EVALUATION OF SOME LENTIL VARIETIES UNDER SPRINKLER AND DRIPPING IRRIGATION SYSTEMS IN NEWLY RECLAIMED SANDY SOIL

E. A. Khattab **E. A. El-Housini,**
Assist. Prof. **Assist. Prof.**
Dept. Field Crops Research, National Research Centre- 33 El Bohouth St., Dokki, Giza, Egypt
Corresponding author's e-mail: sayedkh2004@yahoo.com

ABSTRACT

Two field experiments were carried out during winter seasons 2014/2015 and 2015/2016 at the Research and Production Station, National Research Centre, El-Nubaria Province, El-Behira Governorate, Egypt. The main objective of this study is to evaluate growth, yield and yield component of some lentil varieties (Giza 29, Giza 51, Giza 9, Giza 370 and Giza 4) under different irrigation system (sprinkler and dripping irrigation). Results were showed that Giza 29 produced the highest 100 seed weight (1.50 gm), seed yield (1.23 ton/ha) and harvest index 2.34%, however Giza 51 recorded the highest number of pods and seed yield/plant. Furthermore, Giza 9 recorded the highest number of branches and biological yield (1.25 ton/ha), however either Giza 370 Giza 4 and had the lowest values of the same traits. Also the results revealed that Giza 29 recorded the highest values of chemical contents. Concerning the effect of irrigation system, result were highlighted that drip irrigation system significantly increased all of the studied characters, while sprinkler irrigation system produced the lowest values for all the studied characters.

Key words: ***seed yield, yield components, seed quality, seed weight***

مجلة العلوم الزراعية العراقية -2019 :50(3):753-758 **خطاب والحسيني**

تقييم بعض أصناف العدس تحت نظامى الري بالرش والرى بالتنقيط في التربة الرملية المستصلحة حديثًا

السيد عبد الله خطاب **ابتسام عبدالعزيز الحسينى**
استاذ مساعد **استاذ مساعد**
قسم بحوث المحاصيل الحقلية ، المركز القومي للبحوث ، 33 شارع البحوث ، الدقي ، الجيزة ، مصر

المستخلص

نفذت تجربتين حقليتين خلال الموسمين الشتويين 2015/2014 و2016/2015 في محطة البحوث والإنتاج التابعة للمركز القومي للبحوث، بمنطقة النوبارية، محافظة البحيرة، مصر. كان الهدف من هذه الدراسة هو تقييم صفات النمو والمحصول ومكوناته لبعض أصناف العدس (جيزة 29 وجيزة 51 وجيزة 9 وجيزة 370 وجيزة 4) تحت نظامى الري (الري بالرش والرى بالتنقيط). أظهرت النتائج تفوق الصنف جيزة 29 في وزن 100 بذرة (1.52 جم)، وحاصل البذور (1.23 طن/ هكتار) ودليل الحصاد (2.43%). وسجل الصنف جيزة 51 أعلى قيم لعدد القرون وحاصل البذور/نبات. علاوة على ذلك، سجل الصنف جيزة 9 أعلى قيم لعدد الفروع والحاصل البيولوجي (1.125 طن/ هكتار)، وسجل كل من الصنف جيزة 370 والصنف جيزة 4 أقل قيم لنفس الصفات. كذلك أوضحت النتائج أن الصنف جيزة 29 سجل أعلى قيم لمحتويات النبات من المركبات الكيميائية. فيما يتعلق بتأثير نظام الري، فقد أظهرت النتائج أن نظام الري بالتنقيط زاد بشكل كبير فى وحدات الصفات المدروسة، في حين أن نظام الري بالرش أعطي أقل قيم لتلك الصفات.

