

STUDIES OF SOME SEED CHARACTERISTIC OF SUNFLOWER UNDER HARDENING TO DROUGHT TOLERANCE

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ABSTRACT

Experiment was conducted during spring season of 2000 and 2001 at Experimental Station of Soil and Water Department , Iraqi Atomic Energy Commission. To evaluate the tolerance of two hybrids (Euroflor and Flame) to drought stress: control (full irrigation) 800, and 600 Kpa. by hardening the seeds before sowing: control (unsoaked), soaking in water, paclobutrazol solution (250ppm) and pix solution (500ppm). The soaking continued for 24 hours then the seeds were dried at room temperature until they regained their original weight. A split-split plot design was used with three replication. The main-plots included the irrigation treatments, the sub-plots were the hybrids and the sub-sub-plots represented soaking treatments. The weight of the mean achene, the weight of husk and kernel, percentage of kernel and husk , oil, protein and carbohydrate contents of dried achenes were determined. The results indicated that water stress 800 Kpa decreased carbohydrate content by 4.8% than control in season 2000. Euroflor cultivar was superior over Flame in kernel weight by 5.8% , kernel percentage by 3.7% and oil content by 6.7%. Soaking in water and paclobutrazol solution increased seed content of oil by 4.1 and 4.3% and decreased carbohydrate content by 6.1 and 4.6%, respectively than control as a mean of seasons. Soaking in paclobutrazol solution decreased protein content by 4.7% than control in season 2000. The interaction between irrigation, cultivars and soaking showed a negative association between oil, protein and carbohydrate in sunflower achenes . Therefore, this study suggests that soaking the seeds presowing in water or plant growth regulators is convenient practice to increase drought tolerance.

INTRODUCTION

Sunflower is a crop grown mainly in the Mediterranean and some other tropical and subtropical regions characterized by semi-arid environments, where (D' Amato and Giordano, 1988; Quaglietta, 1991, 1992) The seed weight and

seed number per head are considered together because they are strictly dependent as yield components, on water deficit, in fact their adjustment follows a compensation mechanism well known in sunflower (Vannozzi et al, 1999 and Merrien, 1986). Seed weight is a characteristic which is often strongly influenced by water availability (Ferreles et al, 1986 and Gimenez and Fereres, 1986), so seed growth rate (SGR) (Baldini and Vannozzi, 1999) and husk:kernel ratio (Tomar et al, 1997) were higher under wet conditions than under drought. The oil content in sunflower achenes mainly depends on proportions of husk and kernel (Fick, 1978), the water and high temperatures (Murieal and Downes, 1974 and Fereres et al, 1986), plant growth regulators (Aboushoba et al, 1984). Fernandez-Martinez and Dominguez-Gimenez (1985) in a study of the variability of the characteristic of sunflower seeds, found values between 23 and 56% of oil in the achenes. According to Tripathi and Sawhney (1989); Kumar et al (1991) and Tomar et al (1996) wet conditions strongly related to dry matter production as well as to oil supply.

It is now certain that plant growth regulators effects seeds weight (Pande and Srivestavce , 1988 and Attiya and AL-Mubarak ,1999). However seeds weight were also significantly more in plants derived from treated seeds (Basu and opadey,1983). Reports on effect of plant growth regulators on seed quality are conflicting , cycocle had an insignificant effect on carbohydrate,oil and protein in sunflower seeds (Abous- hoba etal , 1984) , also paclobutrazol had an insignificant effect on seed oil content (Attiya ,1996) . Inhibitory effects of diverse groups of growth retardants on protein synthesis is well documented (Berry and Smith,1970). Dublijanskaja and Suprunova (1969) and Giordanic and cuichini (1970) found anegative association between oil aa protein content in sunflower seeds. The objectives of this experiments were to study some seed characteristics of sunflower under hardening conditions to drought tolerance.

MATERIALS AND METHODS

The experiment were conducted at Experimental Station of Soil and Water Department , Iraqi Atomic Energy Commission .during the spring season of 2000 and 2001. The seeds were hill planted apart 75cm ridges and 25cm between hills on the 15th of March 2000 and 13th of March 2001.The seedling were thinned after about 3 weeks from sowing to one plant per hill.Asplit- split plots design was used with three replicati-

