

Annals Of Agric. Sc., Moshtohor,
Vol. 45(4): 1285-1292, (2007).

**RESPONSE OF THREE FABA BEAN CULTIVARS TO WATER REGIME
CONDITIONS UNDER CALCAREOUS SOIL IN NORTH DELTA
BY**

Hoda M.G. El Shaboury

Food legumes Res Section, field crop Res. Institute, Agric. Res .Center .Giza, Egypt

ABSTRACT

A field experiment was carried out at Nubaria Research Station during 2003/2004 and 2004/2005 growing seasons, to study the response of three faba bean cultivars i.e. Nubarial, Giza 716 and Sakhal to two water regime conditions (one irrigation, 35 DAP and two irrigations, 35 and 75 DAP) under calcareous soils

Results showed that irrigation treatments application had significant effects on faba bean yields and its components. Two irrigations treatment application significantly increased faba bean seed and straw yields by 27.5 and 21.4%, respectively compared with one irrigation condition.

Nubarial cultivar was superior to both other cultivars Giza 716 and Sakhal, where the former one significantly increased seed yield per fadden and protein content by 17.9, 43.8, 10.2 and 5.0% than those of Giza 716 and Sakhal, respectively.

Planting Nubarial cultivar under two irrigations condition recorded the highest seed (10.92 ardab) and straw (1.95 ton) yields per fadden than those other combinations.

The highest value (26.56%) of protein content was obtained by planting Nubarial cultivar under drought condition (one irrigation, 35 DAP).

INTRODUCTION

Faba bean (*Vicia faba*, L.) is the most important pulse crop in Egypt . It is the main staple food for people and perhaps the main source of protein for middle and low income groups. The yield fluctuated from year to year, this due to varieties, the cultural practices and its utilization, the magnitude of flower abscission, and lower pod setting .The water management, and adapted varieties are important factors for faba bean production in Egypt. The water stress during the reproductive phase resulted in a considerable reduction in seed yield of faba bean, and early pod development was the most sensitive stage to water stress (Mohamed *et al.*, 1988). Husain *et al.*, 1988 indicated that seed yield of fully irrigated faba bean increased about 45% than yield of unirrigated. In addition, full irrigated and late from pod set to maturity treatments yielded best. Gej (1992) indicated that early drought reduced that final above ground DM yield of all cultivars, later drought slightly or highly reduced

yield in three cultivars, also he found differences for seed yield between cultivars under optimum soil moisture conditions.

Gendy *et al.* (1995) reported that increasing of irrigations number increased vegetative, non vegetative characters and protein contents of faba bean seeds. Plies – Balzer *et al.* (1995) showed that flowering stage is extremely sensitive to water stress, it caused a decrease in yield in all faba bean cultivars, but water stress during pod filling had little effect on biomass production of faba bean. Xia (1997) found that all drought treatments decreased seed yield of faba bean compared to control treatment (normal irrigation).

The aim of this research is to study the response of three faba bean cultivars to two water regimes conditions under calcareous soils at North Delta region .

MATERIALS AND METHODS

This investigation was carried out at Nubaria Research Station, ARC, during the winter seasons 2003/2004 and 2004/2005, to study the response of three faba bean cultivars i.e. Nubaria 1, Giza 716 and Sakha 1 to two water regime conditions i.e. one irrigation at growth stage, 35 days after planting and two irrigations at growth and pod setting stages, 35 and 75 days after planting under calcareous soil conditions .The main physical and chemical properties of experimental soil site in two seasons are shown in the following table:

Property	Seasons	
	2003/2004	2004/2005
Coarse sand (%)	12.50	11.30
Fine sand (%)	27.0	27.70
Silt (%)	36.0	35.70
Clay (%)	24.50	25.30
Texture grade	Loamy	Loamy
CaCO ₃ (%)	23.50	22.0
S.P.(%)	30.0	35.0
pH	7.90	8.10
E.C. ds/m	1.57	1.20
Organic matter (%)	0.31	0.22

A randomized complete block design in factorial arrangement with three replications was applied .

