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Effect of foliar application of macro nutrition on productivity lentil plant varieties under dripping system irrigation

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Abstract: Effect of nitrogen, phosphorus and potassium levels on some variety lentil (*Lens culnaris*L.) were study to investegat growth and yeild in newly reclamed, all through 2013/2014 then 2014/2015 respactevely . Experiments were approved out in station of National Research Centre, vallege of Emam Malk, Nobaria Egypt. Nitrogen, phosphorus and potassium were foliar at three levels (control, 1 and 2 g/l) from N: P: K 15:10:30 as foliar application at 30 and 45 after caltevated . In general, best outcome of data were recorded from the plants treated with NPK with level 2g/l at 45 days. Timing of fertilizer application also affected different yield components. The foliar application of NPK with variety giza 51 were more effective than NPK with other varietis in producing higher growth characters (plant height, number of branches/plant, number of pods / plant, seed yield/ plant, weight of 1000 seeds,grain yield t/ha, straw yield t/ha, biological yield t/ha) and seeds contents from (protien, N, P,k, Zn, Mg, Fe, Cu and Mn.
Keywords : *productivity and quality, varieties of lentil, spray of NPK, newly land.*

Introduction

Egypt is one from countries in the world that depended her people on lentil seeds for nutrition, therefor, lentils are rich in protein, have essential amino acids, dietary fiber, folate, other vitamins and minerals and carbohydrates, lentil pgrowth don't needs to heigh content of water and grown on rain water[1,2]. It was first grown in southwest Asia in 7000 BC [3]. .In 2013, worldwide lentil production was 4.885 thousand tones on cultivated area [4]. Lentil sowing get delayed either due to late harvest of preceding long duration rice crop or due to heavy soil moisture in the field forcibly kept for lentil, because it is the only crop which can grow or left field fellow for year round [2,5,6].

All plants need to mineral nutrient specially nitrogen, that's have important role in photosynthesis and protien synthesis, nitrogen plays very importent role in all physiology paths in cell plant [7].

Lentils like the rest of the family crops, leguminous can N_2 fixation to provide part of the needs of fertilizer nitrogen, but this amount is not enough plant needs application of nitrogen fertilizer, especially in semi-arid areas, so it should be added amounts through soil or foliar on plant to increase yield [8.9], small quantities of nitrogen additive is not enough to increase the yield and plant lentils but need large amounts of fertilizer to increase crop [10.11]. Inspect the surface layer of soil a large amount of N_2 fixation therefor the soil needs to add amont of fertilizer to increase yield [12].

Phosphorus of basic nutrients for the plant, where increase P lead to increased vegetative growth and fruiting [13.14]. Phosphorus fertilization increases cell division and elongation developing root and stem and branches increased [15:16:17] and activates the phosphorus from the process of N_2 fixation and increased bacterial

decade [18.] phosphorus deficiency reduces the nodules on the root [19:20:21]. Add phosphorus to leguminous plants lead to increased uptake of nitrogen and thereby increase vegetative growth and crop [22.23].

Leguminous plants more responsive to phosphorus fertilization, where phosphorus leads to increased grain dry weight yield of 24.25. Phosphorus from slow motion elements in soil and plant so it needs the plant to add phosphorus 26.27 large quantities, phosphorus and helps to increase the plant withstand drought and frost 24.28

Potassium is an important component for plant growth and increase crop and potassium moving elements in soil and plant so the plant quantities needed depends on the time and method of [29.30.31.32.33.34.35] added. Plants in response to potassium vary from one plant to another, leguminous crops and are considered more responsive to the element potassium. [36.37.38.39.40.41]

Materials and Methods

Two field experiments were carried out at the Research and Production Station, National Research Centre, El-Nobaria Province, Beheara Governorate, West Delta Egypt, during the two successive seasons 2013/2014 and 2014/2015, respectively, to study the effect of nitrogen, phosphorus and potassium at three levels (0, 1 and 2 g/l) from N: P: K 15:10:30 as foliar spray on growth and production of five varieties (Sinai 1, Giza 9, Giza 370, Giza 4 and Giza51) of lentil plant under condition of Newly cultivated land.

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) during the preparation of the soil.

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

VL= very low, L=low, M = medium H= high, according to 42.

