Effect of Phosphorus and Sulphur on Growth and Yield of Soybean (*Glycine max* L.)

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Abstract

A field experiment was conducted at Sher-e-Bangla Agricultural University Farm, Dhaka, Bangladesh from December 2008 to April 2009 to evaluate the effect of P (viz. 0, 15, 30, 50 kg P_2O_5 ha^{-1}) and S (viz. 0, 10, 20, 40 kg S ha^{-1}) and their interaction on the growth and yield of soybean (*Glycine max* L.). Individual application of different levels of phosphorus and sulphur showed significant effect on yield and yield attributes studied. Among them, plant height, number of primary branch $plant^{-1}$, number of leaves $plant^{-1}$, stover yield increased significantly up to 50 kg P ha^{-1}. On the other hand, numbers of pods $plant^{-1}$, number of seeds $plant^{-1}$, thousand seed weight, grain yield, biological yield increased significantly up to 30 kg P ha^{-1}. However, in case of S, the positve response was observed only upto 20 kg S ha^{-1}. The combined application of phosphorus @ 30 kg P ha^{-1} and sulphur @ 20 kg S ha^{-1} gave rise to the highest number of pods $plant^{-1}$ (30.07), number of seeds $plant^{-1}$ (84.94), thousand seed weight (94.61 g), and in turn produced highest grain yield (2.29 t ha^{-1}). Thus, the combined application of 30 kg Phosphorus ha^{-1} and 20 kg Sulphur ha^{-1} may be considered to be optimum for getting higher yield of soybean.

1. Introduction

Soybean (*Glycine max* L.) is one of the leading oil and protein containing crops of the world. The crop is about 90.19 mha of land and annual production is approximately 220.5 mt in the world (FAO, 2009). Soybean has the capacity to form a symbiotic association with *Rhizobium japonicum* and able to fix 20% of the atmospheric nitrogen throughout the world annually (Franco, 1978). In Bangladesh, soybean is called the *Golden bean*. Soybean grain contains 29.6-50.3% protein, 13.5-24.2% fat and 3.3-6.4% ash (Purseglove, 1984) and 24-26% carbohydrate (Gowda and Kaul, 1982). Besides, it also contains various vitamins and minerals. It provides around 60% of the world supply of vegetable protein and 30% of the oil (Fehr, 1989). However, per hectare yield of soybean in Bangladesh is only 1.2 t ha^{-1} (BARI, 2007) as compared to other soybean producing countries of the world like USA with seed yield of 3.5 t ha^{-1} (James et al., 1999). There is a great possibility to increase its production by adequate supply of nutrients especially phosphorus and sulphur to the crops.

In legumes, phosphorus stimulates rhizobial activity, nodule formation and thus helps in N_2-fixation. It increases the water use efficiency, improves taste, storage quality and skin hardness of the bean. As phosphorus plays a role in photosynthesis, respiration, energy storage and transfer, cell division and enlargement, it has been shown to be important for growth, development and yield of soybean (Kakar et al., 2002). Fageria et al. (1995) suggested that large quantities of P fertilizer may be required for successful soybean production. Phosphorus deficiency is now considered as one of the major constrains to successful production of legumes in Bangladesh. Sulphur also plays very important role in plant; aids in stabilization of protein structure, involve in metabolic activities of vitamins, helps in sysnthesis of sulphur containing essential amino acids and coenzyme A, chlorophyll formation, takes part in N-metabolism and promotes nodulation for N_2-fixation in legumes. It also gives rise to bold seeds in oil seeds. Soybean is a sulphur loving plant and like other oilseed crops, its sulphur requirement is more than that of many other crops for proper growth and yield. The response of soybean to sulphur application has been reported by several workers (Nagar et al., 1993; Rao and Ganeshmurthy, 1994). However, most of the Bangladesh soils are deficient in available sulphur which roughly covers about 44% of the total cropped area (Hussain, 1990). Thus, S application is the need of Bangladesh soil for proper growth, yield and oil content of soybean.

