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RESPONSE OF SOYBEAN TO NITROGEN AND SULPHUR FERTILIZATION IN SALINE SOIL

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The growth and yield of soybean (*Glycine max* var. Shohag Bangladesh) in saline soil was influenced by added nitrogen (0, 50, 100 kg N ha^{-1}) and sulphur (0, 30, 60 kg S ha^{-1}). Single and dual combinations of the fertilizers increased some of the agronomic characers viz height of plant, number of leaf and dry weights of leaf, stem and root appreciably. However, the treatments significantly increased the setting of pod, dry weight of pod, cummulative growth and finally the grain yield of soybean. Combination of the fertilizers performed better to modify the growth and yield of the plant rather than their individual applications. Best yield was achieved by the plant treated with 100 kg N together with 30 kg S ha^{-1}.

Keywords *:*Nitrogen; Saline soil; Soybean; Sulphur.

Introduction

Recently, the use of soybean oil is gaining momentum as an edible oil to the people's of Bangladesh. Consequently, the cultivation of soybean is going to be popularized to the farmers day by day. Moreover, due to acute shortage of edible oil, it is becoming imparative to grow more soybean to meet the national demand. Kanwar[1] reported that judicious application of fertilizers is the kingpin for getting increased yield of crops. Optimization of growth and yield of soybean could be achieved due to fertilization with nitrogen and sulphur[2,3].

Oil seed crops grow in most of the districts of Bangladesh. However, its cultivation in coastal zone did not receive much attention which covers about 30% of the net cultivable area[4]. Only wetland rice is grown during monsoon with poor yield. Recently, Soil Resources Develpment Institute (SRDI) conducted some field experiments to grow sesame and ground nut in a limited scale in the saline belt of Bagherhat area. so, it would be a logical approach if this potential land could be made economically viable for growing soybean during rabi season. With this views in mind, an attempt has been taken to evaluate the impact of nitrogen and sulphur on the growth and yield of the crop in coastal saline soil of Bagherhat, Khulna.

Materials and Methods

Sample of saline soil (0-15 cm) collected from batiaghata series was air-dried, grounded and passed through 2 mm sieve. A portion of this soil sample was further grounded to 100 mesh for chemical analysis of organic carbon and total nitrogen.

Greenhouse Experiment : An experiment in the greenhouse was carried out during rabi season using soybean as the test crop. A portion of soil (5 kg) was weighed out into a series of clean-dry earthen-ware pot (20 cm x 25 cm). Three rates of each of nitrogen (0, 50, 100 kg N ha^{-1}) and sulphur (0, 30, 60 kg S ha^{-1}) in a factorial combination were added to the soil according to the treatment structure. A basal dose of phosphorus (80 kg ha^{-1}) and potassium (60 kg ha^{-1}) was also applied. The fertilizers were mixed to the soil thoroughly as urea, gypsum, triple superphosphate and muriate of potash respectively in the form of aqueous solution of water. Extra amount of water was added to bring the soil into a suitable potting consistancy. Nine treatments, in triplicate, were arranged in a completely randomized block design.

Ten healthy and uniform size seeds of soybean (*Glycine max* var. Shohag

Bangladesh) were sown in each pot in the following day maintaining an almost equal space among them. Thin spray of water was given until the emergence of seedlings. After germination, best seven seedlings were allowed to grow and the rest was removed. Water was given periodically and weeds were removed as and when appeared.

Analytical Procedures : Analyses were done for particle size distribution[5] (clay texture), pH (6.6, soil : water ratio being 1:2.5, electrochemically), organic carbon[6] (1.06%, by wet oxidation), ECe[7] (6.1 dSm^{-1}, soil : water ratio being 1:2), CEC[8] (26.0 meq 100 g^{-1}, by N NH_4 OAc, pH 7.0), exchangable cations[8] (Ca(8.0), Mg (8.15), Na (9.0), K (0.85) meq 100 g^{-1}) by atomic absorption spectrophotometer and flame photometer, total N[9] (0.18%), available N[9] (6.21 mg 100 g^{-1}), and available S[8] (3.55 µg g^{-1}).

Results and Discussion

Application of nitrogen (0,50, 100 kg N ha^{-1}) and sulphur (0, 30, 60 kg S ha^{-1}) influenced the growth and yield of soybean (Table 1).

Addition of nitrogen and sulphur either alone or in combination increased the height of the plant in most of the treatments but not significantly (Table 1). Among the single dose, 50 kg N ha^{-1} and 60 kg S ha^{-1} produced the best effect on height of the plant. However, interactions of the fertilizers stimulated the height of the plant between 4.4 and 8.9% except the combination of highest level of nitrogen and sulphur ($N_{100}S_{60}$) where a reduction (3.6%) in the same was observed over the control (N_0S_0). Similar views were also reported by Mondal *et al*[3] for soybean plant.

Leaf an intergral part of the growth component was also modified positively by the treatment combinations in most of the cases (Table 1). Like height, the same treatments, $N_{50}S_0$ and N_0S_{60}, among the individual combinations helped to increase the number of leaves about 11.7 and 16.1% more over the control respectively. Moreover, the combined application of nitrogen and sulphur performed better to modify the leaf number per plant accounting about 15.4 to 17.6% more over the plant receiving no fertilizers.

