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Impact of levels of nitrogen and sulphur on yield attributes of lentil (*Lens culinaris*.)

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ABSTRACT

Abstracts: The present investigation entitled “Impact of different levels of Nitrogen and Sulphur on yield attributes of lentil (*Lens culinaris*.)” was laid out factorial randomized block design (FRBD) with three replication and the basic principles of randomization was followed at hajipur research farm of Chandra Bhanu Gupta Post Graduate College Bakshi Ka Talab Lucknow (Uttar Pradesh) consisted of 16 treatment combination having four nitrogen levels (0, 30, 60, and 90 Kg/Ha) and four phosphorus levels (0, 20, 40, and 60 Kg/Ha). Economic yield of a crop is the outcome and contribution of its different growth parameters and yield attribute, and therefore, optimization of the contribution of these yield components through judicious and equitable management of resources like N and S helps in harvesting of maximum yield. Improved availability of Sulphur and favourable nutritional environment might have helped the plants at the peak growth period and flowering stages which ultimately increased the number of pods/plant, number of seeds/pod and test weight. The higher values of yield attributes with application of N was mainly due to increase availability of nitrogen to plant which enhanced the photosynthesis activity and its translocation to sink resulted in improved yield attributes. Crop fertilized with 90 kg N/ha produced significantly highest grain yield (10.00 q/ha) straw yield (11.75 q/ha) and biological yield (21.75 q/ha) over rest of nitrogen levels.

Keywords: Management, Contribution, Optimization, Environment and Translocation

Introduction

Being a leguminous crop, lentil can make use of atmospheric Nitrogen to fulfill its N requirements through biological nitrogen fixation. Nitrogen fixation in legumes is governed by several factors like rhizobial strains as well N and S availability in the soil. Sulphur and nitrogen play specific roles in symbiotic N₂ –fixation through their effects on nodulation and N₂ fixation process symbiotic nitrogen fixation has a high S demand indirectly because the process consumes large amounts of energy (Schulze, 2006) [1] and energy generating metabolism strongly depends upon the availability of P.

Earlier maturity due to late season N deficiency reduces lentil biomass, harvest index and seed yield. The association of using late season N deficiency to trigger earlier maturity infers that lentil has a high seed demand for N and low N remobilization ability. Any N management strategy should target reducing late season N uptake in lentil, because N deficiency during maximum growth may reduce yield to a greater extent than late season N deficiency.

Sulphur is an important secondary plant nutrient, plays a critical role in various physiological processes in the plant in the formation of amino acids, synthesis of protein and chlorophyll. It activates enzymes and involves in the metabolic activities of vitamins (biotin and thiamine) and a part of co-enzyme A and pyrophosphate. Its deficiency can be responsible for flowering, fruiting and stunted growth. Pulses are reported to be second after oil seed in requirement of Sulphur (Tandon, 1991) [2].

Sulphur is found in nutrients viz, biotin & thiamine, cofactors Sadenosyl-L-methionine, coenzyme A, molybdenum cofactor (MoCo), and lipoic corrosive the chloroplast lipid sulphoquinovosyl, 524 diacylglycerol, and numerous auxiliary mixes. At physiological level, this is directly associated with enhanced photosynthesis, increased metabolite translocation and co-ordinated regulation of plants source to sink relationships (Pandey et al., 2013) [3]. Sulphur promotes nodules formation on roots of leguminous plants. Sulphur is taken up from the soil solution by the plant in the sulphate form in legume Sulphur is necessary for the efficient fixation of nitrogen by the plant (Scherer et al., 2009) [4].

