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Studying Effects of Different Levels of Organic and Phosphorus Fertilizer on Yield and Yield Components of Lentil (Lens culinaris) under Dry Farming Conditions and Amount of Plant Phosphor in Kohgiluye-IRAN

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Abstract

In order to study the effects of different levels of organic and phosphorus fertilizer on Lentil dry farming performance and amount of plant's phosphor, an experiment on Factorial, random block-complete plan in 9 treatments was carried with 3 levels been repeated in kohgiluye & boyer ahmad-Iran during 2013- 2014. Treatments included three levels of animal fertilizer (0, 10, 20, ton per hectare) and different levels of super triple phosphate (0, 100, 200 kg per hectare). The results showed that the maximum amount of plant height in treatment D_0P_1 (nonuse of organic fertilizer with use of 100kg per hectare the triple super phosphate) attained the amount of 37.5cm, pod number in plant in treatment D_0P_1 (nonuse organic fertilizer with use of 100kg per hectare of triple super phosphate) attained the amount of 195.3, grain yield in treatment D_0P_1 (nonuse organic fertilizer with use of 100kg per hectare of triple super phosphate) attained the amount of 1404kg per hectare and the highest amount of harvest index in the treatment D_1P_2 (taking 10 tons per acre of livestock manure by consuming 200 kg of triple superphosphate per ha) was seen at a rate of 36.16%, grain protein was seen at a rate of 30.93% in the treatment D_1 P_1 (taking 20 tons of livestock manure per acre with the consumption of 100 kg triple superphosphate per ha) and the maximum amount of plant phosphorus was seen at a rate of 0.42% in the treatment P_2 (with the consumption of 200 kg per ha of triple superphosphate).

Keywords: Organic fertilizer, Phosphor, Lentil, Seed yield, Leaf protein.

Introduction

The Lentil with scientific name of (*L.esculenta*) *Lens Culinaris* is one of the oldest plant food sources of human, as for importance it is considered as the fourth important plant of Legume gens in the universe after bean, pea and chich-pea. Content of soil organic materials is considered as an indicator of the stability of ecosystems. In agricultural ecosystems the determination of soil fertility content can be done through percent of organic materials contained in it. So that dynamism of soil organisms and biological diversity level of terricolous organism are directly related to percent of organic materials contained in it. Organic fertilizer is one of the most important organic materials that is available to farmers (Tandon, 1999). One of the most important effective factors on stability of food production is soil fertility maintaining through the application of organic fertilizers and as well as by means of non-chemical alternatives instead of chemical pesticides (Neeson, 2004). The use of different sources of fertilizer could have considerable impacts on performance that is about two tons per hectare, absorb from the soil about 100kg nitrogen, 82kg phosphor (P_2O_5) and 87kg potassium (K_2O). Thus, will be essential the replace of food materials for crop stable production. It

is recommended that about 10 to 15 tons the organic fertilizer applied per hectare (Snowbar, 1998). In sandy soils deficient of born ion (B) occurs and the use of about 5kg borax per hectare will increase seed performance to 60% (Toor et al., 2006).

Lentil mainly cultivated homebred and could use well of residual moisture in soil. Water requirement is low and about 300-350mm. Transpiration coefficient of this plant in moist areas is 200-500 and the amount of water need to produce one kilogram of dry matter is 800-1500 liter (Saxena, 1981). Of suitable features the Lentil the high level of saponin (3.7-4.6g per kg of seed) can be mentioned (Savage, 1991). Lentil because of with large percentage of fiber is recommended for the treatment of diabetic patients. Of other characteristies of Lentil less cooking time can be mentioned (Williams and Sing, 1988).

Various studies had shown that the use of organic fertilizer can in addition improve of soil physical properties and increasing of holding capacity of the moist, besides it is also effective for supply the nutrient elements to plant. So far performed many researches about the use of additive materials of various on organic (animal) fertilizers in order to effect increasing of this organic materials on growth and performance of agricultural plants (Adelay and Ojeney, 2010).

