

# INFELUNCE OF VERNALIZATION AND FERTILIZATION ON SQUASH PRODUCTIVITY AT WINTER SEASON.

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## ABSTRACT

A field experiment was conducted at the farm of Faculty of Agriculture, Moshtohor, Benha University during the 1998/1999 and 1999/2000 winter seasons. The study aimed to evaluate the productive characteristics of two squash cultivars (Eskandarani and Arlika F<sub>1</sub> hybrid) that fertilized through 100% biogas fertilizer, 50% biogas + 50% mineral fertilizer and 100% mineral fertilizer on nitrogen basis (60 kg N/ feddan) with or without seed vernalization. Treatments were arranged in split plot design where cultivars were located in the main plots, vernalization in subplots and fertilization in sub-sub plots. Vegetative growth characteristics, leaves photosynthetic pigments, foliage chemical constituents, flowering behavior, early and total yield and fruit quality were studied.

As evident, Arlika hybrid was better than Eskandarani and the effect of vernalization and that of 100% biogas fertilization was obvious.

**Keywords:** Winter squash, varieties, vernalization, biogas and mineral fertilizers, vegetative growth, flowering, yield and quality.

## INTRODUCTION

Squash is one of the popular vegetable crops in Egypt. Its cultivated area is about 90 thousand feddans (fdn) which produce about 660 thousand tons, according to the institute of Agricultural Economics and statistics in Egypt, 1999.

El-Askandarany cultivar is widespread in Egypt and Arlika F<sub>1</sub> hybrid belongs to *Cucurbita pepo*. Arlika was reported to have high productivity along with a good quality fruits.

The effect of biogas manure alone or with mineral fertilizers on some vegetable crops was reported (El-Shimi, 1998 and Ali, 2000). Also the positive effect of seed vernalization on vegetable crops productivity was observed by (Higazy *et al*, 1976; Shafshak, 1987; Abdallah, 2000, and Ali, 2000).

The present study aimed to obtain information on the effect of seed vernalization and fertilization system on Elskandarany and Arlika F<sub>1</sub> hybrid productivity during winter seasons.

## MATERIAL AND METHODS

Winter experiment was performed at the farm of Faculty of Agriculture, Benha University. The effect of mineral and organic fertilization as well as vernalization on El-Askandarany and Arlika F<sub>1</sub> hybrid cultivar characteristics and productivity were studied. Environmental temperature and relative humidity during the study is presented in Table 1. The soil was clayey loamy (7.4% coarse sand, 16.8% fine sand, 34.8% silt, 40.9% clay) with pH 7.5.

**Table 1. Air temperature and relative humidity at 1998/1999 and 1999/2000 winter seasons.**

Items	1998/99 season				1999/2000 season			
	Temperature, °C		Relative humidity, %		Temperature, °C		Relative humidity, %	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
October	32.0	18.3	84	30	29.7	17.5	82	36
November	26.6	15.2	82	37	28.0	14.5	82	30
December	21.5	11.4	80	39	23.2	10.8	82	38
January	20.9	8.7	84	38	19.1	9.2	86	44

Treatments were arranged in split-split plot design with 3 replicates. Cultivars (c.v. Eskandarany & Arlika F<sub>1</sub> hybrid) were arranged in the main plots, vernalization (non or vernalized seed) in sub-plots and fertilization systems (Table 2) in sub-sub plots.

Seeds were sown in hills, 85 cm apart, on one side of the ridge of 4 meters in length and 80 cm in width. Thinning took place after complete germination. Biogas fertilizer was added to the soil before sowing and incorporated into the soil before ridging each experimental plot. Biogas/fdn was 15-m<sup>3</sup> mineral fertilizer was added 3 and 5 weeks after seed sowing (Table 2). Vernalization was conducted by immersing seeds in water for 2 hrs, then put in 1 °C for 24 hrs before sowing.

**Table 2. Squash fertilization system tested.**

Treatment No.	Fertilization system	Kg N/ fdn
1	100% biogas (15 m <sup>3</sup> /fdn)	60
2	50% biogas + 50% mineral*	60
3	100% mineral*	60

\* A mixture of potassium sulphate (48 % K<sub>2</sub>O), calcium super-phosphate (15.5% P<sub>2</sub>O<sub>5</sub>) & ammonium sulphate (20.5% N) were added at a ratio of 1:3:3 from the fertilizer.