The interaction of P and S is quite expected in soil and plant system as both of these are adsorbed on similar sites on soil colloids and show similar composition of precipitates produced with Ca, Fe and Al. Higher P and S demands of pulses and oilseeds have a definite bearing on their interrelationships. P and S interactions in soils of poor fertility may be more important (Aulakh et al., 1990). In Bangladesh, limited information is available on the role of phosphorus and sulphur on the growth and yield of soybean. With a view to generate information, a field experiment was conducted to observe the interaction effect of P and S on the growth and yield of soybean and to find out the optimum doses of P and S for maximum growth and yield of soybean.

2. Materials and Methods

In order to study the role of P and S in influencing growth and yield of soybean, an experiment was conducted at the Sher-e-Bangla Agricultural University Farm, Dhaka 1207 (Tejgaon series under AEZ No. 28) during the *rabi* season of 2008-2009. The experimental site was located at 23^{o}77 N latitude and 90^{o}3 E longitudes with an elevation of 1.0 meter from the sea level. Temperature during the cropping period ranged between 12.20^{o}C to 29.2^{o}C, the humidity 73.52% to 81.25% with 10.5-11.0 hours day length and a very little rainfall was recorded. The surface (0-15 cm) soil of the experimental site was sandy loamy with pH 6.4, organic carbon 0.78%, total nitrogen 0.062%, available phosphorus 20.54 kg ha^{-1}, sulphur 39.24 kg ha^{-1} and potassium 88.92 kg ha^{-1}. The soil type was deep red brown terrace soils and textural class is silty clay loam. The experiment was laid out in randomized block design with factorial concept, each plot measuring 2.5×2.0 (5 m^{2}) with 3 replications. The experiment comprised of 2 factors viz.; 4 levels of phosphorus: P_0=0 kg P ha^{-1}, P_1=15 kg P ha^{-1}, P_2=30 kg P ha^{-1}, P_3=50 kg P ha^{-1} and 4 levels of sulphur: S_0=0 kg S ha^{-1}, S_1=10 kg S ha^{-1}, S_2=20 kg S ha^{-1}, S_3=40 kg S ha^{-1}. BARI Soybean-5, a high yielding variety of soybean was used as the test crop in this experiment. The adjacent block and neighboring plots were separated by 1.0 m and 0.5 m, respectively. Recommended doses of N, K, Zn and B (30 kg N ha^{-1} from urea, 40 kg K ha^{-1} from MOP, 2 kg Zn ha^{-1} from ZnO and 1 kg B ha^{-1}from Boric acid, respectively) were applied. Soybean seeds were sown in lines with a spacing of 30×5 cm^{2} on 27th December, 2008. All other recommended agronomic practices were followed. The crop was harvested at maturity on 14th April, 2009. The data on growth and yield parameters were recorded and analyzed statistically to find out the treatment difference and the mean differences were compared using DMRT (Gomez and Gomez, 1984).

3. Results and Discussion

3.1. Growth parameters

Among the different doses of phosphorus, 50 kg P ha^{-1} gave rise to the highest plant height (Table 1), which was closely followed by 30 kg P ha^{-1}. On the other hand, the lowest plant height was observed where no phosphorus was applied. These results were attributed to the positive effect of phosphorus on the growth of soybean. The present findings are in partially agreement with the result of Bothe et al. (2000) who reported that the application of phosphorus @ 75 kg ha^{-1} enhanced the plant height at highest value. Maurya and Rathi (2000) also found the positive effect of P on the plant height of soybean. Soybean plants showed significant variation in respect of plant height when different doses of sulphur fertilizer were applied (Table 2). Among the different fertilizer doses, 40 kg S ha^{-1} resulted in highest plant height which was statistically similar with that of 20 kg S ha^{-1}. Plant height increased with increasing levels of sulphur up to maximum level of S application. The increase in plant height as observed in the experiment may be due to the favorable effects of sulphur on N-metabolism and consequently on the vegetative growth of soybean plant. Similar findings were also reported in groundnut (Chaubey et at., 2000) and linseed (Dubey et al., 1997). Shortest plant was observed in control plot. The result is similar to Tabatabai (1986) who reported that lack of sulphur reduces plant height. Crop responses to sulphur and phosphorus interaction for plant height has been presented in (Table 3).The lowest plant height was observed in the control treatment combination (No phosphorus and no sulphur). On the other hand, the highest plant height was recorded with 50 kg P ha^{-1} and 40 kg S ha^{-1}.

