Agriways 7(1): 29-32. June 2019

ISSN: 2321-8614 (Print)
ISSN: 2454-2318 (Online)

Research Article

PRODUCTION AND PRODUCTIVITY OF LENTIL (*LENS CULINARIS* M.) AS INFLUENCED BY VARIOUS LEVELS OF PHOSPHORUS AND SULPHUR

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Received: 15 November 2018/Accepted: 28 May 2019

Abstract The present field experiment was conducted at the Crop Research Farm of S.D.J.P.G. College Chandeshwar, Azamgarh U.P. to find out the enhancing yield and economics of lentil using phosphorous and sulphur under Eastern Uttar Pradesh. In this context, a study was conducted in Randomized Block Design (RBD) with replicated four times. The experiment comprising of twelve treatments with four levels of Phosphorus viz.-0, 20, 40 and 60 kg P_2O_5/ha and three levels of Sulphur i.e.- 0, 20 and 40 kg/ha. The results showed that the significantly the highest biological yield, grain yield and straw yield of lentil crop were recorded by 60kg P_2O_5 /ha as compared to its lower dose of P_2O_5 during both the year of study, respectively. Among used sulphur doses, the biological, grain and straw yield of lentil crop were the significantly higher upto 20 kg/ha sulphur as compared with control during first and second year of experimentation. On the basis of economics, application of 40kg P_2O_5/ha along with 20kg sulphur/ha is the significantly best for achieving higher gross income and benefit cost ratio of lentil as well as economically more net return alongwith variety Naendra Masoor-2.
Key words: Lentil, Phosphorus, Sulphur

Introduction

Lentil (*Lens culinaris* M) is one of the oldest and most nutritious pluses crops. It cultivation clears back to begening agriculture itself. It is also used as a cover crop to check the soil erosion in problem areas. It is mostly eaten as 'dal'. The grain is consumed as a whole decorticated or decorticated and split. The cotyledons are deep orange red or orange yellow in colour. The whole bold seeded grain which is commonly known as "Malka Masoor" is also used in some of the dishes. In India, pulses occupy 23.76 million ha area contributing 14.11million tones to the world food basket (Ananymous 2007). India ranked first in the area (18.00 lakh ha) and second in the production (11.00 lakh tonnes) with 39% and 22% of world area and production, respectively. The highest productivity is recorded in croatia (2862 kg/ha) followed by New Zealand (2469 kg/ha). Canada rank first in production (41%) due to very high level of productivity (1633 kg/ha) as compared to India (611 kg/ha), (Annomymouse 2017) The present demand of pulses is about 18 million tones and will be about 29 million tones in the year 2025. The productivity of Lentil in U.P. is absolutely low due to several limitation viz.- nutrients deficiencies (Macro and Micro nutrients), imbalance fertilizer management practices and infestation of serious disease and pests as well as lack of new technology like proper sowing time, plant population and inadequate supply of fertilizer and lack of good seeds etc. Legumes usually require almost equal amount of phosphorus and sulphur. Phosphorus and sulphur below critical amount in the soil adversely affect both plant growth and quality of produce. To increase production with balanced fertilization particularly phosphorus and sulphur. Therefore present study was conducted to study the production and productivity of lentil as influence various levels of phosphorus and sulphur.

Methods and Materials

The field trial was conducted at the research form of S.D.J.P.G. College Chandeshwar Azamgarh (U.P.) during Rabi season of 2005-06 and 2006-07. The research farm is situated at a distance of 8 km away from Azamgarh city on Azamgarh-Gazipur road. The experiemental site falls under semiarid to sub-humid zones in Indo-gamgatic plains and lies between 25^0 18^0 N latitude and 83^0 $o3^0$ east longitude at an altitude of about 100 meter far mean sea level and is subjected to extremes of weather conditions.

The total winter rain fall during crop period (November to April) was 26.45 mm in 2005-06 and 8.42 mm in 2006-07. The maximum temperature during crop season was in the month of March during crop 2005-06 and 2006-07 respectively. On the basis of the analysis the soil of the site is silty loam in texture, alkaline in reaction (P^H) and normal in salt contents (E.C.) farm the nutrient availability point of view. The soil was low in organic carbon and nitrogen and medium in phosphorous and potassium.