Data recorded were, vegetative growth characteristics, leaves chemical composition, flowering behavior, fruit yield and fruit quality.

Photosynthetic pigments (chlorophyll a, b and a+b) as well as fruit dry weight, carbohydrates, fiber, total soluble solids (TSS%) were determined according to A.O.A.C. (1970). Total N, phosphorus (P) and Potassium (K) in digested dry matter of plant leaves and fruits were determined according to Pregal (1945) Murphy & Riely (1962) as modified by John (1970) and Brown & Lilleland (1946). Statistical analysis (split-split plot design) was made after Gomez & Gomez (1983).

## RESULTS AND DISCUSSION

### Vegetative growth characteristics:

Table 3 illustrates the effect of cultivar, seed vernalization and fertilization system on vegetative growth characteristics of squash cultivars during 1998/1999 and 1999/2000 winter seasons. The vegetative growth characteristics tested were stem length, stem diameter, fresh weight. Dry weight, plant height, number of leaves, weight of leaves, leaf area and weight of stem.

As for the tested cultivars, Eskandarany had greater vegetative growth than Arlika generally. However, stem diameter and plant height was nearly similar between cultivars in the second season. Leaf area was insignificant different between cultivars in both seasons. Vernalization treatment increased stem diameter, fresh weight, plant height, number of leaves and weight of leaves in the first season only. It increased dry weight in both seasons. Leaf area was not affected by vernalization treatment. Biogas fertilizer (100%) had greater positive effect on squash vegetative growth than 50% Biogas + 50% mineral fertilizer. The later had better effect than mineral fertilizer (100%) generally. The general trend of interactions showed insignificant differences.

Elgouhary (1977) found insignificant differences in leaf area when comparing different squash cultivars at summer period and significant differences at Nile period. More experiments on pea were conducted by Higazy et al (1976), Shafshak (1987) and Abdallah (2000) indicated that vernalization enhanced fresh and dry weight. Ali (2000) observed that pea seed vernalization had no effect on stem length and had significant effect on fresh and dry weight, So, cleared that biogas treatment enhanced plant vegetative growth more than 50% Biogas + 50% mineral fertilizer working on pea.

#### **Photosynthetic pigments:**

Table 4 indicates the effect of cultivar, vernalization and fertilization on leaves photosynthetic pigments of squash during 1998/1999 and 1999/2000 winter seasons.

As for cultivars, Arlika leaves contained more chlorophyll A, b and a+b than Eskandarani. Vernalization tended to increase chlorophyll a and a+b. the biogas fertilizer had better significant effect than 50%biogas+ 50% mineral fertilizer and the later had better effect than the 100% mineral fertilizer. The interactions were in the same direction to that indicated above.

Abdallah (2000), Mady (2000) and Ali (2000) stated that vernalization increased photosynthetic pigments. El-Shimi (1998) observed that the highest photosynthetic pigments were with biogas fertilizer + mineral fertilizer. Ali (2000) indicated the positive effect of biogas alone or along with mineral fertilizer (1:1) on photosynthetic pigments.

#### **Plant foliage content of NPK:**

Table (4) show the effect of cultivar, vernalization and fertilization on foliage N, P and K contents of squash during 1998/1999 and 1999/2000 winter seasons.

**Table 3. Effect of cultivar, seed vernalization and fertilization system on vegetative growth characteristics of squash cultivars during 1998/1999 and 1999/2000 winter seasons.**