Table 1: Effect of phosphorus on growth and yield of soybean

Treatments	Plant height (cm)	Number of primary branches plant^{-1}	Number of leaves plant^{-1}	Number of pods plant^{-1}	Number of seeds plant^{-1}	Test weight (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})
P_0	64.06^{c}	2.46^{c}	10.30^{b}	14.57^{d}	54.20^{c}	88.62^{c}	1.51^{c}	2.47^{c}	4.00^{c}
P_1	64.46^{c}	2.96^{b}	10.82^{ab}	22.42^{c}	68.27^{b}	90.73^{b}	1.85^{b}	2.80^{b}	4.63^{b}
P_2	66.66^{b}	3.53^{a}	11.34^{a}	27.73^{a}	80.21^{a}	93.57^{a}	2.04^{a}	2.89^{a}	4.96^{a}
P_3	68.50^{a}	3.59^{a}	11.38^{a}	26.82^{b}	78.28^{a}	92.71^{a}	2.03^{a}	2.93^{a}	4.92^{a}

In a column figures having similar letter(s) do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT

Tomar et al. (2004) also found the positive interaction effect of P and S on the plant height of soybean. The highest plant height might have resulted from the synergistic effect of P and S on the growth processes of the plant.

Application of phosphorus significantly influenced the number of primary branches plant^{-1} in soybean (Table 1). The highest number of primary branches plant^{-1} (3.59) was recorded with 50 kg P ha^{-1} which was statistically at par with 30 kg P ha^{-1} application (3.53). The lowest number of primary branches plant^{-1} (2.46) was recorded in the control treatment. The increase number of primary branches plant^{-1} may be due to favorable effects of phosphorus on hormonal balance that helped proper growth and development of the soybean plant. Sulphur fertilizer application also caused significant variations in number of primary branches of soybean. Among the different doses, 20 kg S ha^{-1} application showed the highest number of primary branches plant^{-1} (3.49). On the contrary, the lowest number of primary branches plant^{-1} (2.62) was recorded in no sulphur fertilizer application. Mohanti et al. (2004) reported similar observations with 30 kg S ha^{-1} application. Dubey et al. (1997) reported that S increased the number of primary branches per plant of linseed up to 40 kg S ha^{-1}. The combined application of P and S fertilizer had a significant impact on the number of primary branches plant^{-1} of soybean (Table 3). The highest number of primary branches plant^{-1} (4.167) was recorded with the treatment combination of 50 kg P ha^{-1} and 20 kg S ha^{-1}. On the other hand, the lowest number of primary branches plant^{-1} (2.0) was recorded in the control treatment.

Phosphorus fertilizer application resulted significant variation in the number of leaves plant^{-1} (Table 1). The highest number of leaves plant^{-1} (11.38) was recorded with 50 kg P ha^{-1} which was statistically at per with that observed in 30 kg P ha^{-1} (11.34) application. The lowest number of leaves plant^{-1} (10.30) was recorded in no phosphorus application.

Different doses of sulphur fertilizer also caused significant variations in the number of leaves plant^{-1} (Table 2).

Among the different doses of fertilizers, 40 kg S ha^{-1} application gave rise to the highest number of leaves plant^{-1} (11.63). On the contrary, the lowest number of leaves plant^{-1} (9.950) was recorded in no S application (Table 3). The highest number of leaves plant^{-1} (12.53) was recorded with the treatment combination of P_3S_2 (50 kg P ha^{-1}+40 kg S ha^{-1}). On the other hand, the lowest number of leaves plant^{-1} (9.133) was recorded in the P_0S_0 treatment combination.