Table 1: Analysis of the experimental soil according to the methods given by 43.

Character	**2003/2004**	**2004/2005**
Fine sand (%)	94.8	4.72
Silt (%)	4.5	2
Clay (%)	0.7	3.28
Texture	Sandy	Sandy
Organic matter (%)	0.93	0.85
pH	7.9	8
EC (mmhos/cm2)	1.3	2.4
CaCo3	3.8	2.86
Total N (ppm)	4.1	5.6
Available P (ppm)	4.3	4.7
K (mg/100 g soil)	5.6	4.55
Fe (ppm)	1.3	1.43
Zn (ppm)	0.35	0.5
Mn (ppm)	1.2	1.3

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 (Jackson, 1967). 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,[44].

Potassium content: weight of 0.2 g dry matter from canola shoot was extracted 45 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 AgNO3 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 [43].

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 [46], and L.S.D value for comparison.

Results

Data in tables (2 and 3) showed the average effect of NPK on varieties of lentil plants during 2013/2014 and 2014/2015 to investigate any cultivate had improvement to awards NPK concentration and any times for treatment.Table (2) show that the response of lentil varieties development to concentration of NPK (0, 1 and 2 g/l). The highest significantly levels of growth parameters of lentil plants i.e plant height (24.7), number of branches / plant (12.5), number of pods / plant (17.0), seed yield / plant (1.69) g, weight of 1000 seeds (17.06) g, grain yield (2.36) tha^{-1}, straw yield (3.02) tha^{-1} and biological yield (4.4) tha^{-1}.

Table 2:Mean effect ofNPK on yield and its components of lentils plant during seasons 2013/2014 and 2014/2015.

Treatments		Plant height	number of branches /plant	Number of pods / plant	Seed yield / plant g	1000 seeds g	Grain yield t/ha	Straw yield t/ha	Biological Yield t/ha
Giza 29	**Control**	19.9	8.0	14.2	1.45	14.64	2.11	2.56	4.68
	1 g/l	22.6	10.1	15.4	1.57	15.85	2.17	2.66	4.83
	2 g/l	24.5	12.0	16.3	1.62	16.36	2.23	2.70	4.94
Giza-9	**Control**	20.9	8.1	14.1	1.47	14.84	2.17	2.53	4.71
	1 g/l	22.7	10.2	15.3	1.61	16.26	2.22	2.79	5.01
	2 g/l	24.4	11.5	16.0	1.64	16.56	2.34	2.92	5.28
Giza-51	**Control**	21.1	8.2	14.8	1.51	15.25	2.22	2.62	4.84
	1 g/l	23.2	11.1	16.2	1.64	16.56	2.26	2.94	5.28
	2 g/l	24.7	12.5	17.0	1.69	17.06	2.36	3.02	5.40
Giza370	**Control**	20.9	8.1	14.5	1.41	14.24	2.13	2.52	4.65
	1 g/l	22.7	10.8	15.6	1.48	14.94	2.20	2.82	5.03
	2 g/l	24.6	11.4	15.9	1.53	15.45	2.21	2.93	5.14
Giza-4	**Control**	20.9	8.0	1.4	1.44	14.54	2.14	2.42	4.56
	1 g/l	22.4	10.7	15.2	1.53	15.45	2.18	2.51	4.74
	2 g/l	23.9	11.9	16.1	1.61	16.26	2.22	2.99	5.22
LSD V		3.5	4.2	1.8	0.7	2.7	0.4	0.7	0.8
LSD NPK		2.4	2.4	1.1	0.2	1.6	0.1	0.3	0.4
LSD Vx NPK		1.3	1.4	0.8	0.07	1.0	0.05	0.07	0.1

Data obtainable in Table (3) showed that all NPK levels significant increased the content of protein, nitrogen, phosphorus, potassium, zinc, magnesium, iron, copper and manganese as compared with control. The

increase in concentration of elements in grains of lentil plants were obtained by treatment NPK at 10% and interaction with Giza 51 cultivate.

Table 3:Main effect ofNPK on yield and its components of lentils plantduring seasons 2013/2014 and 2014/2015.

