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FERTILIZER MANAGEMENT FOR MAXIMIZING SOYBEAN (*Glycine max* L.) PRODUCTION IN SALINE AGRO-ECOSYSTEM OF BARGUNA

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Abstract

An experiment was conducted at saline agro-ecosystem of Burir Char Union, Barguna District during January to June 2018, with a view to find out the fertilizer management for maximizing soybean (*Glycine max* L.) production in saline agro-ecosystem was laid out in randomized complete block design consisted of three varieties of soybean and four levels of fertilizer doses with three replications. Three varieties of soybean viz. BARI Soybean-5, BARI Soybean-6 and Binasoybean-3 and four fertilizer levels viz. T_1 = 25-30-45-10-1.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Soil test based fertilizer); T_2 = 30-40-60-12-2.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Fertilizer recommendation guide, 2012); T_3 = 40-20-15-0-0-0 kgha^{-1} N-P-K-S-Zn-B (Farmers practices); T_4 = Control native fertility were considered which placed in a factorial randomized block design. The variety had significant influence on plant height, branches plant^{-1}, number of filled pods plant^{-1}, number of unfilled pods plant^{-1}, seed yield plant^{-1}, seed yield (t ha^{-1}), stover yield (t ha^{-1}). BARI Soybean-6 performed better than the other two varieties. The fertilizer doses had significant influence on plant height, branches plant^{-1}, number of filled pods plant^{-1}, number of unfilled pods plant^{-1}, seed yield plant^{-1}, 100-seed weight, seed yield (t ha^{-1}), stover yield (t ha^{-1}). Fertilizer doses 25-30-45-10-1.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Soil test based fertilizer) gave the maximum yield. The interaction between variety and fertilizer doses V_2T_1 (BARI Soybean-6 and 25-30-45-10-1.0-1.0 kgha^{-1} N-P-K-S-Zn-B) produced the maximum yield SO, the variety BARI Soybean-6 with fertilizer dose 25-30-45-10-1.0-1.0 kgha^{-1} N-P-K-S-Zn-B could be suitable combination for higher yield of soybean in saline agro ecosystem of Barguna.

Introduction

Soybean (*Glycine max L.*) is an important global legume crop that grows in the tropical, subtropical and temperate climates. Its seed contains about 40% protein and 20% oil, provides approximately 60% of the world supply of vegetable protein and 30% of the oil (Fehr, 1989). Soybean is an important source of human dietary protein with an average of 40% content, 30% carbohydrate and oil content of 20% (Adu-Dapaah *et al.*, 2004; MoFA and CSIR, 2005). As a grain legume, it is gaining important position in the agriculture of tropical countries including Bangladesh. Now, soybean producing areas are Barisal, Bhola, Faridpur, Patuakhali, Meherpur, Jessore, Rangpur, Kurigram, Thakurgaon, Tangail, Mymensingh, Jamalpur, Chandpur, Feni, Noakhali and Laxmipur (Chowdhury *et al.*, 2013). Farmers of this area generally grow local variety of soybean with no or limited application of fertilizer. For this reason, the yield of soybean in this

region is much below than that of potential yield level. Balanced fertilization can play a major role to enhance the present yield level. Although soybean can fix atmospheric N in soil which is necessary for better yield. Fertilizer recommendation solely based on crop response data often fails to show economic viability. Since the application of optimum dose of fertilizer is important for increasing the yield of soybean, but very limited information in this regard is available in Bangladesh. The present study was undertaken to find out salt tolerant variety and develop a fertilizer management practices for coastal area.

Materials and Methods

The experiment was conducted at Saline agro-ecosystem of Barguna during January to June 2018 with geographical location of 22.1508 N latitude and 90.1264 E longitude at the elevation of 1.5 m above the sea level. Before conducting the experiment the initial composite soil sample (0-15cm) were collected from the experiment plot. The land was clay loam in texture having a soil pH value of 7.9, moderate in organic matter content. Soil characteristics of the experimental plot have been presented in Table (1). The experiment was laid out in a factorial randomized complete block design (RCBD) with 3 replications. The variety BARI Soybean -5, BARI Soybean-6 and Bina soybean-3 was used as test crops. The unit plot size was 4m Ч 3m.Spacing 30 cmЧ 10 cm. Four fertilizer treatments viz.; T_1 : 25-30-45-10-1.0-1.0 $kgha^{-1}$ N-P-K-S-Zn-B (Soil test based fertilizer)), T_2: 30-40-60-12-2.0-1.0 $kgha^{-1}$ N-P-K-S-Zn-B (Fertilizer recommendation guide, 2012) T_3 : 40-20-15-0-0-0 $kgha^{-1}$ N-P-K-S-Zn-B (Farmers practices) and T_4 : native fertility (control) were applied Half of urea and entire amount of other fertilization was applied as basal during final land preparation and the remaining half of urea was applied as top-dressed after 21 days of sowing. First irrigation was applied after 35 days after sowing before flowering and the second irrigation was applied at pod formation stage. Different intercultural operations and plant protection measures was taken as and when necessary to raise healthy crop. Data were collected on an individual plant basis and seed yield $plant^{-1}$ (g) was estimated after cleaning and proper drying. Plot yield was recorded ($3m^2$ from each plot) and then converted to t ha^{-1}. All data were statistically analyzed using 'Analysis of variance technique' with the help of MSTAT- C computer program and the mean difference were compared by Duncan's Multiple Range Test at 5% level of significance.