3.2. *Yield contributing characters*

Significant variation in number of pods plant^{-1} was observed at various levels of phosphorus application (Table 1). The highest number of pods plant^{-1} (27.73) was recorded with 30 kg P application ha^{-1}. The lowest number of pods plant^{-1} (14.57) was recorded in no phosphorus application. These findings are in agreement with Reddy and Giri (1989) who reported that phosphorus application @ 20 kg P ha^{-1} increased the pod yield of soybean. Similar results were also found in soybean by Jana et at. (1990) and Singh and Bajpai (1990). Different doses of sulphur fertilizer application increased number of pods plant^{-1} (Table 2). Among the different doses of fertilizers, 40 kg S ha^{-1} resulted in production of highest number of pods plant^{-1} (25.38). Whereas, the lowest number of pods plant^{-1} (19.21) was recorded in no S application. Sriramachandrasekharan et al. (2004) made similar type of observations with the application of 30 kg S ha^{-1} in the presence of *Bradyrhizobium* inoculation. The combined effect of different doses of P and S fertilizers on the number of pods plant^{-1} was significant (Table 3). The highest number of pods plant^{-1} (30.73) was recorded with the combined application of 30 kg P ha^{-1} and 40 kg S ha^{-1}. On the other hand, the lowest number of pods plant^{-1} (13.00) was recorded in the P_0S_0 treatment combination. Majumdar et al. (2001) found that combined application of P and S @ 60 kg P_2O_5 ha^{-1} and 40 kg S ha^{-1} respectively increased the number of pods plant^{-1}. The highest number of pods plant^{-1} may be due to the fact that, the combined effect of both phosphorus and sulphur had positive effect on the reproductive growth and pod formation of soybean.

Table 2: Effect of sulphur on the growth and yield of soybean

Treat-ments	Plant height (cm)	Number of primary branches plant^{-1}	Number of leaves plant^{-1}	Number of pods plant^{-1}	Number of seeds plant^{-1}	Test weight (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})
S_0	62.82^c	2.625^c	9.9 b	19.21^c	62.82^b	89.10^c	1.57^c	2.51^c	4.11^c
S_1	65.46^b	3.075^b	10.71^{ab}	22.02^b	70.43^a	91.13^b	1.74^b	2.74^b	4.49^b
S_2	67.20^a	3.492^a	11.55^a	24.92^a	72.32^a	92.62^a	2.06^a	2.94^a	4.98^a
S_3	68.21^a	3.362^a	11.63^a	25.38^a	75.40^a	92.78^a	2.06^a	2.91^a	4.94^a

In a column figures having similar letter(s) do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT

Application of different doses of P resulted significant variation in number of seeds plant^{-1} (Table 1). The highest number of seeds plant^{-1} (80.21) was recorded with 30 kg P ha^{-1} which was statistically similar with that obtained from the application of 50 kg P ha^{-1}. The lowest number of seeds plant^{-1} (54.20) was recorded in no phosphorus application treatment. The result confirms with the findings of Jana et al. (1990). Sulphur fertilizer application increased number of seeds plant^{-1} (Table 2). But there was no significant difference among the different doses of S fertilizer application. The lowest number of seeds plant^{-1} (62.82) was recorded in the control treatment. The present findings are in accordance with the observations of Dubey et al. (1997) who reported increase in seeds capsule^{-1} of linseed with the application of sulphur. Saran and Giri (1990) also found similar results with the application of 60 kg S ha^{-1}. The combined application of P and S fertilizers increased the number of seeds plant^{-1} in soybean (Table 3). The highest number of seeds plant^{-1} (84.94) was recorded with P_2S_2 (30 kg P ha^{-1}+20 kg S ha^{-1}) which was statistically at per with P_2S_3, and P_3S_2. On the other hand, the lowest number of seeds plant^{-1} (50.29) was recorded in the control treatment combination. The present observations are in accordance with the findings of Tomar et al. (2004) and Majumdar et al. (2001) who reported that combined application of P and S increased significantly the number of seeds plant^{-1} in soybean. Application of nutrients particularly P and S in right proportion might have lead to balance development of vegetative and reproductive structure which in turn resulted in formation of large number of seeds plant^{-1}.

Phosphorus application increased test weight in soybean and the highest test weight (93.57 g) was recorded with the application of 30 kg P ha^{-1} which was statistical similar with that obtained from application of 50 kg P ha^{-1} (Table 1). The result confirms with the findings of Reddy and Giri (1989). Similarly, S application also increased test weight and the maximum test weight (92.78 g) was recorded with 40 kg S application ha^{-1} (Table 2). These results are in agreement with the findings of Hemantarajan and Trivedi (1997), Agrawal and Mishra (1994) who also reported that S application increased test weight in soybean. The combined application of P and S further increased test weight and the highest test weight (94.61 g) was recorded with the treatment combination of 30 kg P ha^{-1} and 20 kg S ha^{-1} (Table 3). The control treatment (P_0S_0) recorded lowest test weight (86.98 g).