Materials and Methods

The present investigation entitled “Impact of different levels of Nitrogen and Sulphur on yield attributes of lentil (*Lens culinaris*.)” was laid out factorial randomized block design (FRBD) with three replication and the basic principles of randomization was followed at hajipur research farm of Chandra Bhanu Gupta Post Graduate College Bakshi Ka Talab Lucknow (Uttar Pradesh) consisted of 16 treatment combination

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having four nitrogen levels (0, 30, 60, and 90 Kg/Ha) and four phosphors levels (0, 20, 40, and 60 Kg/Ha) included in the experiment. The data recorded with respect to different observation on yield attributes, yield and nutrients in the present experiment were analyzed statistically with the help procedure for factorial Randomized Block Design. (Gomaz and Gomaz). Yield attributing characters like Number of pods/plant, Number of grains/pods, Grain weight/plant, Test Weight, Grain Yield (kg/ha), Straw Yield (kg/ha) and Biological yield (kg/ha). The soil of experimental field was slightly alkaline in reaction (pH 7.85), low in organic carbon (0.45%) and low in available nitrogen (176.0 kg ha^{-1}) and phosphorus (15.2 kg ha^{-1}) and medium in potassium (210 kg ha^{-1}).

Results and Discussion

1. Yield attributes

The data pertaining to yield attributes viz, number of pods/plant, number of grains/pod, grain weight/plant, 1000 grain weight, grain weight/plant was subjected to statically analysis and presented in table. An examination of data revealed that the number of pods/plant, number of grain/pod, grain weight/plant, 1000 grain weight (g), grain weight/plant were affected significantly due to levels of nitrogen and sulphur.

Levels of nitrogen

The Data recorded on different yield attributes was subjected to statistically analysis and are presented in table (1). The data revealed that yield attributes like number of pods/plant, number of grains/pod, grain weight/plant and 1000 grain weight was affected due to levels of nitrogen and sulphur.

A perusal of data revealed that increasing levels of nitrogen increased the all yield attributes significantly. Crop fertilized with 90 kg N/ha produced the highest number of pods/plant (52.96), number of grains/pod (2.81), grain weight/plant (4.62) and test weight (21.44) over rest of the nitrogen levels. The significantly lowest value of yield attributes like number of pods/plant (33.20), number of grains/pod (1.88), grain weight/pod (2.94) and test weight (18.18) was recorded with control treatments (0 kg N/ha).

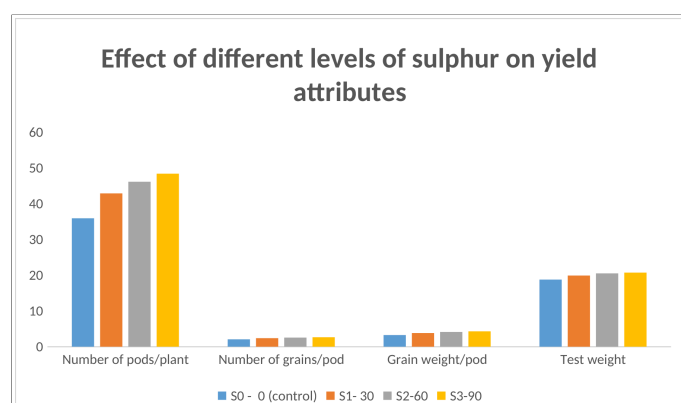
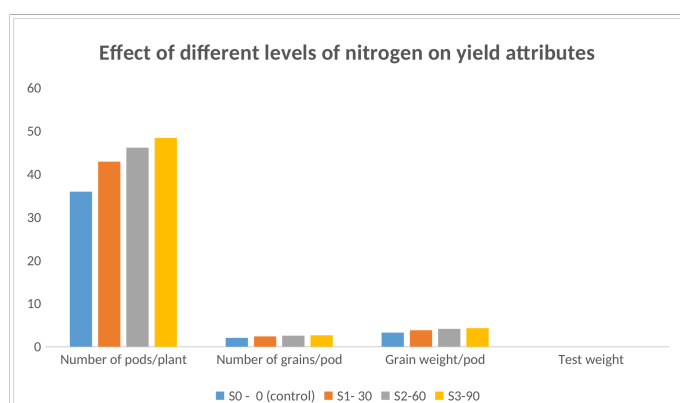
4.2.4 Levels of sulphur

Maximum number of pods/plant, number of grains/pod, grain weight/plant and test weight was recorded with application of 60 kg S/ha followed by 40 kg S/ha, 20 Kg S/ha, and being minimum with control (0 Kg S/ha) at all growth stages.