Table 1. Chemical properties of soil (0 -15 cm depth) collected before cultivation of thecrop in experimental field at Barguna

Soil properties	Values
A. Physical properties	
1. Particle size	
a. Sand (%)	19.17
b. Silt (%)	54.82
c. Clay (%)	26.01
2. Soil textural class	Silty clay
B. Chemical properties	
1. Soil pH	7.9
2. Electrical conductivity	6.34 dS m^{-1}
3. Organic carbon	0.35
4. Organic matter	1.42
5. Total N (%)	0.071
6. Available P (ppm)	8.49
7. Available S (µg/100 g soil)	0.58
8. Exchangeable K	0.18
9. Boron (µg/100 g soil)	0.59

Results and Discussion

Plant height

The effect of variety and different fertilizer treatments on the plant height is presented in Table 2. There were significant variations among variety and treatments. In case of variety the highest plant height (52.20 cm) was observed in BARI Soybean-6 and shortest plant height (48.12 cm) in BARI Soybean-5.In case of fertilizer doses, the highest plant height (51.26 cm) was observed in T_1 and shortest plant height (44.20 cm) in T_4. Incase of interaction effect of variety and treatment in Table 3, the highest plant height (45.67 cm) was observed inV_2T_2 and shortest plant height (33.58 cm) was observed in V_3T_4. Hasio *et al.* (1976) stated that plant height is the function of vertically cell enlargement and it is an important morphological character that influenced by growing condition such as plant variety.

Number of filled pods per plant^{-1}

Table 2 showed there was no significant differences in variety but fertilizer treatment had significant effect where the highest number of filled pods plant^{-1} (43.69) was produced in T_1 and the lowest number of filled pods plant^{-1} (33.78) in T_4 treatment. In case of interaction effect of variety and fertilizer dose (Table 3), the highest number of filled pods plant^{-1} (51.33) was produced in V_2 T_1 and the lowest number of filled pods splant^{-1} (23.60) s in V_1T_4. This result was in conformity with the findings of Karte *et al.* (1983).

Table 2. Effect of variety and fertilizer dose on plant height, seeds pod^{-1}, filled pods plant^{-1}, 100-seed weight, seed yield and stover yield

Treatments	Plant height (cm)	Number of seeds pod^{-1}	Number of filled pods plant^{-1}	100-seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})
Variety						
BARI Soybean-5	48.12	2.44 b	38.35 a	7.92 a	1.75 ab	4.63 b
BARI Soybean-6	52.20	2.68 a	41.07 a	7.67 b	1.78 a	4.73 a
Binasoybean-3	49.11	2.43 b	36.72 a	7.42 b	1.73 b	3.62 c
$LSD_{(0.05)}$	5.49	0.19	6.21	1.18	0.91	1.15
CV (%)	3.82	9.57	8.20	14.41	2.15	12.67
Fertilizer dose						
T_1	51.26	2.50 a	43.69 a	8.00	1.86 a	4.98 b
T_2	47.39	2.45 a	35.69 b	8.44	1.80 b	5.28 a
T_3	46.85	2.44 a	39.02 ab	7.88	1.70 c	4.98 b
T_4	44.20	2.42 b	33.78 b	7.66	1.65 d	3.08 c
$LSD_{(0.05)}$	6.34	0.23	7.50	1.36	0.05	1.33
CV (%)	3.82	9.57	8.20	14.41	2.15	12.67

Common letters do not differ significantly by Duncan's Multiple Range Test at 5% level of significance

T_1 : 25-30-45-10-1.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Soil test based fertilizer)), T_2: 30-40-60-12-2.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Fertilizer recommendation guide, 2012) T_3 : 40-20-15-0-0-0 kgha^{-1} N-P-K-S-Zn-B (Farmers practices) and T_4 : native fertility (control)

100-seed weight

Significantly highest 1000-seed weight was obtained from BARI Soybean 5. In case of fertilizer treatment, there was no significant difference was found. Butinter action effect of variety and fertilizer dose (Table 3) showed significant where the maximum 100-seed weight (9.33 g) was obtained from V_1T_1 and V_1T_2 and the lowest 100-seed weight (7.00 g) from V_3T_4.The present results were in agreement with those of Singh and Singh (1995) who reported that 100-seed weight increased by STB based fertilizer dose over control due to optimum uptake of nutrients.