Cultivar	Ver.	Fertilization systems	Plant height , cm	Stem diameter ,cm	Plant fresh weight ,g	Plant dry matter ,g	Leaves weight , g	Leaf area , cm <sup>2</sup>	No. of leaves
<b>1998/1999 winter season</b>									
1			181.83	2.32	1022.9	125.40	369.4	54.92	25.61
2			84.83	2.08	716.9	78.51	277.5	38.37	18.56
LSD			7.06	0.15	57.5	7.55	10.41	NS	0.86
1			95.33	2.12	486.8	97.25	316.44	39.10	20.55
2			91.33	2.28	893.1	106.70	330.05	54.19	23.61
LSD			2.37	0.12	16.56	1.12	9.52	NS	0.38
		1	101.75	2.41	959.2	116.76	351.25	53024	24.58
		2	93.83	2.23	859.4	99.84	320.83	49022	21.42
		3	84.42	1.97	791.3	89.24	298.33	37.48	20.25
		LSD	2.58	0.07	12.51	3.95	6.72	9.38	0.53
<b>1999/2000 winter season</b>									
1			62.64	2.91	652.2	75.52	245.80	21.44	17.39
2			59.72	2.66	583.3	58.78	215.00	20.39	13.89
LSD			NS	NS	64.91	11.19	19.74	NS	1.80
1			60.02	2.47	601.4	62.82	223.16	21.67	15.50
2			62.33	2.82	634.2	71.47	237.22	20.16	15.78
LSD			NS	NS	NS	5.44	NS	NS	NS
		1	68.92	2.98	718.3	81.34	247.92	24.41	17.25
		2	61.67	2.76	601.3	64.41	232.50	22.13	15.75
		3	52.96	2.61	533.8	55.70	210.80	16.20	13.92
		LSD	2.84	0.08	22.5	3.02	6.57	NS	0.50

Cultivars are (1) Eskandarani & (2) Arlika.

Ver., Vernalization is (1) Non-Vernalized & (2) vernalized.

Fertilizer systems are 1) 100% Biogas, 2) 50% Biogas + 50% Mineral & 3) 100% Mineral.

LSD, Least significant differences at .05 level.

NS, not significant.

The cultivars tested contained nearly similar N and P, however K was higher in the first season with Arlika and in the second season with Eskandarani. Vernalization tended to have an effect regarding N in the first season and K in the second. The 100% biogas fertilizer tended to increase N < P and K content of plant foliage more than the other fertilizers in general. The 50% biogas+50% mineral fertilizer tended to increase foliage N, P and K insignificantly than the 100% mineral fertilizer. The interaction effects were insignificant in most cases.

The effect of low temperature on increasing foliage N, P and K content was reported (Abdalla *et al.*, 1983; Shafshak, 1983, Gabal, 1990, Fathy, 1995 and Ahmed, 1997). El-Shimi (1998) stated, in cabbage, that N, P and K content of head leaves increased significantly with biogas manure along with mineral fertilizer. Such difference may reflect of fertilization systems, cultivars used as well as the seasonal variations.

**Table 4. Effect of cultivar, vernalization and fertilization on leaves photosynthetic pigments of squash during 1998/1999 and 1999/2000 winter seasons.**

Cultivar	Ver.	Fertilization systems	Chlorophyll , mg/ 100 g			N, %	P, %	K, %
			A	B	A+B			
<b>1998/1999 winter season</b>								
1			126.50	62.50	189.60	3.07	0.31	4.30
2			128.70	64.30	193.00	3.20	0.27	4.70
LSD			1.94	1.56	NS	NS	NS	0.41
1			127.22	62.72	190.00	2.80	0.30	4.30
2			127.22	64.1	192.60	3.43	0.29	4.70
LSD			NS	NS	1.37	0.37	NS	NS
	1		131.08	65.50	195.60	3.27	0.31	5.24
	2		128.92	63.80	192.42	3.10	0.30	4.27
	3		122.75	60.62	185.80	2.98	0.26	3.94
	LSD		1.64	1.14	3.27	0.21	NS	0.42
<b>1999/2000 winter season</b>								
2			123.70	60.70	184.60	2.81	0.20	2.90
LSD			127.30	62.22	189.33	3.22	0.18	2.24
			3.51	1.45	1.26	NS	NS	0.37
	1		124.83	60.83	185.50	2.94	0.18	2.80
	2		126.20	62.10	188.40	3.10	0.20	3.40
	LSD		1.18	NS	2.12	NS	NS	0.10
	1		128.80	63.10	191.83	3.30	0.22	3.76
	2		127.10	61.83	188.90	2.95	0.19	2.90
	3		120.71	59.42	180.10	2.87	0.16	2.51
	LSD		1.63	1.03	1.44	0.15	0.05	0.17

Cultivars are (1) Eskandarani & (2) Arlika.