كلمات مفتاحية: حاصل البذور, مكونات الحاصل, نوعية البذور, وزن البذور

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INTRODUCTION

Water is the most vital input in agricultural production. Globally, agriculture is the dominant user of available water; it is consumed about 80 % of available water. Therefore, irrigation systems must be modified to be adequately applied to crops to avoid loses large quantities of water. Hence, the efficiency of water use in agriculture needs to increase in a sustainable manner, i.e. unit of water used has to be raised food production (29). Therefore, the adoption of suitable irrigation system is needed to increase water-use efficiency. Several investigators stated that, drip irrigation is more efficiency in water conserving, since there are reduced water losses through surface evaporation, less surface runoff, as well as minimal deep percolation (25). Sprinkle irrigation is the application of water in the form of a spray from the flow of water under pressure through small nozzles. The most common intent of sprinkle irrigation is to apply water uniformly to the soil surface to replace water extracted by plants. Lentil is one of the important pulse crops of the world that is consumed for its high protein and mineral content. This crop including red, green and black types, is an excellent source of dietary fibers and B-complex vitamins .In addition to human consumption, high-quality lentil hay is extensively used as animal feed (24). It is also supports crop rotation due to its potential to sustain soil productivity and restore soil fertility, due to their ability to atmospheric nitrogen fixation (1). Ismail, et. al., (19) showed that the water requirement for lentil crop is Lower. Egypt is equal to 318 mm for the total growing period. He pointed that the water requirement for the initial stage (15 to 30 days) equals to 14.4 mm, the development stage (30 to 45 days) equals to 90 mm, the mid-season stage (30 to 50 days) equals to 45 mm, the late–season stage (20 to 30 days) 85mm, and at harvest 35.9mm. He also pointed that crop coefficient (Kc) equals to 0.3 at initial stage, and 1.1 at development stage and 0.3 at harvest stage. Snyder, et al., (30) found that crop coefficient (Kc) equals to 1 at mid stage and 0.3 at end of the season. Guy, (17) stated that the values of lentil crop coefficients for initial, mid-season and late season at harvest equal to 0.3, 1.15 and 0.25, respectively. Water is the major constraint to expand the agricultural area in Egypt, which is essential to reducing the country's food gap. Optimum utilization and good management of water resources represent direct efforts towards minimizing water losses and raising the efficiency of water use. One way to achieve is the employment of modern irrigation systems especially in the newly reclaimed sandy soils (2). If water shortage occurs early during crop development stage, maturity may be delayed and yield could be reduced significantly. Similarly if moisture shortage occurs later during the growing season, quality is often reduced even though total yields are not affected (15). The sprinkler system offers a great application potential as a highly efficient irrigation system.This study was aimed evaluation lentil varieties under sprinkler and drip irrigation systems at a newly reclaimed sandy soil.

MATERIALS AND METHODS

Two field experiments were carried out at the Research and Production Station, National Research Centre, El-Nubaria Province, El-Behira Governorate, Egypt during winter seasons of 2014/2015 and 2015/2016, the studywas aimed evaluation some varieties of lentil (Giza29, Giza9, Giza 51, Giza 370 and Giza 4) under sprinkler and dripping irrigation systems on yield and yield components at newly reclaimed sandy soil. Physical and chemical properties of the soil analyses were done according to Jackson (20), and presented in Table 1. The recommended doses of fertilizers were applied i.e., nitrogen (50 kg, ha^{-1}), phosphorus (160 kg, ha^{-1}) and potash (110 kg, ha^{-1}). Lentil seeds were inoculated with *Bradyrhizobium japonicum* culture wifh 5g kg^{-1} seed after treating with bavistin at 2.5g kg^{-1} seed before sowing. The total plot area was 10.5m² (3 x 3.5m) and seeds of lentil cultivars were sowing on 12th November, 15th November during 2014/2015 and 2015/2016, seasons, respectively in rows. All agronomic practices were done according to the Ministry of Agriculture recomindations. The crop was harvested on 10th and 18th May, 2015 and 2016, respectively.

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

Item	Value		Element	Value	
Physical properties			Available macro element (mg/100g)		
Sand%	85.00		P	0.781	L
Silt%	10.00		K	8.894	L
Clay%	4.00		Mg	15.12	L
Texture	Sandy		Ca	6.26	L
			Na	3.23	L
Chemical properties			Available microelement (ppm)		
P^H	7.81	H	Fe	7.51	L
Ec(dS/m)	1.62	H	Mn	6.62	L
CaCO3%	1.93	L	Zn	1.17	L
O.M%	0.52	VL	Cu	0.43	L

VL= very low, L=low, M = medium H= high, according to Ankerman and Large (4).

