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The productivity of some varieties of lentil under irrigation intervals in conditions of Sinai

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Abstract : Two field experiments were carried out during 2013/2014 and 2014/2015 winter seasons at production and research station of Maghara at north of Sinai government, Desert research center, ministry of agriculture, Egypt. The objective of this study was to investigate the effect of irrigation intervals on yield, yield components and chemical content in grains of some varieties of lentil. The results could be lead to as follows, the cultivar Giza-9 recorded the highest plant height and dry weight of plant however Giza 370 and Sinai 1 recorded the lowest value; on the other hand, cultivar Giza 370 recorded the highest secondary branches/plant while Sinai 1 recoded the lowest value; cultivar Giza 4 recorded the highest value primary branches/plant, however, cultivar Giza 51 recorded the lowest value; cultivar Giza 51 recorded the highest number of pods and 100 seeds weight, while cultivar Giza 9 and Giza 4 recorded the lowest; on the other, cultivar Sinai 1 recorded the highest value on chemical analysis .the result indicated irrigation intervals 2 day significantly increased all the previous characters while irrigation intervals 8 day give the lowest value for all study characters.
Key words: lentil – varieties – yield- irrigation intervals.

Introduction

Lentils are a pulsate crop that has been used in agricultural production for a great deal of human history. There is evidence of human consumption of lentils dating back to approximately 10,000 years ago, and it has been indicated that they were among the very first crops domesticated by humans. Lentils are known for their high nutrient content and health benefits in humans. They have the third highest protein content of any legume, at 30% of their calories. They are also a great source of carbohydrates and high in fiber. Furthermore, they are high in content of important minerals and vitamins such as iron and zinc. Lentils also include essential amino acids isoleucine and lysine, making them a cheap source of protein in developing countries[1] .Not only are lentils an excellent source of proper nutrition, but there is also a growing body of information on how beneficial they are in regards to disease treatment, prevention, and overall health. Lentils have shown to have strong anti-oxidant properties, being more effective radical scavengers than other legumes such as peas. The crop has been shown as useful to people with diabetes, as it contains slow digesting starches which can be useful for controlling blood sugar levels. Cardiovascular health has been shown to improve due to lentil consumption through a reduction in hypertension and weight loss. Studies have found that the pulse decrease cancer rates, and is often prescribed as a food for patients during their cancer treatments, which is likely related to its anti-oxidant capabilities[2]. Overall lentils are one of the most nutrient rich and health benefiting crops that human beings have ever produced.

They are an important crop in poorer areas of the world as an important source of daily nutrients and protein. This shows in the world market, since Canada is the world's largest exporter of lentils, with

Saskatchewan producing nearly all of exports. Just fewer than half the world's lentils are produced in Saskatchewan. However, lentil is often dry-farmed in marginal field and in soils with low fertility which in this state, due to low and irregular rainfall, its yield is unstable and poor[3] Complementary irrigation at critical stage of plant requirements [flowering stage] is an effective method requirements [flowering stage] is an effective method of preventing yield fluctuation and achieving a stable production of lentil in arid and semi-arid areas[4] .In this method, the effects of drought on plant lessen and rather a suitable moisture, especially at sensitive growth stages, is provided and consequently the yield is improved[5] .

Also, irrigation in areas where temperature during plant growth and development is above the optimal degree will favorably reduce soil temperature and plant canopy and is useful for node-making, N fixation and finally the plant yield[3] .The findings of [6]confirm that grain yield and lentil biomass increase with increasing grain yield and lentil biomass increase with increasing irrigation intervals. Application of two complementary irrigation intervals

[before flowering and at grain filling] increased the lentil yield by 20% relative to dry farming on the average[7] .

Therefore, irrigation at reproductive stage which not only increases the velocity of plant growth at grain filling and elongates the lifetime of plant's green tissues during that stage, but also improves growth in higher crop yield. Studies on rhizobium of alfalfa[8] and bean[9] have indicated that with increasing drought the content reduces.

Materials and Methods

Two field experiments were carried out at the Research and Production Station, Maghara at north of Sinai government, Desert research center, ministry of agriculture, Egypt during the two successive seasons 2013/2014 and 2014/2015. respectively, to study the effect of intervals of water [2days, 4 days and 8 days] on growth and production of five varieties [Sinai 1, Giza 9, Giza 370, Giza 4 and Giza51] of lentil plant under condition of Sinai.

Physical and chemical properties of the soil analysis showed in [Table1]. The soil was well prepared were added at the rate of 8 kg/m^2 as well as calcium super phosphate [15.5% P_2O_5] at the rate of 150 k/feddan [hectare = 2.4 feddan] during the preparation of the soil. Seeds were sown in hills 10 cm apart on rows 60 cm in between and covered with a thin layer of the soil, then irrigated. Three weeks later, the developed plants were thinned to leave one plant per hill.