The experiment was laid in Randomized Block Design with four levels of phosphorous and three levels of sulphur making 12 treatment combinations and replicating four times. The data recorded during the course of investigation were subjected to statistical analysis as per "mothod of analysis of variance" (Fisher, 1954). The phosphorous and sulphur (as one treatment) was applied as basal application through D.A.P. and elemental sulphur nitrogen at the rate of 20kg/ha through urea and 40kg K_2O/ha through muriatic of potash at the time of sowing. The crop was irrigated at 50 days after sowing.

Results and Discussion

(a) Effect of phosphorus on production:

The data on Biological yield grain yield and straw yield due to applied phosphorus are presented in table-1. Biological yield was the maximum under the effect of 60 Kg P_2O_5 ha-1 which was significantly higher than the 0 and 20 Kg P_2O_5/ha during both the years of study. Significantly higher grain yield was recorded by 60 Kg P_2O_5/ha as compared with its lower doses during both the years of study. Application of 60 Kg P_2O_5/ha enhanced the crop yield over control by 27.2 and 28.23 per cent during first and second year respectively. Straw yield was the maximum under the effect of 60 Kg P_2O_5/ha which was significantly higher than the control during both the years of study. Use of 60 Kg P_2O_5/ha registered the highest values of harvest index followed by 40 Kg P_2O_5/ha during both the years of study. Similar effect of fertilizer application was also obtained in case of straw yield which was due to fevourable effect of phosphatic fertilizer on growth characters of lentil. Harvest index increased with increasing phosphorus levels as compared to control. This might be due to the fact that better translocation of photosynthesis from source to sink increases the seed yield. Yield is result of coordinated interplay of growth and yield attributing characters. As the level of the phosphorus supply increase the extra protein synthesized allows the plant to grow larger foliage and hence to have a larger surface available for photosynthesis is roughly proportional to the amount of phosphorus supplied under higher levels of phosphorus, plants synthesize more photosynthesis and were better development. The findings are in close conformity with those of Maqsood *et al* (2000), Aga *et.al* (2004) and Saha *et.al* (2004).

Effect of sulphur in production:

The data on production of Lentil viz. biological yield, grain yield and straw yield under different sulphar doses are presented in table-1. Biological yield was the maximum under the effect of 40 Kg sulphar/ha which was significantly higher than the control treatments during both the years of study. Significantly the highest grain yield was recorded by 40 Kg S/ha as compared with control during both the years of study. Application of 40 Kg sulphar/ha enhanced the crop yield over control by 10.95 and 12.72 per cent during first and second year, respectively. Straw yield was the maximum under the effect of 40 Kg S/ha which was significantly higher than control during both the years of study. Application of 20 Kg Sulphar/ha registered the highest values of harvest index in first year and 40 Kg sulphar/ha in second year while, minimum of the same was recorded with control. The yield increased with due to improvement in growth characters and yield attributes. The effect of Sulphar in improving the crop yield might be due to low availability of its protein content. Similar effect of fertilizer application was also obtained in case of straw yield which was due to favorable effect of sulphar, fertilizer on growth characters of Lentil. Harvest index increased with increasing sulphar levels as compared to control. This might be due to the fact that better translocation of photosynthesis from source to sinc increases the seed yield. The findings are in close conformity with these Singh *et.al* (2004) Singh and Chauhan (2005) and Singh and Sekhan (2007).

(c) Effect of phosphorus on productivity of Lentil:

The data on economics like gross income, net income and benefits cost ratio due to applied phosphorus are presented in table-2. The application of phosphorus upto 40 kg/ha exerted a significantly effect on gross income during both year (Rs. 33429.25/ha in first year and Rs. 33383.83/ha in second year but economically increase at increasing level (120 kg/ha) during both years. On mean basis application of 40 kg/ha P_2O_5 enhanced the gross income by Rs. 3302.12/ha and Rs. 1531.12/ha compared to control and 20 kg/ha P_2O_5, respectively. The net return was significantly highest upto 40 kg/ha P_2O_5 of Rs. 19186.67 in first year and Rs. 19307.92/ha in second year in comparison to control and 20 kg/ha P_2O_5, respectively whereas in first year economically more net profit at increasing level of 120 kg/ha only. The application of 40 kg P_2O_5/ha increase the net return by a margin of Rs. 2431.90/ha (14.51%) and Rs. 1130.70/ha (6.26%) during first year and Rs. 2649.82/ha (15.91%) and Rs. 1356.61/ha (7.56%) during second year than control and use of 20 kg P_2O_5/ha, respectively. Significant response was noted with 40 kg P_2O_5/ha which gave significantly more return per rupee over control and 20 kg P_2O_5/ha in both the years. Significantly higher economics at 40 kg P_2O_5/ha might be due to sufficient dose for better grain and biological yield and favorable effect of lentil. The findings are conformity with Maqsood *et al.* (2000).