Significant variation was observed in the grain yield of soybean with different doses of phosphorus application (Table 1). The highest grain yield of soybean (2.046 t ha^{-1}) was obtained in the treatment of 30 kg P ha^{-1} which was statistically at par with that obtained from 50 kg P ha^{-1}. The lowest grain yield (1.518 t ha^{-1}) was recorded in the P_0 treatment. These results are in agreement with the findings of Maurya and Rathi (2000) who reported the increase in grain yield of soybean with the application of P and the highest grain yield was recorded with

Table 3: Interaction effect of P and S on the growth and yield of soybean

Treatments	Plant height (cm)	Number of primary branches plant^{-1}	Number of leaves plant^{-1}	Number of pods plant^{-1}	Number of seeds plant^{-1}	Test weight (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})
P_0S_0	60.87^{i}	2.00^{i}	9.13^{e}	13^{i}	50.29^{g}	86.98^{f}	1.32^{f}	1.95^{g}	3.28^{h}
P_0S_1	62.60^{g-i}	2.33^{hi}	9.33^{de}	14.07^{hi}	55.88^{fg}	87.53^{f}	1.38^{f}	2.45^{f}	3.87^{g}
P_0S_2	65.53^{d-f}	2.80^{fg}	11.7^{ab}	14.67^{h}	50.99^{g}	89.43^{e}	1.62^{e}	2.82^{c-e}	4.45^{ef}
P_0S_3	67.25^{b-d}	2.71^{f-h}	11.0^{a-d}	16.57^{g}	59.65^{e-g}	90.54^{de}	1.73^{de}	2.67^{e}	4.40^{f}
P_1S_0	61.18^{hi}	2.66^{gh}	9.53^{c-e}	17.87^{fg}	61.51^{e-g}	87.37^{f}	1.44^{f}	2.50^{f}	3.94^{g}
P_1S_1	63.46^{f-h}	3.13^{d-f}	10.6^{b-e}	19.23^{f}	66.12^{d-f}	90.39^{de}	1.84^{d}	2.82^{c-e}	4.67^{cd}
P_1S_2	66.34^{c-e}	3.06^{d-g}	11.7^{ab}	25.77^{d}	70.34^{b-e}	92.63^{a-c}	2.08^{bc}	2.87^{b-d}	4.95^{b}
P_1S_3	66.46^{c-e}	3.00^{e-g}	11.40^{ab}	26.83^{cd}	75.13^{a-d}	92.54^{bc}	2.06^{c}	3.01^{ab}	4.97^{b}
P_2S_0	64.74^{d-g}	2.80^{fg}	10.87^{a-d}	22.43^{e}	70.49^{b-e}	91.76^{cd}	1.77^{de}	2.86^{b-d}	4.71^{cd}
P_2S_1	66.25^{c-e}	3.40^{c-e}	11.67^{ab}	27.67^{bc}	80.76^{ab}	93.43^{a-c}	1.88^{d}	2.74^{de}	4.62^{c-e}
P_2S_2	67.29^{b-d}	3.93^{ab}	11.27^{a-c}	30.07^{a}	84.94^{a}	94.61^{a}	2.29^{a}	3.01^{ab}	5.30^{a}
P_2S_3	68.36^{a-c}	4.00^{ab}	11.57^{ab}	30.73^{a}	84.65^{a}	94.46^{ab}	2.22^{ab}	2.98^{a-c}	5.20^{a}
P_3S_0	64.50^{e-g}	3.03^{d-g}	10.27^{b-e}	23.53^{e}	68.29^{c-e}	90.28^{de}	1.76^{de}	2.74^{de}	4.50^{d-f}
P_3S_1	69.52^{ab}	3.43^{cd}	11.23^{a-c}	27.13^{cd}	78.95^{a-c}	93.18^{a-c}	1.88^{d}	2.94^{a-c}	4.79^{bc}
P_3S_2	69.65^{ab}	4.16^{a}	11.47^{ab}	29.20^{ab}	83.69^{a}	93.82^{ab}	2.27^{a}	3.06^{a}	5.23^{a}
P_3S_3	70.35^{a}	3.73^{bc}	12.53^{a}	27.40^{cd}	82.18^{ab}	93.58^{a-c}	2.22^{ab}	2.99^{ab}	5.18^{a}