Planting took place on ridges, 60 cm apart, two plants per hill, 20 cm apart .Plot area was 12 m², each plot included 5 ridges, 4 meter long. To avoid the interference between irrigation treatments, 1.5 meter beds were left among the experimental plots. Faba bean seeds were inoculated with Rhizobium before planting. All experimental plots received 15 kg N/fed. in the form of ammonium sulphate (20.5 N %) as a starter dose at planting and 30 kg P₂O₅/fed. in the form of calcium superphosphate (15.5 P₂O₅%) before planting. The other agricultural practices were applied

as recommended .The total quantity of rain fall at Nubaria region was 130.5 and 100.1 mm in the first and second growing seasons, respectively. At harvest, ten random plants were taken from each plot to determine the following traits:

Plant highest (cm), number of branches and pods and seeds/ plant, seed weight (gm)/ plant and 100-seed weight (gm). Moreover, feba bean seed and straw yields were estimated (ardab and ton/ feddan, respectively) as well as mature seeds of the second season were subjected to chemical analysis to determine protein content percentage according to A.O.A.C. (1990).

The collected data were analyzed statistically according to Steel and Torrie (1980) in each season .Combined analysis of the two seasons were completed and discussion was held on the mean of two seasons except chemical analysis .

RESULTS AND DISCUSSION

I- Faba bean yields and its components:

a- Effect of water regime conditions:

Result in tables (1), (2) and (3) indicated that, irrigation treatments application had significant effects on faba bean yields and its components. Where the two irrigations treatment application significantly increased plant height, number of pods and seeds as well as seed yield per plant and 100-seed weight by 16.71 cm (17.1%), 3.52 pods (40.6%), 16.1 seeds (50.3%) and 14.62 gm (18.3%), respectively than that of one irrigation treatment application.

Table (1): Effect of water regime conditions on some growth traits of faba bean cultivars (combined data of 2003/04 and 2004/05 seasons)

Irrigation treatments	Cultivars	Plant height (cm)			No . of branches /plant		
		2003/2004	2004/2005	Comb	2003/2004	2004/2005	Comb
One Irrigation, 35 DAP	Nubaria1	88.17	87.61	87.89	8.20	8.40	8.30
	Giza 716	98.41	100.22	99.31	6.12	6.25	6.19
	Sakha 1	106.81	105.14	105.97	4.57	4.90	4.72
Mean		97.80	97.66	97.73	6.28	6.52	6.40
Two Irrigations, 35 and 75 DAP	Nubaria1	103.11	101.51	101.98	8.40	8.90	8.65
	Giza 716	119.30	118.35	118.83	6.50	6.80	6.65
	Sakha 1	123.15	121.90	122.53	4.70	5.10	5.04
Mean		115.19	113.92	114.44	6.63	6.93	6.78
Over both irrigation treatments	Nubaria1	95.64	94.56	94.93	8.30	8.65	8.48
	Giza 716	108.86	109.29	109.07	6.31	6.53	6.42
	Sakha 1	114.98	113.52	114.25	4.76	5.0	4.88
L.S.D. 0.05: Irrigation		*	*	*	N.S	N.S	N.S
Cultivars		2.29	2.46	1.57	0.45	0.69	0.39
Irr.x cult.		3.24	N.S	2.22	N.S	N.S	N.S

Regarding to faba bean yields, the same trend was obtained, which the two irrigations treatment application recorded higher seed (9.32 ard.) and straw (1.70 ton) yields per feddan with an increase of 27.5 and 21.4%, respectively compared with one irrigation condition. This results could be due to the increase in soil moisture content (two irrigations) resulted in an increase of faba bean grows and yield components which was reflected on faba bean productivity. These results are in full agreement with those obtained by Bakheit *et al.*, (1989), Salih (1992) and El-Far (1999).

b- Effect of faba bean cultivars:

Data presented in tables (1), (2) and (3) showed that, faba bean cultivars were significantly differed in yields and its components. Sakhal cultivar was superior in plant height (114.25 cm) to other cultivars Giza 716 (109.07 cm) and Nubarial (94.93 cm).

Giza 716 cultivar significantly increased number of pods and seeds per plant by 9.0, 19.5, 16.4 and 30.2% compared with Sakhal and Nubaria 1, respectively. This could be attributed to the fact that, Giza 716 cultivar was more earlier than both other cultivars under Nubaria region.