Ver., Vernalization is (1) Non-Vernalized & (2) vernalized.

Fertilizer systems are 1) 100% Biogas, 2) 50% Biogas + 50% Mineral & 3) 100% Mineral.

LSD, Least significant differences at .05 level.

NS, not significant.

#### Flowering behavior:

Table (5) illustrate the effect of cultivar, vernalization and fertilization systems on flowering behavior during 1998/1999 and 1999/2000 seasons for winter squash.

Arlika cultivar produced more male and female flowers than Eskandarani. However the sex ratio (No. of female/ No. of males) was in favor of Eskandarani cultivar. Vernalization had no effect on male flowers but increased female flowers and consequently the sex ratio. Fertilization systems showed a general positive trend toward the 100% biogas fertilization system compared to the other two systems. Interaction effect was not significant.

Differences between squash cultivars were expected. Shenouda (1968) found differences between Eskandarani and Zucchini. Elgouhary (1977) found such differences between Eskandarani and other cultivars among them Zucchini and White Bush cultivars. Zaki et al (1982) and Eid et al (1988) working on broad bean, cited the positive effect of vernalization on female flowers and consequently on flowering behavior. Similarly, Higazy et

al (1976), Shafshak (1987) and Abdallah (2000) reported such effect working on pea. Ali (2000) observed the positive effect of biogas alone or along with mineral fertilization on pea. Meanwhile, Faisal and Shalaby (1998) found the positive effect of biogas on maize. Such trend was going in the same direction of the present work generally.

**Table 5. Effect of cultivar, vernalization and fertilization on flowering behavior of squash during 1998/1999 and 1999/2000 winter seasons.**

Cultivar	Ver.	Fertilization system	1998/1999 season			1999/2000 season		
			Number of flowers		Sex ratio	Number of flowers		Sex ratio
			males	females		males	females	
1			8.28	10.17	1.24	8.89	11.11	1.25
2			11.33	12.94	1.12	11.66	13.33	1.17
LSD			0.42	1.95	0.11	0.63	0.86	0.08
	1		10.55	10.94	1.10	10.55	11.78	1.13
	2		9.50	12.17	1.27	10.00	12.67	1.29
	LSD		NS	0.91	0.18	NS	0.90	0.14
		1	10.33	12.25	1.20	10.75	13.17	1.26
		2	9.66	11.75	1.23	10.00	12.42	1.25
		3	9.42	10.67	1.33	10.08	11.08	1.11
		LSD	0.58	0.56	NS	0.55	0.38	0.08
	1		8.44	9.22	1.11	9.11	10.44	1.14
	2		8.11	11.11	1.38	8.66	11.77	1.36
	1		11.78	12.67	1.09	12.00	13.11	1.11
	2		10.88	13.22	1.16	11.33	13.55	1.22
	LSD		NS	NS	NS	NS	NS	NS
		1	8.5	11.00	1.32	9.00	12.17	1.35
		2	8.17	10.33	1.27	8.67	11.33	1.30
		3	8.17	9.17	1.15	9.00	9.83	1.10
		1	12.17	13.50	1.08	12.50	14.17	1.17
		2	11.17	13.17	1.20	11.33	13.50	1.22
		3	10.67	12.17	1.10	11.17	12.33	1.12
		LSD	NS	NS	NS	NS	NS	0.11
		1	10.5	11.5	1.13	10.83	12.50	1.20
		2	10.00	11.17	1.11	10.33	12.00	1.20
		3	9.83	10.17	1.05	10.50	10.83	1.03
		1	10.17	13.00	1.26	10.66	13.83	1.35
		2	9.33	12.33	1.35	9.66	12.83	1.33
		3	9.00	11.17	1.20	9.66	11.33	1.18
		LSD	NS	NS	NS	NS	NS	NS

Cultivars are (1) Eskandarani & (2) Arlika.