Materials and methods

This farm study was performed in from of factorial and in format of complete block design with 9 treatments and three replications in 2013-2014, 2012-2013 cultivation years. Experiment treatments consisted of three levels of organic fertilizer (zero, 10 and 20tons per hectare) and various levels of triple super phosphate (zero, 100 and 200kg per hectare) (Khadem and Galavi, 2010). Experimental was formed with the autumn disc ploughing and clods crushing. Then the farm was divided into plots of 3*4 m while the distance between implant rows was 20cm and distance of seeds in the implant row 4 to 5cm. In this study, after plant evolution to obtain seed performance and biomass (straw), herbs were dissevered from bottom and seeds were separated from the spikes and then plant was weighed to separate the seed and plant biomass. Finally, seed performance and biomass in term of kg per hectare were attained. Of seed thousand weight, 5 samples of chiliad from each treatment were counted in order to attain the average until seed thousand weight in term of kg was attained. For root length measure (cm), plant height (cm) and then obtaining the average, five plants were considered. Also in growing stage and flowering stage, sample from leaf of each treatment was prepared and sent to the laboratory for the measurement of leaf phosphor level. Statistical analysis using SAS software and comparison of average were performed using Duncan's multiple range test. In order to study and check of parameters used in the experiment, every day a sampling was done from all treatments from grow stage to harvest stage (Montemurro et al., 2005, Patel, 1988).

Results and discussion

The Plant height

The result of variance analysis show the effect of various factor of organic fertilizers on plant height was significant at possible level of 1% and also the effect of various factor of triple super phosphate on plant height was significant at possible level of 5% and interaction of various factor of organic fertilizer and triple super phosphate was significant level of 5% (table 1).

The effect of fertilizer on plant height

Comparison result of average data suggest that the effect of various factors of organic fertilizer on plant height had significant difference, so that the maximum amount of plant height in treatment D_2 (use of 20 tons per hectare of organic fertilizer) attain to the amount of 33.14cm and

lowest amount of plant height in treatment D_0 (nonuse of organic fertilizer) attain to the amount of 30.11cm (table 2).

Table 1.Analysis variance of yield and yield components

PLANT PHOSPHOR	HI PERCENT	LEAF PROTEIN PERCENT	SEED PROTEIN PERCENT	GRAIN	NUMBEROF PODS PER PLANT	PLANT HEIGHT	DF	TREATMENTS
0/74 ^{ns}	0/895 ^{ns}	0/782 ^{ns}	3/1021 **	932/35 ^{ns}	72/441 ^{ns}	10/778 ^{ns}	2	BLOCK
3/7 *	36/603 **	241/344 **	3/015 **	520464/70 **	3541/902 **	99/983 **	2	MANURE
15/72	12/708	1/860	0/369	8810/10	44/849	7/873	6	MAIN ERROR BLOCK* MANURE
0/95 **	12/976 *	11/822 **	0/757 ^{ns}	119691/22 *	293/554 *	20/504 *	2	PHOSPHORUS
1/84 **	29/526 **	11/810 **	1/342 **	14234/32 **	193/709 *	3/292 *	6	INTERACTION MANURE & P
13/2	3/359	0/307	0/362	4564/66	73/041	6/091	24	SUB ERROR
7/8	6/565	2/339	2/087	8/339	30/203	7/937		CV

*& ** Respectively significant at the 5% & 1% level, and ns is insignificance.

Table 2.The result of main comparison the effect of various factors of organic fertilizer on yield and yield components

PLANT PHOSPHOR	HI PERCENT	LEAF PROTEIN PERCENT	SEED PROTEIN PERCENT	GRAIN (kg/ha)	NUMBEROF PODS PER PLANT	PLANT HEIGHT (cm)	TREATMENTS
0/3c	27/56a	24/44b	29/12a	693/2c	92/01c	30/11b	D0 (NON USE)
0/35b	28/02a	20/68c	28/86ab	791/3b	102/5b	31/04b	D1 (USE 10T/HA)
0/4a	29/12a	26/02a	28/56b	946/1a	188/7a	33/14a	D2 (USE 30T/HA)

The effect of triple super phosphate on plant height

Study of various factor of triple super phosphate on plant height level suggest that there were significant difference between various level of triple super phosphate, so that the maximum amount of plant height in treatment P_1 (use of 100kg per hectare of triple super phosphate) attain to the 32.06cm and lowest amount of plant height in treatment P_0 (nonuse of triple phosphate) to the amount of 29.96cm (table 3).