The plants were collected after 110 days from sowing to determine the growth and yield characters: Plant height [cm], dry weight [gm/plant], primary branches/plant secondary branches /plant, No of pods/plant and weight of 100 seeds [gm].

Chemical analysis:

Total Nitrogen content: Sample of 0.2 gm dry material were digested by sulphuric and perchloric acids using Micro-Kjeldahl method[10] .Distillation was carried out with 40% NaOH, and ammonia was received in 4% boric acid solution. Protein content was determined by the Kjeldahl method for the calculation of all proteins which equal nitrogen content multiplied by 6.25,[11] .

Potassium content: weight of 0.2 g dry matter from canola shoot was extracted for one hour in a boiling-tube of distilled water in a boiling water bath, the extract was filtered. Sodium and potassium content in the aqueous extracts were measured with Flame Photometer. Meanwhile, chloride was determined by titration by 0.001 N $AgNO_3$ and using potassium dichromate as indicator. Phosphorous content: Phosphorous was determined calorimetrically at wave length 725 nm using chlorostannous-reduced molybdo phosphoric blue color method, in hydrochloric described system as described by[11].

Statistical analysis

The experiment was conducted as split plot design having varieties in main plot and intervals in sub plot. Data were subjected to statistical analysis of variance according to[12] ,and L.S.D value for comparison.

Table (1): Mechanical and chemical analyses of experimental soil [average of the two seasons].

Item	Value	Element	Value
Physical properties		**Available macro element mg/100g**	
Sand%	85.00	P	0.82 L
Silt%	10.00	K	9.94 L
Clay%	4.00	Mg	17.00 L
Texture	Sandy	Ca	94.21 L
		Na	52.17 H
Chemical properties		Available microelement ppm	
P^H	7.8 H	Fe	7.40 L
Ec dS/m	1.6 H	Mn	6.50 L
CaCO3%	1.9 L	Zn	1.13 L
O.M%	0.5 VL	Cu	0.42 L

VL= very low, L=low, M = medium H= high

Results and Discussion

Effect of irrigation intervals

The results presented in Table (2) indicated that there was significant effect due to the irrigation intervals where the irrigation every 2 day give the highest mean values of plant height (cm), dry weight(gm/plant), primary branches/plant, secondary branches/ plant, number of pods/plant and 100 seeds weight (gm) for all varieties of lentil (Sinai1, Giza9, Giza 370,Giza4 and Giza51) compared with the other two irrigation treatments ,the irrigation every 8 day give the lowest values for all studded characters this may be due to the water irrigation supply every 2 day which gave the plants its requirements of water where water supply lead to increasing of total dry weight per plant as result of increasing metabolism process, while insufficient water can be deleterious for the yield and maturity, these results are in agreement with those obtained by[13,14,15,16] and[17]. Data presented in Table (3) indicated that the protein (%), Nitrogen (g/kg), Potassium (g/kg), Phosphors (g/kg), Zn (m/kg), Cu (m/kg), Fe (m/kg) and Mn (m/kg) was significantly affected by intervals where irrigation every 2 day for all varieties of lentil (Sinai1, Giza9, Giza 370, Giza4 and Giza51) compared with the other two irrigation treatments. The results are parallel with those obtained by[18,19,20] And[21]

Chemical analysis

Data presented in Table (3) showed that the cultivar Sinai(1) produced the highest value of protein (26.875%), nitrogen (4.12g/kg), potassium(5.71g/kg), phosphors (5.01g/kg), Zm (50.29m/kg) Cu (11.29m/kg) ,Fe (6.08m/kg) and Mn (53.31m/kg). In intervals irrigation every 2 day followed by cultivar Giza4, Giza9, while the cultivar Giza 370 produced the lowest value for all chemical analysis in intervals every 8 day .observed superiority cultivar Sinai(1) in chemical analysis of seeds compared with other variety.