Whereas, Nubaria 1 cultivar was superior in 100-seed weight (106.94 gm) to both other cultivars Giza 716 (81.78 gm) and Sakhal (73.40 gm). This reflected on seed yield per plant as well as seed yield per feddan, where the former one significantly increased seed yield per plant by 6.6 and 38.2% and seed yield per feddan by 17.9 and 43.8% compared with Giza 716 and Sakhal, respectively.

c- Effect of water regimes and faba bean cultivars interactions:

There were no significant effects of irrigation treatments and faba bean cultivars interaction on faba bean yields (Table 3).

However, planting Nubaria 1 cultivar under two irrigations condition recorded the highest seed (10.92 ardab) and straw (1.95 ton) yields values per feddan followed by Giza 716 cultivar under the same condition of irrigation (9.35 ardab seeds and 1.67 ton straw/feddan) than those other combinations.

II - Protein content of seeds:

The crude protein of faba bean seeds as affected by number of irrigations in the second season only are shown in table (4). Results indicated that, protein content of seeds was increased (25.33%) as imposed plants to drought condition or soil moisture stress (one irrigation, 35 DAP). In other words, the lowest value of protein content (22.31%) was obtained by two irrigations condition (35 and 75 DAP). These results may indicated that accumulation of nitrogenous compounds is enhanced by dry soil moisture rather than wet condition. The obtained results are in full agreement with those reported by El-Far (1994) and Abdallah (1996) who reported that protein content in faba bean seeds was increased by drought conditions.

Regarding to faba bean cultivars, the highest value of protein content (24.99%) was obtained by Nubarial followed by Sakhal (23.80%) and Giza 716 (22.68%) cultivars. In this respect, Abdallah and Fischbeck (1992) found that nitrogen

content in faba bean seeds considerably varies within cultivars and genotypes. The highest value (26.56%) of protein content was obtained by planting Nubarial cultivar under drought condition (one irrigation, 35 DAP).

Table (3): Effect of water regime conditions on faba bean yields (combined data of 2003/04 and 2004/05 seasons)

Irrigation treatments	Cultivars	Seed Yield (ard/fed)			Straw yield (ton/fed.)		
		2003/ 2004	2004/ 2005	Comb	2003/ 2004	2004/ 2005	Comb
One irrigation, 35 DAP	Nubarial	8.99	8.42	8.71	1.67	1.60	1.64
	Giza 716	7.45	7.16	7.29	1.44	1.31	1.38
	Sakha 1	6.11	5.75	5.93	1.21	1.14	1.18
Mean		7.52	7.11	7.31	1.44	1.35	1.40
Two Irrigations, 35 and 75 DAP	Nubarial	11.20	10.63	10.92	1.98	1.92	1.95
	Giza 716	9.51	9.22	9.35	1.71	1.63	1.67
	Sakha 1	7.98	7.41	7.69	1.52	1.46	1.49
Mean		9.56	9.09	9.32	1.74	1.67	1.70
Over both irrigation treatments	Nubarial	10.10	9.53	9.81	1.83	1.76	1.79
	Giza 716	8.48	81.19	8.32	1.58	1.47	1.52
	Sakha 1	7.05	6.58	6.82	1.37	1.3	1.33
L.S.D. 0.05: Irrigation		*	*	*	*	*	*
Cultivars		0.96	1.11	0.68	0.18	0.24	0.14
Irr.x cult.		N.S	N.S	N.S	N.S	N, S	N.S

Table (4): Effect of water regime conditions on protein content, 2004/05 season

Irrigation treatments	Cultivars	Protein %
One irrigation, 35 DAP	Nubarial	26.56
	Giza 716	24.15
	Sakha 1	25.28
Mean	25.33	
Two Irrigations, 35 and 75 DAP	Nubarial	23.42
	Giza 716	21.20
	Sakha 1	22.31
Mean	22.31	
Over both irrigation treatments	Nubarial	24.99
	Giza 716	22.68
	Sakha 1	23.80

REFERENCES

- A.O.A.C (1990): Official Methods of Analysis .15th Association of Official Agricultural Chemists, Washington, D.C, USA.
- Abdallah, M.M. (1996): Effect of drought conditions and phosphatic fertilizer on growth, yield and quality of Faba bean. Assiut J. of Agric. Sci, 17(1): 107-120 .