Chemical analyses

The plants were collected after 110 days from the field to determine the growth and yield characters. Total Nitrogen content determined using Micro-Kjeldahl method Jackson, (20). Protein content was by the Kjeldahl method for the calculation of all proteins which equal nitrogen content multiplied by 6.25, Chemists, (8). Potassium content was extracted according to chaudharyetd (7). Phosphorous was determined by calorimetrically at wave length 725 nm as described by Jackson, (20). Total chlorophyll were extracted by using dimethyl formamide and determined according to the methods described by moran (26). Total carbohydrates were determined spectrophotometrically (as glucose) after acid hydrolysis using phenol sulphuric acid reagent (9).

Statistical analysis

The experiment was conducted as asplit plot design using varieties as main plot and irrigation system in sub plot with three replications. Data were subjected to statistical analysis of variance according to Gomez, and Gomez, (16), and L.S.D value for comparison.

RESULTS AND DISCUSSION

A- Effect of varieties:

Data presented in Table 2 show that the cultivar Giza 29 produced the highest value of weight of 1000 seeds, seed yield and harvest index 1.50gm, 1.23ton/ha and 2.34%.While, superiority Giza 9 in number of branches (5.63) and biological yield (1.125 ton/ha). While refer variety Giza 51 gave the highest value number of pods and seed yield of plant (25 and 23.5 gm), The cultivar Giza 370 superiority in plant height only 38.9cm and Giza 4 superiority in dry weight of plants (3.705 gm) only. The results were ugreed with those obtained by other rcsearchens (18, 28, 22)

Table 2. Effect of different systems of irrigation on yield and yield component characters of lentil varieties

Treatments		Plant height(cm)	number of branches /plant	Dry wt. /plant(gm)	Number of pods/ plant	Seed yield / plant (g)	Weight of1000 seed /gm	Straw yield (ton/ha)	Seed yield (ton/ha)	Biological Yield((ton/ha)	Harvest index (%)
Giza 29	Sprinkler	38.5	5.34	3.402	23	21.3	1.182	23.08	1.1718	1.1219	2.2937
	Dripper	37.4	5.23	3.529	22	20.4	1.505	23.76	1.2349	1.1134	2.3484
Giza-9	Sprinkler	37.8	5.63	3.121	24	20.9	1.105	23.27	1.0578	1.1256	2.1835
	Dripper	35.5	5.32	3.276	21	20.3	1.185	23.96	1.1426	1.1143	2.2570
Giza-51	Sprinkler	37.6	4.86	2.613	23	22.4	1.115	21.76	1.1049	1.0578	2.1628
	Dripper	36.8	4.35	3.207	25	23.5	1.419	22.41	1.1643	1.0503	2.2146
Giza370	Sprinkler	38.9	5.32	3.188	24	21.8	1.042	21.95	0.9975	1.0606	2.0582
	Dripper	37.4	5.21	3.432	23	21.2	1.117	22.59	1.0776	1.0503	2.1279
Giza-4	Sprinkler	37.6	4.96	3.490	24	22.4	1.013	21.33	0.9702	1.0305	2.0008
	Dripper	35.8	4.54	3.705	22	22.0	1.086	21.96	1.0475	1.0211	2.0686
LSD V		8.4	1.3	1.2	9.4	5.3	0.41	1.2	0.318	0.7	0.486
LSD S		6.3	0.8	0.7	6.1	3.8	0.52	0.7	0.112	0.5	0.285
LSD V x S		2.6	0.05	0.09	2.3	2.1	0.11	0.09	0.028	0.9	Ns

B- Effect of irrigation system

The results reveal in Table 2 shows that there was significant differences due to the irrigation system, where the drip irrigation system gives the highest mean values of 100 seed weight gm, seed yield ton/ha, harvest index(%), number of pods/plant, seed yield/plant gm and dry weight of plant gm for varieties of lentil Giza 29, Giza51 and Giza4 compared with the sprinkler irrigation system, which had the highest values of number of branches, biological yield ton/ha and plant height cm in cultivar Giza 9 and Giza 4.