Number of pod per plant was influenced positively and significantly by the applied treatments (Table 1). Nitrogen alone increased the number of pod upto 29%. Contrary to this, the peformance of sulphur was accounted to be 6.5 to 22.6% over the control. It is noted that the impact of sulphur on setting of pod was significantly increased with increasing rate of the fertilizers. However, increase in nitrogen from 50 to 100 kg ha^{-1} was of no use in setting of pod per plant. Interactions of the fertilizers also proved their superiority over the control to increase the number of pod and the variation among themselves ranged between 23.3 and 33.3%. Similar opinion was also proposed by Mondal *et al*[3] and Dahatonde and Shava[10]. The author observed that supply of nitrogen and sulphur could significantly increase the setting of pod per plant of soybean.

Vegetative growth of soybean has been assessed as dry weights of pod, leaf, stem and root (Table 1). All these growth parameters have been improved due to applied treatment combinations except root. Nitrogen alone increased all these agronomic characteristics appreciably accounting about 39.6 to 44.8, 28.6 to 14.3 and 18.4 to 1.3% more weight of pod, leaf and stem of soybean, respectively, when applied at 50 and 100 kg ha^{-1}. Application of sulphur also promoted these vegetative growth components almost in the same way comprising about 15.6 to 38.5, 14.3 and 7.6% more over the

Table 1. Effect of nitrogen and sulphur on growth and yield of soybean in saline soil.

Treatment (kg ha^{-1})	Plant height (cm)	No. leaf (Plant^{-1})	No. pod (Plant^{-1})	Dry matter yield (g pot^{-1}) Pod	Leaf	Stem	Root	Cumulative growth	Grain yield (g pot^{-1})
NoSo	22.5	13.6	3.1	0.96	2.1	1.57	0.40	5.03	1.97
$N_{50}So$	24.1	15.2	4.0	1.20	2.7	1.86	0.43	6.19	2.69
$N_{100}So$	22.7	13.4	4.0	1.39	2.4	1.59	0.40	5.78	2.92
NoS_{30}	22.5	15.6	3.3	1.11	2.4	1.52	0.39	5.42	2.86
NoS_{60}	22.9	15.8	3.8	1.33	2.4	1.69	0.39	5.81	2.54
$N_{50}S_{30}$	24.5	13.1	3.7	1.24	2.3	1.54	0.38	5.46	2.89
$N_{100}S_{30}$	24.2	16.0	3.0	1.05	2.7	1.70	0.38	5.83	3.29
$N_{50}S_{60}$	23.5	15.9	3.8	1.47	2.5	1.83	0.41	6.21	3.04
$N_{100}S_{60}$	21.7	15.7	4.0	1.29	2.2	1.55	0.37	5.41	3.05
LSD N	NS	NS	0.20	0.11	NS	NS	NS	0.23	0.15
(P=0.05) S	NS	NS	0.10	0.10	NS	NS	NS	0.19	0.14
N x S	NS	NS	0.25	0.20	NS	NS	NS	0.25	0.21

weight attained by the plants receiving no nitrogen and sulphur fertilizers. However, nitrogen when supplemented with sulphur did not improve the situation too much in comparison to their lone applications. The growth of root did not vary significantly either by main or interaction of the added fertilizers. These findings agreed favourably well with the observations of Hoque *et al*[2]. Similar views were also reported by Hossain *et al*[11].

However, when the cumulative accumulation of dry matter is taken into consideration, a changed picture pattern was observed. A close look at the data revealed that addition of nitrogen decidedly increased the overall vegetative growth of the crop significantly (Table 1). The picture pattern of the production of dry matter due to single application of sulphur was also encouraging and increased the same about 7.7 and 15.5% when applied at the rate of 30 and 60 kg ha^{-1} respectively. Increase in application of sulphur from 30 to 60 kg ha^{-1} accentuated the accumulation of dry matter about 7.8%. Generally, interactions of the fertilizers ($N_{50}S_{60}$) played the best role to promote the growth of the plant than their individual applications. Gaines and Phatak[12] reported from a hydrophonic experiment that increase in sulphur levels increased the dry weight of soybean significantly. However, increase in dry weight of

soybean due to combined application of nitrogen and sulphur has also been reported[2].

Supply of nitrogen and sulphur decidedly improved the yield of grain of soybean and was found to be statistically significant (Table 1). Individual application of nitrogen and sulphur promoted the yield of grain significantly. Moreover, the yield increase due to increment in fertilizer was also significant. About 8.6% more yield of grain was achieved due to increase in rate of nitrogen from 50 to 100 kg ha^{-1}. However, no such positive impact of sulphur was recorded rather a retardation in yield was observed at the highest level of sulphur. Nitrogen in association with lower dose of sulphur accentuated the yield of grain also significantly. Moreover, the yield increase due to increase in nitrogen showed glaringly better result. On the other hand, nitrogen in conjuction with higher dose of sulphur stimulated the production of grain significantly too. However, the yield increase due to increase in supply of nitrogen was not statistically significant. A glance look at the data reveals that yield of grain was significantly better at either levels of nitrogen when incorporated with lower dose of sulphur as compared to higher dose of the fertilizer. This possibly suggests that higher dose of sulphur failed to increase the yield of grain rather interacted on the other way round. Applicated on 100 kg N ha^{-1} in conjunction with 30 kg S ha^{-1} proved the best efficacy to produce the highest yield of grain.

Improvement in grain yield of soybean by nitrogen and sulphur application has also been reported by other workers[2,3]. Prasad and Hajare[14] reported that application of these fertilizers could increase the seed yield of soybean too.

Summerization of the results suggest that the best yield of soybean grain could be obtained provided the soil is fertilized with 100 kg N together with 30 kg S ha^{-1}.

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