Table 3.The result of main comparison the effect of various factors of triple super phosphate on yield and yield components

Plant Phosphor (%)	HI (%)	Leaf Protein (%)	Seed protein (%)	Grain yield (kg/ha)	Number of pods per plant	Plant height (cm)	Treatments
0/32b	27/07b	23/34c	28/68b	719/0b	91/43c	29/96b	P0 (nonuse)
0/4ab	27/53ab	23/78b	28/68b	867/6a	119/2a	32/06a	P1 (use 100kg/ha)
0/42a	28/47a	24/67a	29/00a	864/3a	104/7b	31/59a	P2 (use 200kg/ha)

The interaction of organic fertilizer and various levels of triple super phosphate on plant height

The interaction results of various factors also suggest that there were significant difference between treatments, so that the maximum amount of plant height in treatment D_0P_1 (nonuse of organic fertilizer with use of 100kg per hectare the triple super phosphate) attain to the amount of 37.5cm and lowest amount of plant height in treatment D_1P_2 (use of 10 tons per hectare of organic fertilizer with use of 200kg per hectare the triple super phosphate) to the amount of 30.6cm (table 4).

Table 4.The interaction of organic fertilizer and phosphor on plant yield

D_2P_2	D_2P_1	D_2P_0	D_1P_2	D_1P_1	D_1P_0	D_0P_2	D_0P_1	D_0P_0	Measured traits
32/3bc	32/1bc	30/9d	30/6de	30/90d	31/45c	36/45a	37/05a	33/4b	Plant height (cm)
147/6ef	177/1b	138/6g	149/5e	156/8cd	141f	160/3c	195/3a	152/3d	Number of pods per plant
1197d	1236cd	1019g	1238cd	1157e	1052f	1386b	1404a	1275c	Grain yield (kg/ha)
33/1b	30/44cd	32/67bc	16/36a	26/38ef	27/8e	24/96f	31/08c	29/5d	HI (%)
29/09b	29/05b	26/58c	24/62d	24/01d	21/11e	30/42a	26/39c	29/02bc	Leaf Protein (%)
29/46b	30/93a	30/33a	30/51a	28/59bc	29/44b	79/28bc	28/57bc	27/6c	Seed protein (%)
0/41a	0/38b	0/32d	30/51b	0/35c	0/3e	0/34c	0/32d	0/3e	Plant Phosphor (%)

The pod number in plant

The results of variance analysis show that the effect of various factors of organic fertilizer 0n the pod number in plant was significant at possible level of 1% and also the effect of various factor of triple super phosphate on the pod number in plant was significant at possible level of 5% and interaction of various factor of organic fertilizer and triple super phosphate was significant at possible level of 5% (table 1).

The effect of organic fertilizer on pod number in plant

Comparison result of average data suggest that the effect of various factors of organic fertilizer on pod number in plant had significant difference, so that the maximum amount of pod number in plant in treatment D_2 (use of 20 tons per hectare of organic fertilizer) attain to the amount of 118.7 and lowest amount of pod number in plant in treatment D_0 (nonuse of organic fertilizer) to the amount of 92.01 (table 2).

The effect of triple super phosphate on pod number in plant

Study of various factor of triple super phosphate on pod number level in plant suggest that there were significant difference between various levels of triple super phosphate, so that the maximum amount of pod number in plant in treatment P_1 (use of 100kg per hectare of triple super phosphate) attain to the amount of 119.2 and lowest amount of pod number in plant in treatment P_0 (nonuse of triple super phosphate) to the amount of 91.43 (table 3).

The interaction of organic fertilizer and phosphor on pod number in plant

The interaction results of various factors also suggest that there were significant difference between treatments, so that the maximum amount of pod number in plant in treatment D_0P_1 (nonuse organic fertilizer with use of 100kg per hectare of triple super phosphate) attain to the amount of

195.3 and lowest amount of pod number in plant in treatment D_2P_0 (use of 20 tons per hectare of organic fertilizer without use of triple super phosphate) to the amount of 138.6 (table 4).

Grain yield (kg per hectare)

The results of variance analysis show that the effect of various factors of organic fertilizer 0n grain yield was significant at possible level of 1% and also the effect of various factors of triple super phosphate on grain yield was significant at possible level of 5% and interaction of various factors of organic fertilizer and triple super phosphate was significant at possible level of 1% (table 1).