ons, the main plot included the irrigation treatment:irrigation to100% (full irrigation), 75%(600 Kpa) and 50%(800 Kpa) of available water.The sub plots were the cultivars were (Euroflor and Flame). The sub-sub plots represented four soaking treatments: control (unsoaked),soaking in water, paclobutrazol solution (250ppm) and pix solution (500ppm).The soaking continued for 24 hours then seeds were dried at room tempera- ture until they regained their original weight .Soil water content was measured with a neutron probe. Agricultural practices were carried out as usual. The following chara- cters were studied: mean achene weight (m.a.w.),the value of m.a.w. was determined as the arithmetical average of the mean weight of three samples containing 100 chene randomly chosen, kernel weight (m.a.k.c.)and husk weight (m.a.h.c.)of the mean achene ,kernel and husk percentage(%).The achenes quality oil (o.c.d.a.%), protein (p.c.d.a.%) and carbohydrate (c.c.d.a.%) were estimated by using Infrared Analyzer.All the data were subjected to the statistical analysis using Mstat program, and the mean values were compared by (L.S.D.) test.

RESULTS AND DISCUSSION

Although the experimental data (table.1) related to the weight distribution between the tow main parts of sunflower achenes (kernel and husk) , and macrocomposition of the achenes . Only the achenes sample coming from water stress 800 Kpa portion at season 2000 seem to show the existence of significant decrease in carbohydrate content by 4.8% than control. The oil, protein and carbohydrate content in sunflower achenes mainly dep- ends on the proportions of husk and kernel (Fick,1978) the water stress and high temper- atures (Muriel and Downes ,1974 ; Fereres etal , 1986 and Fernandez-Martinez and Dominguez-Gimenez,1985).

The cultivars tested appear to be differences in kernel and husk weight ,kernel %, husk % and seed content of oil in season 2001 and as amean of seasons (table .2) . Euro- flor hybrid was superior over Flame in kernel weight by 5.8 % , kernel % by 3.7 % and oil content by 6.7 %as amean of seasons.This may be due to the differfnce between genot- ypes in ability to interaction

with environmental conditions , and the difference in oil content probably due to the weight distribution between kernel and husk .These results agreed with those reported by (Dorrel,1978; Merrien et al,1981;Andrich et al,1996 and Attiya,1996).

It is clear from the data that soaking in water and paclobutrazol solution had a significant effect on seed content of oil in season 2000 and as a mean of seasons (table.3). The increased in oil content were 4.1 and 4.3% than control as a mean of seasons, respectively. In contrast, decreased the carbohydrate content by 6.1 and 4.6 % than control as a mean of seasons, respectively. Soaking in paclobutrazol solution decreased protein content significantly by 4.7 % than control in season 2000. It was noticed that the treatments which had highest oil content associated with the lowest protein and carbohydrate content. This results agreed with those reported by (Dublijanskaja and Supranova,1969; Giordani and Cichini,1970; Naggpa,1983 and Aboushoba et al,1984).

Table.1, Effect of water stress on weight of the mean achene (m.a.w.), kernel and husk weight of mean achene (m.a.k.c. and m.a.h.c.) , kernel% , husk% , percentage of oil (%o.c.d.a.), protein (%p.c.d.a.) and carbohydrate(%c.c.d.a.) in the achenes during season 2000,2001 and as a mean of two seasons.

Irr. treat.(kpa)	M.a.w. (mg)	m.a.k.c. (mg)	m.a.h.c. (mg)	kernel (%)	husk (%)	o.c.d.a. (%)	p.c.d.a. (%)	c.c.d.a. (%)
season 2000								
control	52.70	40.36	12.34	76.61	23.39	43.46	20.78	18.60
21.38	17.75	600	54.8	42.18	12.71	76.88	23.13	44.43
				800	51.59	39.34	12.25	76.14
		L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
								0.524
season 2001								
control	58.01	42.71	15.30	73.59	26.41	44.38	22.40	17.66
	600	56.05	41.60	14.45	74.18	25.83	46.11	22.49
	800	55.88	41.63	14.25	74.33	25.68	44.65	22.61
	L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Mean seasons								
control	55.36	41.54	13.82	75.10	24.9	43.92	21.59	18.13
	600	55.47	41.89	13.58	75.53	24.48	45.27	21.92
	800	53.74	40.49	13.25	75.24	24.77	43.95	22.00
	L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

This data from tab.4, showed that the interaction between irrigation, cultivars and soaking had significant effect on oil , protein and carbohydrate content of achenes . A clear trend increased oil content decreasing protein and carbohydrate content were obtained. Steer et al (1984) found that most protein accumulation in sunflower achenes occurs early in the first anthesis period, While in contrast, accumulation of oil commences 7-14 days after anthesis, reaching a maximum one week before physiological maturity (Goffner et al,1988). This asynchrony and

continuing oil accumulation has the effect of diluting protein and may be the major cause of the inverse relationship between oil and protein concentration in achenes (Conner and Sadras, 1992). Therefore, this study suggest that soaking the seeds presowing in water or plant growth regulators is convenient practice to increase drought tolerance.