Application of sulphur 60 kg S/ha followed by 40 kg S/ha, 20 Kg S/ha has showed significant effect on pods/plant, number of grains/pod, grain weight/pod and test weight as compared to control (0 Kg S/ha).

Table 1: Effect of different levels of nitrogen and Sulphur yield attributes.

Treatment				
Nitrogen(kg/ha)	Number of pods/plant	Number of grains/pod	Grain weight/plant (g)	Test weight (g)
N ₀ - 0 (control)	33.20	1.88	2.94	18.18
N ₁ - 30	39.91	2.32	3.68	19.64
N ₂ - 60	47.24	2.63	4.25	20.63
N ₃ - 90	52.96	2.81	4.62	21.44
SE _m ±	0.47	0.02	0.01	0.13
CD(P = 0.05)	1.37	0.07	0.03	0.39
Sulphur (kg/ha)				
S ₀ - (control)	35.92	2.06	3.25	18.77
S ₁ - 20	42.88	2.39	3.82	19.90
S ₂ - 40	46.13	2.55	4.13	20.50
S ₃ - 60	48.39	2.64	4.29	20.73
SE _m ±	0.47	0.02	0.01	0.13
CD(P = 0.05)	1.37	0.07	0.03	0.39



Discussion

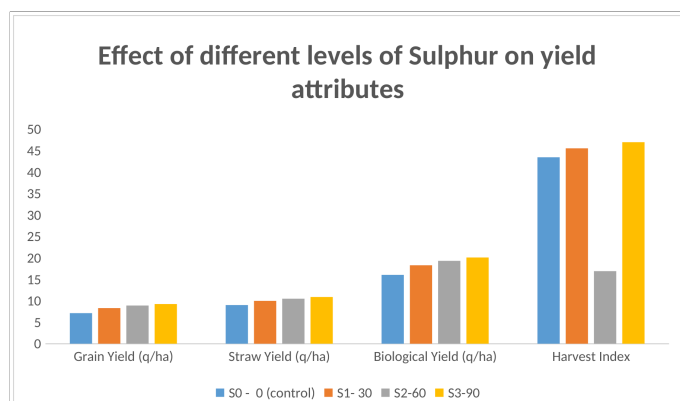
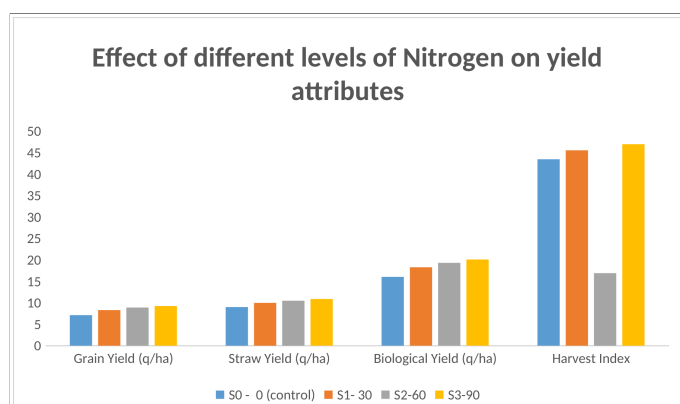
Economic yield of a crop is the outcome and contribution of its different growth parameters and yield attribute, and therefore, optimization of the contribution of these yield components through judicious and

equitable management of resources like N and S helps in harvesting of maximum yield. Improved availability of Sulphur and favourable nutritional environment might have helped the plants at the peak growth period and flowering stages which ultimately increased the number of pods/plant, number of seeds/pod and test weight. Improved growth characters might have also resulted into the improved source,

sink relationship and sink size. The higher values of yield attributes with application of N was mainly due to increase availability of nitrogen to plant which enhanced the photosynthesis activity and its translocation to sink resulted in improved yield attributes. These results are in agreement with the findings of Kumar *et al.* (2008) [5] and Mandal *et al.* (2001) [6].

Table 2. Grain yield (q/ha), straw yield (q/ha), biological yield (q/ha) and harvest index (%) of lentil as affected by Nitrogen and Sulphur at harvest stage of crop.