The effect of organic fertilizer on economic yield

Comparison result of average data suggest that the effect of various factors of organic fertilizer on grain yield had significant difference, so that the maximum amount of grain yield in treatment D_2 (use of 20 tons per hectare of organic fertilizer) attain to the amount of 946.1kg per hectare and lowest amount of grain yield in treatment D_0 (nonuse of organic fertilizer) to the amount of 693.2kg per hectare (table 2).

The effect of triple super phosphate on economic yield

Study of various factor of triple super phosphate on grain yield level suggest that there were significant difference between various levels of triple super phosphate, so that the maximum amount of grain yield in treatment P_1 (use of 100kg per hectare of triple super phosphate) attain to the amount of 867.6kg per hectare and lowest amount of grain yield in treatment P_0 (nonuse of triple super phosphate) to the amount of 719kg per hectare (table 3).

The interaction of organic fertilizer and phosphor on economic yield

The interaction results of various factors also suggest that there were significant difference between treatments, so that the maximum amount of grain yield in treatment D_0P_1 (nonuse organic fertilizer with use of 100kg per hectare of triple super phosphate) attain to the amount of 1404kg per hectare and lowest amount of grain yield in treatment D_2P_0 (use of 20 tons per hectare of organic fertilizer without use of triple super phosphate) to the amount of 1019kg per hectare (table 4).

Harvest index of grain

The results of variance analysis show that the effect of various factors of organic fertilizer on harvest index was significant at possible level of 1% and also the effect of various factors of triple super phosphate on grain harvest index was significant at possible level of 1% and interaction of various factors of organic fertilizer and triple super phosphate was significant at possible level of 1% (table 1).

The effect of organic fertilizer on harvest index

Comparison result of average data suggest that the effect of various factors of organic fertilizer on harvest index had significant difference, so that the maximum amount of harvest index in treatment D_2 (use of 20 tons per hectare of organic fertilizer) attain to the amount of 29.12 percent and lowest amount of harvest index in treatment D_0 (nonuse of organic fertilizer) to the amount of 27.58 percent (table 2).

The effect of triple superphosphate on harvest index

In the study into various factors of triple superphosphate affecting the level of harvest index, there is a significant difference between various levels of triple superphosphate, in that the highest amount of harvest index in the treatment P2 (with the consumption of 200 kg per ha of triple superphosphate) was seen at a rate of 27.48 percent, and the lowest amount was in the treatment p0 (lack of consumption of triple superphosphate) was obtained at a rate of 27.07 percent (table 3).

The interaction between livestock and phosphorus manure and harvest index

The results of the interaction of various factors showed that there was a significant difference between treatments in the sense that the highest amount of harvest index in the treatment D1p2

(taking 10 tons per acre of livestock manure by consuming 200 kg of triple superphosphate per ha) was seen at a rate of 36.16%, and the lowest amount of harvest index in the treatment D0 p2 (without taking livestock manure and with the consumption of 200 kg of triple superphosphate per ha) was obtained at a rate of 24.96 percent (table 4).

Grain protein (percent)

The result of data variance analysis showed that the effect of various livestock manure factors on grain protein became significant at a probability level of 1 percent; moreover, the effect of various triple superphosphate factors on grain protein became significant at a probability level of 1 percent. The interaction of various livestock factors with triple superphosphate became also significant at a probability level of 1 percent (table 1).

The effect of livestock manure on grain protein

The results of the analogy of mean data indicated that the effect of various livestock manure factors on grain protein had significant difference, in that the highest amount of grain protein was seen at a rate of 29.12 percent in treatment D0 (without taking livestock manure), and the lowest amount of grain protein was obtained at a rate of 28.51 percent in treatment D2 (with the consumption of 20 tons of livestock manure per ha) (table 2).

The effect of triple superphosphate on grain protein

By studying various factors of triple superphosphate affecting the level of grain protein, there was a significant difference between various levels of triple superphosphate, in that the highest amount of grain protein was seen at a rate of 29 percent in treatment p2 (with the consumption of 200 kg of triple superphosphate per ha, and the lowest amount of grain protein was obtained at a rate of 28.68 in treatment p0 (without taking triple superphosphate) (table 3).