Table.2, weight of the mean achene (m.a.w.), kernel and husk weight of mean achene (m.a.k.c. and m.a.h.c.), kernel%, husk%, percentage of oil (%o.c.d.a.), protein (%p.c.d.a.) and carbohydrate(%c.c.d.a.) in the achenes of cultivars during season 2000, 2001 and as a mean of tow seasons.

cultivars	M.a.w.	m.a.k.c.	m.a.h.c.	kernel	husk	o.c.d.a.	p.c.d.a.	c.c.d.a.
	(mg)	(mg)	(mg)	(%)	(%)	(%)	(%)	(%)
season 2000								
Euroflor	51.98	39.80	12.10	76.69	23.31	45.22	20.85	18.20
N.S.	N.S.	Flame	54.13	41.37	12.77	76.39	23.61	42.20
			L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.
season 2001								
Euroflor	58.91	45.19	13.72	76.71	23.29	46.62	22.13	16.66
	Flame	54.38	38.79	15.62	71.35	28.65	43.48	22.88
		L.S.D.0.05	3.61	3.08	1.04	0.95	0.95	1.97
							N.S.	0.85
Mean seasons								
Euroflor		55.45	42.54	12.91	76.70	23.30	45.92	21.49
	Flame	54.26	40.08	14.20	73.87	26.13	42.48	22.18
		L.S.D.0.05	N.S.	2.14	0.64	0.98	0.60	1.76
							N.S.	N.S.

Table.3, Effect of soaking treatments on weight of the mean achene (m.a.w.), kernel and husk weight of mean achene (m.a.k.c. and m.a.h.c.), kernel%, husk%, percentage of oil (%o.c.d.a.), protein (%p.c.d.a.) and carbohydrate (%c.c.d.a.) in the achene during season 2000, 2001 and as a mean of tow seasons.

soaking treat.	M.a.w. (mg)	m.a.k.c. (mg)	m.a.h.c. (mg)	kernel (%)	husk (%)	o.c.d.a. (%)	p.c.d.a. (%)	c.c.d.a. (%)
season 2000								
control	52.13	40.02	12.12	76.65	23.35	42.70	21.48	18.25
water		53.00	40.62	12.38	76.60	23.40	44.98	21.20 17.45
paclobutrazol	53.23	40.83	12.40	76.68	23.32	44.97	20.52	17.82
pix	53.87	41.03	12.83	76.23	23.77	42.18	21.45	18.97
	L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.	1.84	0.57 N.S.
season 2001								
control	55.67	41.02	14.65	73.77	26.23	44.35	22.47	17.90
water		59.77	44.42	15.35	74.27	25.73	45.75	22.58 16.62
paclobutrazol	54.62	40.27	14.35	73.62	26.38	46.05	22.85	
pix	56.53				16.73			
		42.22	14.32	74.47	25.53	44.03	22.10	18.02
	L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	1.06
Mean seasons								
control	53.90	40.52	13.39	75.21	24.79	43.53	21.98	18.08
water		56.39	42.52	13.87	75.44	24.57	45.37	21.89 17.04
paclobutrazol	53.39	40.55	13.38	75.15	24.85	45.51	21.69	1
pix	7.28 55.20	41.63	13.58	75.35	24.65	43.11	21.78	18.50
	L.S.D.0.05	N.S.	N.S.	N.S.	N.S.	N.S.	1.53	N.S. 0.75

Tab.4, Effect of the interaction between irrigation, cultivars and soaking treatments on percentage of oil, protein and carbohydrate in the achene during season 2000, 2001 and as a mean of two seasons.

Irr.	Cultiv.	Soak.	%o.c.d.a.	%o.c.d.a.	%o.c.d.a.	%p.c.d.a.%
			p.c.d.a.	%p.c.d.a.%	c.c.d.a.%	c.c.d.a.%