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60 kg P $ha^{-1.}$ Sulphur fertilizer application also increased grain yield of soybean (Table 2) and the highest grain yield was recorded in S_2 (20 kg S ha^{-1}) and S_3 (40 kg S ha^{-1}) treatments which were at per. Sriramachandrasekharan et al. (2004) found highest grain yield with the application of 30 kg S ha^{-1} in the presence of *Bradyrhizobium* inoculation. Sangale et al. (2004) observed that application of S @ 20 kg ha^{-1} gave highest seed yield. Mohanti et al. (2004) found similar results with the application of 30 kg S ha^{-1}. Tomar et al. (2000) reported the highest seed yield (2257 kg ha^{-1}) with the application of 50 kg S ha^{-1} regardless of sources. The combined application of P and S further enhanced seed yield of soybean (Table 3) and the highest grain yield of soybean (2.29 t ha^{-1}) was recorded in the P_2S_2 treatment combination (30 kg P ha^{-1}+20 kg S ha^{-1}) which was statistically at similar performance with P_2S_2 treatment. Whereas, the lowest grain yield of soybean (1.32 t ha^{-1}) was recorded in the P_0S_0 treatment combination. The present studies are in accordance with the findings of Tomar et al. (2004) and Majumdar et al. (2001) who reported greater increase in grain yield of soybean with combined application of phosphorus and sulphur.

Application of different doses of phosphorus increased stover yield of soybean significantly (Table 1). The highest stover yield of soybean (2.94 t ha^{-1}) was recorded with 50 kg P ha^{-1} whereas, lowest stover yield (2.47 t ha^{-1}) was recorded in no phosphorus application treatment. The findings are in agreement with the results obtained by Sacchidanand et al. (1980) who observed that straw yields of soybean increased with the application of P @ 30 kg P_2O_5 ha^{-1}. Similarly, application of sulphur increased stover yield of soybean and the highest stover yield of soybean (2.942 t ha^{-1}) was obtained with 20 kg S $ha^{-1,}$ which was statistically at per with that obtained from 40 kg S ha^{-1} application (Table 2). Similar findings were reported by Tomar et al. (1995) who observed that straw yields of mustard increased with increasing S application rates. The stover yield got further increased with the combined application of phosphorus and sulphur and the highest stover yield was recorded with combined application of 50 kg P ha^{-1} and 20 kg S ha^{-1} which was closely followed by P_3S_3 treatment (50 kg P ha^{-1}+40 kg S ha^{-1}). On the other hand, the lowest stover yield of soybean (1.9533 t ha^{-1}) was recorded in the control treatment. These findings agree with the observation made by Tomar et al. (2004) and Majumdar et al. (2001) who reported that straw yield of soybean increased significantly with the combined application of phosphorus and sulphur in increasing rate.

Application of different doses of phosphorus caused significant variation in biological yield of soybean (Table 1). The highest biological yield of soybean (4.964 t ha^{-1}) was recorded with P_2 treatment (30 kg P ha^{-1}) which was statistically at par with that obtained from P_3 treatment (50 kg P ha^{-1}). The lowest biological yield (4.003 t ha^{-1}) was recorded in the control treatment. Different doses of sulphur fertilizer application increased biological yield of soybean (Table 2) and the highest biological yield of soybean (4.986 t ha^{-1}) was obtained from the application of 20 kg S ha^{-1} the lowest biological yield of soybean (3.112 t ha^{-1}) was recorded in the control treatment. The combined application of different doses of P and S fertilizers further increased biological yield of soybean (Table 3) and the highest biological yield of soybean (5.307 t ha^{-1}) was recorded with the treatment combination of P_3S_2 (50 kg P ha^{-1}+20 kg S ha^{-1}) which was statistically at par with P_3S_3 (50 kg P ha^{-1}+40 kg S ha^{-1}). On the other hand, the lowest biological yield of soybean (3.280 t ha^{-1}) was recorded in the control treatment.

4. Conclusion

Combined application of 30 kg P ha^{-1} and 20 kg S ha^{-1} may be recommended for getting higher grain yield of soybean because of their synergistic effect on yield attributing characters and grain yield. It is wise and economic to use the optimum dose of phosphorus and sulphur for maximum yield of Soybean.

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