(d) Effect of sulphur on productivity of lentil:

The data on economics of lentils crop viz; gross and net income and return per rupee due to applied sulphur are presented in table-2. Application of sulphur exerted a positive effect on gross income upto 20 kg/ha during both the years. Beyond this dose the meager increase was observed. Application of 40 kg S/ha increased the gross income by a margin of Rs. 1641.25/ha (5.23%) & Rs. 407.75/ha (1.25%)

Table-1: Effect of Phosphorus and Sulphar on biological, grain and straw yield and harvest index of lentil during both years.

Treatment P_2O_5 Levels kg/ha	Biological yield q ha-1		Grain yield q/ha		Straw Yield(qha-1)		Harvest index %	
	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Phosphorus levels (kg/ha-1)								
0	48.45	48.19	16.48	16.40	31.96	31.79	33.98	34.05
20	51.86	51.60	18.66	18.57	33.20	33.03	35.95	35.99
40	56.12	56.05	20.46	20.44	35.66	35.62	36.46	36.46
60	56.96	57.11	20.97	21.03	35.99	36.08	36.81	36.91
SE (d)	1.00	1.10	0.50	0.38	0.67	0.89	1.75	1.81
CD @ 5%	2.78	3.07	1.38	1.06	1.88	1.46	N.S	N.S
Sulphur levels (kg/ha)								
0	50.76	50.14	17.99	17.77	32.78	32.37	33.37	35.37
20	53.98	54.04	19.48	19.53	34.44	34.52	36.07	36.08
40	55.35	55.53	19.96	20.03	35.39	35.51	35.97	36.10
SE (d)	0.86	0.96	0.43	0.33	0.58	0.77	1.35	1.37
CD @ 5%	2.40	2.66	1.20	0.91	1.62	2.13	N.S	N.S

Table-2: Effect of phosphorus and sulphur on gross income, net income and B:C ratio of lentil during both years.

Treatments	Gross income (Rs/ha)		Net income (Rs./ha)		B:C ratio	
	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Phosphorus level (kg/ha)						
0	30152.75	30056.08	16754.77	16658.10	1.26	1.25
20	31927.75	31823.08	18055.97	17951.31	1.32	1.31
40	33429.25	33383.83	19186.67	19307.92	1.35	1.35
60	33845.50	33867.33	19232.12	19253.96	1.32	1.32
SE (d)	352.50	365.90	320.80	286.00	0.016	0.020
CD at 5%	1050.30	1090.60	956.00	853.30	0.050	0.060
Sulphur levels (kg/ha)						
0	31380.56	31166.50	17926.05	17957.24	1.19	1.19
20	32614.06	3262.25	18548.30	18687.49	1.42	1.41
40	33021.81	33053.00	18447.80	18233.74	1.32	1.33
SE (d)	407.20	421.60	369.60	329.90	0.019	0.023
CD at 5%	1213.40	1256.40	N.S.	N.S.	0.060	0.070

during first year and Rs. 1886.50/ha (6.05%) and Rs. 424.75/ha (1.30%) during second year than control and use of 20 kg S/ha, respectively.

Sulphur had not positive effect on net income which was economically more at 20 kg/ha than lower and beyond higher doses of sulphur (0 and 40 kg S/ha) in both the years, respectively. But significant response was noted with 20 kg S/ha which gave significantly more return per rupee over control and used higher dose of sulphur in 40 kg/ha both the years, respectively. The similar findings were reported by Krishikosh, (2000) and Singh et al. (2013).

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