Table (2): Effect of different levels of intervals on yield and its components

Treatments		plant height [cm]	Dry wt. gm/plant	Primary branches/plant	Secondary branches/plant	No. of pods /plant	100seeds Weight/g
Sinai 1	**2 day**	23.9	3.33	5.34	4.68	10.41	4.09
	4 day	23.77	3.17	4.04	3.08	8.61	3.69
	8 day	18.03	2.25	2.64	1.58	7.01	3.39
Giza-9	**2 day**	26.04	3.77	5.54	5.28	10.01	5.09
	4 day	25.81	3.46	3.74	3.68	7.71	4.69
	8 day	22.96	3.09	2.94	1.88	4.81	3.09
Giza370	**2 day**	25.15	3.26	4.94	5.98	10.71	4.99
	4 day	22.19	2.65	4.24	4.08	8.41	4.29
	8 day	16.93	2.53	3.34	1.78	6.71	3.69
Giza-4	**2 day**	25.16	3.49	5.74	4.88	10.11	4.69
	4 day	22.13	3.24	4.94	3.38	6.81	3.19
	8 day	19.09	2.78	3.44	1.98	5.01	2.59
Giza-51	**2 day**	25.48	3.59	5.04	4.58	10.91	5.19
	4 day	24.81	3.55	3.64	3.78	7.81	4.49
	8 day	21.74	3.5	2.24	2.38	5.81	3.79
LSD V		7.5	1.21	1.9	2.9	2.5	2.31
LSD D		4.4	0.82	1.3	1.5	1.21	1.82
LSD V x D		2.11	0.09	0.8	0.9	Ns	1.03

Yield and its components

Data presented in Table (2)showed that the cultivar Giza (9) produced the highest value of plant height and dry weight of plant(26.04cm) and(3.77g) followed by cultivar Giza51 (25.48cm), (3.59g) in intervals irrigation every 2 day while, the cultivar Giza 370 produced the lowest value in plant height one (16.93cm) but cultivar Sinai(1) produced the lowest value in dry weight (2.25g) in intervals irrigation every 8 day. Giza370 produced the highest value of secondary branches/plant (5.98) followed by cultivar Giza4 (4.88) in intervals irrigation every 2 day while, the cultivar Sinai (1) produced the lowest value on (1.58) in intervals irrigation every 8 day. Giza4 produced the highest value of primary branches/plant (5.74) followed by cultivar Sinai 1(5.34) in intervals irrigation every 2 day, while the cultivar Giza 51 produced the lowest value on (2.24) in intervals irrigation every 8 day. Giza 51 produced the highest value of no. of pods (10.91) and 100seeds weight(5.19gm) followed by cultivar Giza 370(10.71)of no .of pods and Giza9(5.09gm)in 100seeds weight while the cultivar Giza9 produced the lowest value on no .of pods (4.81)and cultivar Giza 4 produced the lowest value on 100 seeds weight (2.59gm) in intervals irrigation every 8 day.

Table (3): Effect of different levels of intervals on some menials contents of lentil cultivars.

Treatments		Protein %	Nitrogen g/kg	Potassium g/kg	Phosphor g/kg	Zn m/kg	Cu m/ kg	Fe m/ kg	Mn m/kg
Sinai 1	**2 day**	26.875	4.12	5.71	5.01	50.29	11.29	56.08	53.31
	4 day	23.937	3.65	5.36	4.61	47.29	10.42	53.14	49.3
	8 day	22.437	3.41	5.13	4.23	46.19	9.72	50.77	46.09
Giza-9	**2 day**	26.187	4.01	5.65	4.93	48.99	10.86	55.6	52.71
	4 day	23.25	3.54	5.31	4.54	47.09	10.16	52.98	49.08
	8 day	21.875	3.32	5.07	4.16	46.09	9.63	50.6	46.02
Giza370	**2 day**	25.187	3.85	5.66	4.85	48.69	10.63	55.48	52.6
	4 day	22.511	3.42	5.26	4.47	46.89	10.01	52.78	51.66
	8 day	21.437	3.25	4.98	4.11	45.79	9.56	50.54	45.77
Giza-4	**2 day**	26.562	4.07	5.71	4.98	50.19	11.26	55.84	52.19
	4 day	23.75	3.62	5.34	4.59	47.19	10.39	52.9	48.18
	8 day	22.125	3.36	5.11	4.21	46.09	9.67	50.53	44.97
Giza-51	**2 day**	25.875	3.96	5.63	4.91	49.39	10.83	55.37	51.59
	4 day	22.937	3.49	5.28	4.52	46.99	10.13	52.74	47.96
	8 day	21.562	3.27	5.05	4.14	45.99	9.61	50.37	44.9
LSD V		4.496	0.139	0.204	0.379	3.121	1.146	2.785	0.301
LSD D		4.346	0.143	0.084	-0.002	2.521	2.556	5.485	0.871
LSD V x D		3.136	0.188	0.033	0.003	1.621	1.426	2.685	0.721

Conclusion:

The current study revealed that Best varieties growing in the Sinai area cultivar Giza 51 because it gives higher productivity in the number of pods and weight of 100 seeds and thus obtain the highest yield. Irrigation preferably every two days because the increase irrigation intervals negative impact on the characteristics of the plant and therefore less affects the productivity of the crop.

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