Nitrogen(kg/ha)		Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
N ₀ -	0 (control)	6.59	8.17	14.76	43.90
N ₁ -	30	7.92	9.53	17.36	45.79
N ₂ -	60	9.06	10.90	19.96	45.78
N ₃ -	90	10.00	11.75	21.66	47.42
SE _m ±		0.09	0.16	0.21	0.04
CD(P = 0.05)		0.27	0.47	0.61	0.12
Sulphur (kg/ha)		Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
S ₀ -	(control)	7.12	9.00	16.04	43.46
S ₁ -	20	8.30	9.99	18.29	45.55
S ₂ -	40	8.90	10.48	19.32	46.91
S ₃ -	60	9.24	10.88	20.10	46.97
SE _m ±		0.09	0.16	0.21	0.04
CD(P = 0.05)		0.27	0.47	0.61	0.12



2. Yield

The data pertaining to yield viz, grain yield (q/ha), straw yield (q/ha), biological yield (q/ha) and harvest index were subjected to statically analysis and presented in table. The examination of data revealed that

the grain yield (q/ha), straw yield (q/ha), biological yield (q/ha), were affected significantly due to levels of Nitrogen and Sulphur.

Levels of nitrogen

The perusal of data revealed that the application of nitrogen from 0-90 kg/ha increased significantly grain yield, straw yield and biological yield. Crop fertilized with 90 kg N/ha produced significantly highest gain yield (10.00 q/ha) straw yield (11.75 q/ha) and biological yield (21.75 q/ha) over rest of nitrogen levels. The lowest value of grain yield (6.59 q/ha), straw yield (8.17 q/ha), and biological yield (14.76 q/ha) was recorded in control treatment. Harvest index (%) increased with increasing levels of nitrogen. The highest harvest index (47.42%) was found with 90 kg N/ha treatment.

Levels of sulphur

The data revealed that application of Sulphur 0-60 kg/ha increased significantly the grain yield, straw yield and biological yield. Significantly the highest grain yield (9.24 q/ha), as compared to it, lower levels of N except in case of straw yield where 90 and 60 kg N/ha was found statistically at par with each other. Straw yield (10.88 q/ha) and biological yield (20.10 q/ha) was recorded with application of 60 kg S/ha. Harvest index (%) was increase with increasing levels of Sulphur. However, the highest harvest index (46.97%) was found with 60 kg S/ha treatment. The lowest harvest index (43.46) was recorded with the application of 0 kg S/ha.

Discussion

Significantly increase in yields was observed from N₀ to N₉₀ and being highest with the application of 90 kg N/ha. as compare to remaining treatment. The increase in yield with increasing nitrogen levels was mainly due to combined affect of higher growth and yield parameters which were significantly higher with nitrogen fertilization. The results are conformity with those of Sharma (1999) [7], Mandal *et al.* (2001) [6] who reported significantly increase in yield with increasing of N doses. Harvest index showed significantly improvement up to

90 kg N/ha. Increase in grain yield potentially to biological yield with increased nitrogen levels could be attributed to significant improvement in harvest index.

Sulphur plays an important role in enhancing the yield of legumes. Lentil responds well to sulphur application. Sulphur fertilization exhibited its ultimate influence on the seed and straw yield of lentil. Data presented in the table reveals that seed yield increased significantly with an increase in the levels of Sulphur up to 60 kg S/ha. Sulphur fertilization at the rate of 20, 40 and 60 kg S/ha produced seed yield of 8.30, 8.90, 9.24 and straw 9.99, 10.48, 10.88 respectively. Under the present study, number of pods/plant, number of seeds/pod, number of branches, 1000- seed weight etc. increased significantly with an increase in the sulphur level up to 60 kg S/ha. Thus, the seed yield was also increased significantly with increases sulphur application the seed yield is directly dependent on the yield attributing characters. The straw yield is also showed the same trend like the seed yield. These results are in conformity with the findings of Tomar *et al.* (2000) [8], Muhammad *et al.* (2002) [9], and Togay *et al.* (2008) [10].

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