- Abdallah, M.M. and Fishbeck, G. (1992): Investigations on Faba bean (*Vicia faba*, L.) 3-performance of the high yielding land races and other stocks and their analytical composition. In Proc. 5th Conf. Agron., Vol.(1):353-360. Zagazig, Egypt.
- Bakheit B.R.; Dawood, R.A. and Kheiralla, K.A. (1989): Effect of moisture stress on growth yield, yield attributes and quality of lentil (*lens culinaris*, Med.) Assiut J. Agric. Sci. 20(3): 193-206.
- El-Far, I. A. (1994): Response of faba bean (*Vicia Faba*, L.) to irrigation regime and depth of sowing. Assiut J. Agric. Sci., 25 (5): 119-128.
- Gej, B. (1992): Biomass increment and transpiration of field bean (*Vicia Faba*, L. Minor) under conditions of periodical soil drought, Annals of Warsaw. Agric. Univ. SGGW-AR, Agric. No. 24:3-9. (C.F. Field Crop Abstr., No. 12:1033, 1994).
- Gendy, E.N.; El-Raies, S.A.A. and Reheem, M.A.A. (1995): Effect of number of irrigations and sulphur application on broad bean growth and yield. Egyptian J. Soil Sci., 35(3): 379 – 393.
- Husain, M.M.; Hill, G.D. and Gallagher, J. N. (1988): The response of field beans (*Vicia Faba*, L.) to irrigation and sowing date. 2-Growth and development in relation to yield. J. Agric. Sci. Camb., 111:233-254.
- Mohamed, G.; El-Sarrag, F.A. Salih and Ageel, O.O.A. (1988): Effect of moisture stress at different stages of plant growth on faba bean seeds yield. FABIS Newsletter, 22:17-19.
- Plies-Balzer, E.; Kong, T.; Schubert, S. and Mengel, K. (1995): Effect of water stress on plant growth and nitrogenase activity of nitrogen economy of four different cultivars of (*Vicia Faba*, L.). European J. Agron., 4 (2):167-173.
- Salih, F.A., (1992): Effect of watering intervals and hill planting on faba bean seed yield and its components. FABIS Newsletter, 13:17-20.
- Steel, R.G.D. and Torrie, J.H. (1980): Principles and procedures of statistics. Mc Graw Hill Book company, New York, 2nd Ed.
- Xia, M.Z. (1997): Effect of soil drought during the generative development phase on seed yield and nutrient uptake of Faba bean (*Vicia faba*). Australian J. Agric. Res., 48(4): 447-451. (C.F. Field Crop Abstr., 50(9), 6669).

استجابة ثلاثة أصناف من الفول البلدي للري بالأراضي الجيرية بمنطقة شمال الدلتا

هدى محمد جمال الشاوبرى

قسم بحوث المحاصيل البقولية - معهد بحوث المحاصيل - مركز البحوث الزراعية -
الجيزة - مصر

أقيمت تجربة حقلية فى محطة البحوث الزراعية بالنوبارية فى موسمي
٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ لدراسة إستجابة ثلاث أصناف من الفول البلدى وهى
نوبارية ١ ، جيزة ٧١٦ ، سخا ١ لمعاملات الري المختلفة وهى رية واحدة (٣٥ يوم من
الزراعة) وريتان (٣٥ ، ٧٥ يوم من الزراعة) تحت ظروف الأراضي الجيرية.

- أظهرت النتائج المتحصل عليها أن تطبيق معاملة الري مرتين بعد ٣٥، ٧٥ يوم من الزراعة قد أدى لزيادة محصول البذور والقش بمقدار ٢٧,٥، ٢١,٤% على الترتيب وذلك مقارنة بمعاملة الري مرة واحدة بعد ٣٥ يوم من الزراعة.
- وقد أوضحت النتائج أن زراعة الصنف نوبارية ١ قد أدى لزيادة محصول البذور للقدان والمحتوى البروتيني للبذور بمقدار ١٧,٩، ٤٣,٨، ١٠,٢، ٥% على التوالي وذلك مقارنة بالصنفين جيزة ٧١٦، سخا ١ .
- كما أشارت النتائج أيضاً أن زراعة الصنف نوبارية ١ والري مرتين بعد ٣٥، ٧٥ يوم من الزراعة قد أعطى أعلى محصول من البذور (١٠,٩٢ أردب) والقش (١,٩٥ طن) للقدان.
- هذا وقد تم الحصول على أعلى قيمة للمحتوى البروتيني (٢٦,٥٦%) من زراعة الصنف نوبارية ١ تحت ظروف الجفاف (الري مرة واحدة بعد ٣٥ يوم من الزراعة).