Ver., Vernalization is (1) Non-Vernalized & (2) vernalized.

Fertilizer systems are 1) 100% Biogas, 2) 50% Biogas + 50% Mineral & 3) 100% Mineral.

LSD, Least significant differences at .05 level.

NS, not significant.

#### Early and total yield:

The effect of cultivar, vernalization and fertilization on squash early and total yield/ fdn during 1998/1999 and 1999/2000 winter seasons is stated in Table 6.

Arlika cultivar produced greater early and total yield (640.8 - 682.4 kg, 1.8 - 2.0 ton/fdn) than Eskandarani cultivar (364.5 - 414.3 kg, 1.4 - 1.6 ton/fdn). The positive effect of vernalization was found only in early yield in

the first season. The effect of fertilization system was in favor of biogas followed by 50 % biogas + 50 % mineral fertilizer regarding total yield.

**Table 6. The effect of cultivar, vernalization and fertilization on squash early and total yield/ fdn during 1998/1999 and 1999/2000 winter seasons.**

Cultivar	Ver.	Fertilization system	1998/1999 season		1999/2000 season	
			Total yield Ton / fdn.	Early yield Kg / fdn.	Total yield Ton / fdn.	Early yield Kg / fdn.
1			1.62	414.28	1.40	364.50
2			2.00	682.36	1.83	640.83
LSD			0.21	242.57	0.24	287.71
	1		1.78	512.73	1.50	445.45
	2		1.85	583.91	1.64	559.88
	LSD		NS	77.56	NS	NS
		1	2.03	570.87	1.77	532.8
		2	1.83	513.21	1.62	463.36
		3	1.58	560.89	1.46	511.84
		LSD	0.21	NS	0.10	NS
1	1		1.51	331.01	1.28	281.01
	2		1.73	497.56	1.52	447.99
2	1		2.04	694.46	1.86	609.89
	2		1.96	670.27	1.78	671.78
LSD			NS	NS	NS	NS
		1	1.84	405.4	1.40	335.43
		2	1.85	430.77	1.48	380.90
		3	1.44	406.68	1.33	357.17
		1	2.21	736.33	2.15	710.17
2		2	2.08	595.65	1.78	545.82
		3	1.72	715.10	1.59	666.52
	LSD		NS	NS	0.15	NS
		1	1.93	405.40	1.61	378.45
	1	2	1.91	430.77	1.75	469.78
		3	1.50	406.68	1.40	488.12
		1	2.13	736.33	1.94	687.15
	2	2	1.76	595.65	1.49	456.93
		3	1.66	715.10	1.51	353.57
	LSD		0.18	117.11	0.15	126.02

Cultivars are (1) Eskandarani & (2) Arlika.

Ver., Vernalization is (1) Non-Vernalized & (2) vernalized.

Fertilizer systems are 1) 100% Biogas, 2) 50% Biogas + 50% Mineral & 3) 100% Mineral.

LSD, Least significant differences at .05 level.

NS, not significant.

The interaction effect was non-significant except that of total yield in the second season with Arlika favoring 100% biogas fertilization (variety X fertilizers) as well as that of vernalization X fertilization system favoring vernalization and 100% biogas fertilizer.

Shenouda (1968) and Elgouhary (1977) indicated that Eskandarani cultivar had better yield than imported cultivars. Such results were not parallel to that obtained herein. However Chizhkov (1984), Damarany et al (1995), Khalil et al (1996) and Vanprays (1999) cited differences between Cucurbita cultivars.

The positive effect of vernalization on yield was observed by Higazy et al (1976) , Shafshak (1987) and Abdallah (2000), but this effect was observed in early yield in the first season. In the present study the effect of

vernalization X fertilization was in favor of Arlika that received biogas fertilizer in early and total yield. Ali (2000) reported the positive effect of either biogas or biogas with mineral fertilizer.

**Fruit quality:**

**Physical characteristics:**

The effect of cultivar, vernalization and fertilization on squash fruits physical characteristics during 1998/1999 and 1999/2000 winter seasons is stated in Table (7).