		Seeds mg/kg								
Treatments		**protien**	**N**	**P**	**k**	**Zn**	**Mg**	**Fe**	**Cu**	**Mn**
Giza- 29	**Control**	23.95	3.833	4.9131	3.893	45.391	9.6339	46.289	42.095	45.391
	1 g/l	25.45	4.073	5.1431	4.273	46.491	10.353	48.659	45.305	46.491
	2 g/l	26.83	4.293	5.3231	4.513	48.181	10.623	50.199	47.875	48.181
Giza-9	**Control**	23.39	3.743	4.8531	3.823	45.291	9.5639	46.119	42.025	45.291
	1 g/l	24.76	3.963	5.0831	4.203	46.291	10.093	48.499	45.085	46.291
	2 g/l	26.08	4.173	5.2531	4.343	46.821	10.413	48.929	46.845	46.821
Giza-51	**Control**	22.95	3.673	4.7631	3.773	44.991	9.4939	46.059	41.775	44.991
	1 g/l	24.01	3.843	5.0431	4.133	46.091	9.9339	48.299	47.665	46.091
	2 g/l	26.70	4.273	5.4431	4.513	47.891	10.563	50.999	48.605	47.891
Giza370	**Control**	23.64	3.783	4.8931	3.873	45.291	9.6039	46.049	40.975	45.291
	1 g/l	25.26	4.043	5.1231	4.253	46.391	10.323	48.419	44.185	46.391
	2 g/l	28.08	4.493	5.4831	4.643	49.391	11.193	51.359	48.195	49.391
Giza-4	**Control**	23.08	3.693	4.8331	3.803	45.191	9.5339	45.889	40.905	45.191
	1 g/l	24.45	3.913	5.0631	4.183	46.191	10.063	48.259	43.965	46.191
	2 g/l	27.39	4.383	5.4131	4.573	48.591	10.763	50.889	47.595	48.591
LSD V			6.981	0.595	0.184	0.456	6.773	2.829	4.272	6.773
LSD T			6.121	0.905	0.074	0.556	2.623	2.939	7.372	2.623
LSD V x T			2.801	0.386	0.172	0.056	1.493	0.899	1.212	1.493

Discussion

In this study, we determined some growth characters and some yield and chemical content in seeds in in five lentil cultivars. We found impressive genetic variation in the lentil germplasm for the investigated all characters. The genotypes with high macronutrient of nitrogen, potassium and phosphrus levels might be suitable for studying the mechanisms of mineral element accumulation and transport. The mineral characteristics of the crop plants depend on genetic and environmental factors[47,48,49,50,51].

Nitrogen, phsphorus and potassium are called major elements because roles important in life plants from germination to harvest. Added NPK frtilizer to lentil plants is compulsory at branched and flowring to milk stage [52]. The increase in dry mater, weight of 1000 seeds, weight of seed and straw yield and all growth characters lead to effect of nitrogen and interaction with varieties. The effect of nitrogen on plants back to the roles of nitrogen is very important in amino acid and protien synthsis, activevate division cells and formation of charbohydrates and affects energy reactions in the plant therefor increasing in growth and yield.

All phosphorus levels increased growth and yield parameter [53]. [54] found that application of phosphate fertilizer increased mean grain yields compared to the control. Also [55] found that phosphorus application enhanced all growth and yield parameters. [56] showed that the highest number of pods per plant and length of pod were produced bean varieties and phosphorus levels significant increased macro and micronutrients.

[57] pointed that phosphorus applications increased the growth and yield. The effects of P application was hiegh significant of minerals contents in seeds. Similar these results [58] obtained that foliar application is very beneficial to the crop growth and yield. [59] reported that application phosphorus increase yield prameters. Increasing in growth and yield lead to effects phosphorus on It contributes to the vital cell processes and development, and works to increase the phosphorus seeds and vitality and carry plant to climate changes and stress quality.

Leguminous plants respond potassium fertilization, where he works to improve the yield and quality characteristicsgrains [60]. K also plays a vital role as macronutrient in plant growth and sustainable crop

production [61]. It maintains turgor pressure of cell which is necessary for cell expansion. It helps in osmo-regulation of plant cell, assists in opening and closing of stomata.. Potassium works to increase the enzymatic activity cell [62.63] so active vital cell processes and increases the rate of photosynthesis and food shifts increases plant growth and dry material. All these reasons lead to increase growth and yield lentil plants.

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