The interaction of livestock and phosphorus manure with grain protein

The results of the interaction of various factors also revealed that there was a significant difference between treatments, in that the highest amount of grain protein was seen at a rate of 30.93% in the treatment D1 P1 (taking 20 tons of livestock manure per acre with the consumption of 100 kg triple superphosphate per ha), and the lowest amount of grain protein was obtained at a rate of 27.6 percent in treatment D0 P0 (without consuming livestock manure and triple superphosphate) (table 4).

Leaf protein (percentage)

The results of data variance analysis indicated that the effect of various livestock manure factors on leaf protein became significant at a probability level of 1 percent, while the effect of various triple superphosphate factors on leaf protein was not significant. The interaction of various livestock manure factors with triple superphosphate became significant at a probability level of 5 percent (table 1).

The effect of livestock manure on the level of leaf protein

The result of the analogy of the mean data indicated that the effect of various livestock manure factors on leaf protein had significant difference, in that the maximum amount of leaf protein was seen at a rate of 26.02 percent in the treatment D2 (with the consumption of 20 tons of livestock manure per hectare), and the lowest amount of leaf protein was obtained at a rate of 20.68% in the treatment D1 (with the consumption of 10 tons of livestock manure per ha)(table 2).

The effect of triple superphosphate manure on leaf protein

Studying various factors of triple superphosphate affecting the level of leaf protein, there was a significant difference between various levels of triple superphosphate, in that the maximum amount of leaf protein was seen at a rate of 24.76 percent in the treatment P2 (with the consumption of 200 kg per ha of triple superphosphate), and the minimum amount of leaf protein was obtained at a rate of 23.34% in the treatment P0 (lack of consuming triple superphosphate) (table 3).

The interaction of livestock and phosphorus manure with the percentage of leaf protein

The results of the interaction of various factors showed that there was a significant difference between treatments, in that the maximum amount of leaf protein was seen at a rate of 30.42 percent in the treatment P2 D0 (without taking livestock manure and with the consumption of 200 kg per ha of triple superphosphate), and the lowest amount of leaf protein was obtained at a rate of 21.11% in the treatment P0 D1 (with the consumption of 10 tons per ha of livestock manure and without the consumption of triple superphosphate) (table 4).

The level of plant phosphor (percentage)

The results of data variance analysis indicated that the effect of various livestock manure factors on the level of plant phosphorus became significant at a probability level of 1 percent. Moreover, the effect of various triple superphosphate factors on the level of plant phosphorus proved significant at a probability level of 5 percent, and the interaction of various livestock manure factors with triple superphosphate became significant at a probability level of 1 percent (table 1).

The effect of livestock manure on the level of plant phosphorus

The results of the mean data indicated that the effect of various livestock manure factors on the level of plant phosphorus had significant difference, in that the maximum amount of plant phosphorus was seen at a rate of 0.4 percent in the treatment D2 (with the consumption of 20 tons per ha of livestock manure), and the lowest amount of plant phosphorus was obtained at a rate of 0.3% in the treatment D0 (without the consumption of livestock manure) (table 2).

The effect of triple superphosphate on the level of plant phosphorus

Studying various triple superphosphate factors affecting the level of plant phosphorus, there was a significant difference between various levels of triple superphosphate, in that the maximum amount of plant phosphorus was seen at a rate of 0.42% in the treatment P2 (with the consumption of 200 kg per ha of triple superphosphate), and the lowest amount of plant phosphorus was obtained at a rate of 0.32 percent in the treatment P0 (without the consumption of triple superphosphate) (table 3).

The interaction of livestock manure with triple phosphorus superphosphate on the level of plant phosphorus

The results of the interaction of various factors also showed that there was a significant difference between treatments, in that the maximum amount of plant phosphorus was seen at a rate of 0.42% in treatment D2 P2 (with the consumption of 20 tons per ha of livestock manure and 200 kg per ha of triple superphosphate), and the lowest amount of plant phosphorus was obtained at a rate of 0.3% in treatment D1 P0 (with the consumption of 10 tons per ha of livestock manure and without the consumption of triple superphosphate) and treatment D0 P0 (without the consumption of livestock manure and triple superphosphate) (table 4).

Conclusion

Livestock manure has significant effect on plant height, number of pods per plant, grain yield, leaf protein percentage, harvest index percentage, and the level of plant phosphorus, and improves all of them. Likewise, the consumption of a triple superphosphate fertilizer had a significant effect on plant height, protein percentage, and harvest index.

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