	treat	treat.	2000	2001	mean	2000	2001	mean	2000	2001			
control	Eur.♂		control	44.7	48.20	46.45	21.90	21.60	21.75	20.30	17.90	19.10	
		water	48.40	49.70	49.05	19.70	22.20	20.95	18.00	15.90	16.95		
		paclo.	48.70	41.70	45.20	17.60	24.70	21.15	17.70	19.00	18.35		
		pix	45.80	44.50	45.15	19.20	20.50	19.85	21.60	17.80	19.70		
	Fla.♂		control	39.30	38.50	38.90	21.70	22.10	21.90	17.30	19.30	18.30	
		water	37.60	40.60	39.10	23.20	22.60	22.90	18.60	17.80	18.20		
		Paclo.	39.00	44.10	41.55	21.10	23.70	22.40	17.60	17.80	17.70		
		pix	44.20	47.70	45.95	21.80	21.80	21.80	17.70	15.80	16.75		
	600	Eur.♂		control	46.90	48.10	47.50	22.00	22.30	22.15	16.60	15.10	15.85
			water	44.90	47.10	46.00	21.80	22.50	22.15	16.10	16.50	16.30	
paclo			42.10	47.90	45.00	22.80	21.80	22.30	19.50	15.70	17.60		
pix			42.10	49.40	45.75	21.40	21.80	21.60	17.70	15.80	16.75		
Fla.♂			control	41.20	40.80	41.00	20.20	23.10	21.65	20.20	21.50	20.85	
		water	47.10	44.80	45.95	20.30	24.10	22.20	18.40	17.80	18.10		
		Paclo.	48.80	49.00	48.90	19.90	21.30	20.60	17.30	17.30	17.30		
		pix	42.30	41.80	42.05	22.30	23.00	22.65	18.30	20.00	19.15		
800		Eur.♂		control	44.80	45.70	45.25	21.00	22.00	21.50	18.00	16.70	17.35
			water	47.40	48.90	48.15	20.60	21.50	21.05	15.60	14.30	14.95	
	paclo.		46.90	47.10	47.00	20.50	21.90	21.20	17.20	15.20	16.20		
	pix		39.90	41.10	40.50	21.70	22.70	22.20	20.10	20.00	20.05		
	Fla.♂		control	39.30	44.80	42.05	22.10	23.70	22.90	17.10	16.90	17.00	
		water	44.50	43.40	43.95	21.60	22.60	22.10	18.00	17.40	17.70		
		Paclo.	44.30	46.50	45.40	21.20	23.70	22.45	17.60	15.40	16.50		
		pix	38.80	39.70	39.25	22.30	22.80	22.55	18.40	18.70	18.55		
	L.S.D.0.05		1.84	N.S.	1.53	0.57	N.S.	0.48	N.S.	1.06	0.75		

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دراسة بعض صفات بذور زهرة الشمس تحت ظروف التطويع لتحمل الجفاف

كامل مطشر مالح الجبوري/كلية العلوم-جامعة بغداد-العراق

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نفذت الدراسة خلال الموسمين الربيعيين 2000 و 2001 في محطة أبحاث قسم التربة والمياه التابع لمنظمة الطاقة الذرية العراقية (الملغاة). لتقدير تحمل صنفين من زهرة الشمس (يوروفلور وفلامي) للشد المائي : المقارنة (ألري الكامل) والشد 600 و 800 كيلوباسكال ، وذلك بتقسية البذور قبل الزراعة بمعاملات النقع: المقارنة (من دون نقع) والنقع في الماء والنقع في محلول الكلثار (250 جزء من المليون) والنقع في محلول البكس (500 جزء من المليون) ، لمدة 24 ساعة ثم تجفيف البذور هوائياً حتى تستعيد وزنها الأصلي قبل النقع . أستعمل ترتيب الألواح المنشقة-المنشقة بتصميم القطاعات العشوائية الكاملة (RCBD) وبثلاث مكررات . قدر متوسط أوزان البذور وأوزان اللب والقشور ونسبة اللب % ونسبة القشور % ومحتوى البذور من الزيت والبروتين والكربوهيدرات . أنخفض محتوى البذور من الكربوهيدرات بنسبة 4.8 % عند مستوى الشد 800 كيلوباسكال مقارنة مع ألري الكامل . وتفوق الصنف يوروفلور على الصنف فلامي في معدل وزن اللب بنسبة 5.8 % ونسبة اللب بنسبة 3.7 % ومحتوى البذور من الزيت بنسبة 6.7 % . أدى نقع البذور في الماء أو في محلول الكلثار الى زيادة محتوى البذور من الزيت بنسبة 4.1 و 4.3 % وخفض محتوى الكربوهيدرات بنسبة 6.1 و 4.6 % على التوالي عن معاملة من دون نقع في متوسط الموسمين ، وخفض محتوى البذور من البروتين بنسبة 4.7 % عن معاملة المقارنة في الموسم 2000 عند النقع في محلول الكلثار. أظهر التداخل بين معاملات ألري والأصناف ونقع البذور علاقة سلبية بين محتوى البذور من الزيت والبروتين والكربوهيدرات. يستنتج من هذه الدراسة أهمية نقع البذور قبل الزراعة في الماء أو محاليل منظمات النمو لزيادة تحمل الجفاف.