The effect of variety on fruit weight and fruit diameter was observed in the first season as well as fruit length in the second season. Generally, Arlika tended to show higher fruit weight. Vernalization affected fruit diameter in both seasons and fruit weight as well as fruit length in the first season only. The 100% biogas fertilizer affected positively fruit weight, diameter and length more than the other fertilization systems. The 50 % biogas + 50 % mineral fertilizer ranked before the 100% mineral fertilizer. The interaction effects were insignificant different.

Elgouhary (1977) compared the common cultivar Eskandarani with different cultivars and found differences in fruit weight and length. Also, Vanprays (1999) mentioned similar observations. Zaghloul (1999) on maize reported increases in ear weight with biogas fertilizer. Shafshak (1987) and Abdallah (2000) indicated favorable effect of vernalization on pod length, diameter and weight along with seed number and weight per pod in pea. Such results followed nearly similar trend to that obtained in the present study.

**Chemical characteristics:**

Table (8) shows the effect of cultivar, vernalization and fertilization on chemical characteristics of squash fruits during 1998/1999 and 1999/2000 winter seasons.

Fruits of the tested cultivars contained nearly similar dry weight, fibers, K and Cu in 1998/1999 and 1999/2000 winter seasons and TSS, N and P in the second season. Eskandarani fruits contained more carbohydrates in both seasons and more TSS and N in the first season. Arlika fruits contained more Pb in both seasons and P in the second season only. Vernalization increased fruits carbohydrates and K and reduced Pb in both seasons.

However, it increased fruit fibers in the second season and TSS in the first season. It has no effect on dry weight. The effect of 100% biogas fertilizer was obvious as it increased dry weight, carbohydrates, TSS, P and K in both seasons more than 50% biogas + 50% mineral fertilizer, more than 100% mineral fertilizer. Also, it increased fruits fibers in the second season and N in the first season more than the other cultivars. However, all fertilizers had insignificant effect on Pb in both seasons. Regarding the interaction effects, insignificant differences were obtained in most parameters studied.



**Table 7. The effect of cultivar, vernalization and fertilization on squash fruit physical characteristics of squash during 1998/1999 and 1999/2000 winter seasons.**

Cultivar	Ver.	Fertilization system	Fruit weight, g	Fruit diameter, cm	Fruit length, cm
<b>1998/1999 winter season</b>					
1			74.83	3.96	12.61
2			81.44	3.73	12.22
LSD			0.63	0.13	NS
	1		73.66	3.76	11.89
	2		82.61	3.92	12.94
	LSD		6.78	0.10	0.56
		1	93.50	3.98	13.41
		2	80.50	3.83	12.42
		3	60.66	3.70	11.41
		LSD	4.53	0.06	0.25
<b>1999/2000 winter season</b>					
1			72.70	3.03	13.66
2			76.62	3.06	9.83
LSD			NS	NS	1.09
	1		69.61	2.93	11.44
	2		79.66	3.16	12.05
	LSD		NS	0.17	NS
		1	88.5	3.19	12.92
		2	77.00	2.99	11.66
		3	58.42	2.94	10.66
		LSD	0.70	0.12	0.59

Cultivars are (1) Eskandarani & (2) Arlika.

Ver., Vernalization is (1) Non-Vernalized & (2) vernalized.

Fertilizer systems are 1) 100% Biogas, 2) 50% Biogas + 50% Mineral & 3) 100% Mineral.

LSD, Least significant differences at .05 level.

NS, not significant.

Elgouhary (1977) stated that variations between cultivars regarding TSS were not great. The positive effect of vernalization on seed contents of total carbohydrates, N, P, and K were detected on pea ( Higazy et al , 1976; Shafshak, 1987; Abdallah, 2000 ; Mady, 2000 and Ali, 2000). Ali (2000) reported the favorable effect of biogas on pea seeds N, P, K and total carbohydrates. Also, the work of Zaghoul (1999) showed similar trend when using biogas manure on grains.

