{127} تنتمى لثلاث مجاميع من النضج لفترات مختلفة من الرى هما :-

(١) الرى العادى و هو عبارة عن رية كل ١٥ يوم شملت ٦ ريات على مدار موسم النمو.

(٢) معدل نقص الريات وشمل ٣ ريات على مدار موسم النمو

وتلخصت النتائج فى التالى:-

١- أدت معاملة الكنترول (٦ ريات) إلى زيادة فى طول النبات ،عدد الفروع لكل نبات وزن مائة بذرة، وزن بذور النبات بالجرام و تراوحت هذه الزيادة ما بين المعنوية و غير المعنوية فى موسم دون آخر .

٢- أدت معاملة نقص عدد الريات (٣ ريات) إلى نقص فى عدد الأيام من الزراعة حتى تزهير ٥٠% من النباتات وعدد الأيام من الزراعة حتى نضج ٩٥% من النباتات .

٣- كانت هناك زيادة غير معنوية فى الموسم الأول فى محصول بذور الفدان بالطن تحت ظروف معاملة الكنترول (٦ ريات) و زيادة معنوية بسيطة في الموسم الثاني .

٤- اختلفت الأصناف معنويا فى كل الصفات تحت الدراسة وكان أكثر الصفات تبكيراً فى الإزهارو النضج السلالة L_{117} وأقصرها فى طول النبات L_{127}

٥- كان الصنف جيزة ١١١ هو أطول التراكيب طولا.

٦- أظهر الصنف DR101 و السلالة L_{117} أعلى محصول فى وزن بذور الفدان بالطن على الترتيب.

٧- كان التفاعل بين أنظمة الرى و الأصناف معنويا لطول النبات، وعدد الأفرع / نبات و عدد القرون / نبات فى الموسم الأول تحت ظروف معاملة الكنترول(٦ ريات).