Table 3. Effect of different systems of irrigation on some chemical contents in seeds of lentil varieties

Treatments		Total chlorophyll mg/g	Carbohydrate g/100gm d.w.	Protein %	Nitrogen g/kg	Potassium g/kg	Phosphor g/kg	Zn m/kg	Cu m/kg	Fe m/kg	Mn m/kg
Giza 29	Sprinkler	7.502	9.228	23.14	3.702	4.890	4.279	43.24	9.848	48.50	45.87
	Dripper	7.947	9.775	24.58	3.933	5.047	4.417	44.46	10.393	49.79	47.20
Giza-9	Sprinkler	7.487	9.209	22.45	3.592	4.825	4.122	41.99	9.653	47.32	44.92
	Dripper	7.931	9.755	23.95	3.831	4.992	4.353	43.25	10.005	49.35	46.65
Giza-51	Sprinkler	7.480	9.200	21.81	3.490	4.771	3.974	41.90	9.405	47.39	45.75
	Dripper	7.923	9.746	23.02	3.684	5.001	4.279	42.98	9.792	49.23	46.55
Giza370	Sprinkler	7.465	9.182	22.39	3.582	4.863	4.113	42.82	9.801	47.14	44.01
	Dripper	7.892	9.707	24.29	3.887	5.038	4.399	44.36	10.373	49.57	46.17
Giza-4	Sprinkler	7.428	9.136	21.47	3.435	4.742	4.113	41.53	9.598	47.32	43.08
	Dripper	7.852	9.658	23.66	3.786	4.973	4.334	43.63	9.976	49.13	45.62
LSD V		2.41	2.331	5.276	0.404	0.18	0.611	6.77	2.901	4.733	8.132
LSD S		1.52	1.217	.416	0.713	0.217	0.711	2.62	3.011	7.833	9.532
LSD V x S		1.11	1.029	5.096	0.193	0.107	0.211	1.49	0.971	1.673	1.232

Chemical analyses

Results in Table 3 shows that the cultivar Giza 29 with drip irrigation system surpassed for all the cultivars in all mineral composition and give the highest values of total chlorophyll (7.947mg/g),carbohydrate 9.775 g/100gm d.w., protein 24.58%, nitrogen 3.933g/kg, potassium 5.047g/kg, phosphor 4.417g/kg, Zn 44.46m/kg, Cu 10.393m/kg, Fe 49.79m/kg and Mn 47.20m/kg. While the cultivar Giza 4 produced the lowest values for all the traits for the some chemical content. Regarding the effect of irrigation system, Table 3 shows that irrigation system slightly increased element concentrations in lentil plants, but it was significantly higher with the drip irrigation compared to the sprinkler irrigation it appears that drip irrigation creates more appropriate conditions in the root zone area for lentil plant growth and productions. These results are in agreement with those obtained by other resachevss (10, 23). Expanding the area of the cultivated land requires the development of the cultivation of sandy soils that suffer from poor content of organic matter and clay elements. Therefore, sandy soil requires special management to deal with irrigation water to reduce the rate of leakage and evaporation, Suganya, and Sivasamy (31) indicoted that Egypt has suffering in recent times a large shortage of water, especially for use in agriculture irrigation, so the demand for new technologies in the field irrigation system increased. Drip irrigation is one of the best techniques, due to the low surface exposed to the evaporation and there is no surface runoff and less surface runoff, as well as minimal deep percolation, (21). Previous results illustrated the superiority of drip irrigation to spring irrigation by increasing characters of yield and growth readings and values. Since drip irrigation provides the optimum use of fertilization and water efficiency ،a (6). Modern technologies and advanced irrigation systems have increased the efficiency of mineral nutrients and less irrigation water according to the results of other researchers(12, 13, 14). therefore, plants grow well in sandy soils, which increases the efficiency of photosynthesis, dry weight and fruit growth, which affects the quantity of the crop yield, this results are in agreement with those obtained by other researchers (3, 5, 11, 22, 27). The increase in the leaves content of

the lentil plant from mineral elements is due to increases the soil content of the moisture which helps in the facilitation of nutrients in the soil in a form suitable for adsorption, (3). Current study revealed that the best varieties can be growing under the condition this of experiment are Giza29 and Giza 51 because it gives higher productivity weight of 100 seed, bioloyical yield, number of pods and seed yield/plant and thus obtain the highest seed yield. Results also, revealed that drip irrigation system is the most combatable method of irrigation can maintains the productivity of lentil and conserving water used.

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