**Table 8. The effect of cultivar , vernalization and fertilization on squash fruit chemical characteristics of squash during 1998/1999 and 1999/2000 winter seasons.**

Cultivar	Ver.	Fertilization system	Fruit dry weight %	Carbohydrates %	Fibers %	TSS %	N %	P %	K %	Cu ppm	Pb ppm
<b>1998 / 1999 winter season</b>											
1			5.94	33.31	47.20	4.50	3.65	0.33	3.62	12.3	91.2
2			6.30	21.04	40.83	4.21	3.61	0.29	3.43	12.3	119.3
LSD			NS	2.55	NS	0.21	0.03	NS	NS	NS	11.3
	1		6.30	24.10	41.39	4.30	3.52	0.31	3.30	12.3	114.6
	2		6.22	30.27	46.67	4.50	3.74	0.33	3.70	12.3	95.9
	LSD		NS	0.73	Ns	0.10	NS	NS	0.13	NS	4.11
		1	7.02	29.62	46.70	4.90	3.92	0.35	3.98	12.8	101.9
		2	6.02	26.82	42.10	4.40	3.69	0.31	3.45	12.4	101.4
		3	5.33	25.10	43.30	3.90	3.28	0.29	3.13	11.9	112.5
		LSD	0.43	0.89	NS	0.18	0.24	0.03	0.40	0.2	NS
<b>1999 / 2000 winter season</b>											
1			5.52	25.04	47.50	4.40	3.60	0.34	3.31	12.3	121.5
2			6.19	21.14	43.30	4.30	3.70	0.38	3.78	12.2	133.7
LSD			NS	0.87	NS	NS	Ns	0.01	NS	NS	6.6
	1		5.77	22.03	43.30	4.32	3.56	0.35	3.39	12.3	135.4
	2		5.94	24.20	47.50	4.50	3.71	0.36	3.70	12.2	119.9
	LSD		Ns	1.35	3.52	NS	NS	NS	0.30	NS	12.3
		1	6.87	24.70	52.50	4.80	3.83	1.40	3.88	12.6	123.7
		2	5.73	23.30	44.20	4.30	3.62	0.35	3.53	12.3	127.7
		3	4.98	21.30	39.60	4.10	3.50	0.32	3.22	11.9	131.5
		LSD	0.62	1.25	5.72	0.28	NS	0.02	0.28	0.15	NS

Cultivars are (1) Eskandarani & (2) Arlika.

Ver., Vernalization is (1) Non-Vernalized & (2) vernalized.

Fertilizer systems are 1) 100% Biogas, 2) 50% Biogas + 50% Mineral & 3) 100% Mineral.

LSD, Least significant differences at .05 level.

NS, not significant.

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تأثير الإرتباع والتسميد على إنتاجية الكوسة في الموسم الشتوي  
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أجريت التجربة خلال الموسمين 1998/1999 و 1999/2000 الشتويين . واحتوت 12 معاملة والتي نتجت من استخدام صنفين من الكوسة ( اسكندراني و هجين ارليكا) وإرتباع البذور ( بدون أو باستخدام الإرتباع) والتسميد ( 100% سماد البيوجاز ، 50% بيوجاز مع 50% سماد معدني ، 100% سماد معدني) بمعدل 60 كجم/ الفدان. واستخدم التصميم الإحصائي للقطع المنشقة مرتين ، حيث وضعت الأصناف في القطع الرئيسية ، و الإرتباع في القطع المنشقة الأولية ، والتسميد في القطع منشقة الثانوية، ودرس النمو الخضري ومحتوى الأوراق من الصيغات الضوئية ومحتوى النبات من النيتروجين والفوسفور والبوتاسيوم وسلوك التزهير والمحصول المبكر والكلى والصفات الطبيعية والكيماوية للثمار.

أوضحت النتائج تميز الصنف اسكندراني بزيادة النمو الخضري عن الارليكا. وتميز الارليكا بزيادة صفة التمثيل الضوئي مع سلوك افضل بالنسبة للازهار مع زيادة المحصول مع وجود اختلافات في الصفات الطبيعية والكيماوية بوجه عام. وكان تأثير الإرتباع افضل من عدم استخدامه، وكان النظام السمادي الذي احتوى على 100% بيوجاز افضل من 50% بيوجاز مع 50% سماد معدني والذي كان بدوره افضل من 100% سماد معدني.