Table 3. Interaction effects of variety and fertilizer dose on plant height, number of seeds pod^{-1}, number of filled pods plant^{-1},100-seed weight, seed yield and stover yield

Variety/ Ч Fertilizer dose	Plant height (cm)	Number of seeds pod^{-1}	Number of filled pods plant^{-1}	100-seed weight (g)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})
V_1T_1	44.07 ab	2.46 abc	38.20 b	9.33 a	1.59 abc	5.40 ab
V_1T_2	35.57 cde	2.50 abc	38.33 b	9.33 a	1.44 bcde	4.90 abc
V_1T_3	44.33 ab	2.53 ab	37.27 b	8.67 ab	1.35 bcdef	4.33 bcd
V_1T_4	33.69 de	2.27 d	23.60 d	8.33 abc	1.14 ef	3.90 cde
V_2T_1	44.41 ab	2.63 a	51.33 a	7.33 c	1.82 a	6.07 a
V_2T_2	45.67 a	2.30 cd	27.00 cd	8.00 bc	1.22 def	3.40 de
V_2T_3	38.82 bcd	2.47 abcd	42.80 ab	7.33 bc	1.49 abcd	4.73 bc
V_2T_4	40.61 abc	2.53 ab	43.13 ab	8.00 bc	1.62 ab	4.73 bc
V_3T_1	44.04 ab	2.50 abc	27.13 cd	7.33 bc	1.13 ef	3.13 de
V_3T_2	42.75 ab	2.33 bcd	41.40 b	8.00 abc	1.51 abcd	4.87 abc
V_3T_3	39.97 abc	2.50 abc	28.00 cd	7.33 bc	1.27 cdef	3.60 cde
V_3T_4	33.58 e	2.43 abcd	34.33 bc	7.00 c	1.02 f	2.87 e
$LSD_{(0.05)}$	5.49	0.19	6.22	1.18	0.91	1.15
CV (%)	3.82	9.57	8.20	14.41	2.15	12.67

Common letters do not differ significantly by Duncan's Multiple Range Test at 5% level of significance

T_1 : 25-30-45-10-1.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Soil test based fertilizer)), T_2: 30-40-60-12-2.0-1.0 kgha^{-1} N-P-K-S-Zn-B (Fertilizer recommendation guide, 2012) T_3 : 40-20-15-0-0-0 kgha^{-1} N-P-K-S-Zn-B (Farmers practices) and T_4: native fertility (control)

Seed yield

Table 2 showed that the highest seed yield (1.86 t ha^{-1}) was recorded from BARI Soybean 6 but at par to BARI Soybean 5 and the lowest fromBinasoybean-3. In case of fertilizer treatment where T_1 gave significantly highest seed yield and the lowest seed yield (1.65 t ha^{-1}) from T_4. Interaction effect of variety and fertilizer dose showed that the maximum seed yield (1.82 t ha^{-1}) was recorded from V_2T_1 and the lowest seed yield (1.02 t ha^{-1}) from V_3T_4. The result was supported by the findings of Paikera and Mishra (1989).

Stover yield

Significant effect was found in variety where highest stover yield was recorded from BARI Soybean 6 (Table 2). In fertilizer treatment, showed that the highest stover yield (5.28 t ha^{-1}) was recorded from T_2 and the lowest stover yield (3.08 t ha^{-1}) from T_4 In case of interaction effect of variety and fertilizer dose, the highest stover yield (6.07 t ha^{-1}) was recorded from V_2T_1 and the lowest stover yield (2.87 t ha^{-1}) from V_3T_4. Tomar and Khajanji (2009) reported that recommended dose of fertilizer (20 kg N + 60 kg P_2O_5+ 20 kg K_2O /ha) recorded significantly higher stover yields of soybean as compared with control and 50% recommended dose of fertilizer.

Conclusion

It could be concluded from the study that STB based fertilizer doses (25-30-45-10-1.0-1.0 kg ha^{-1} N-P-K-S-Zn-B), and soybean var. BARI soybean 6 are superior to the others fertilizer management packages in respect of seed yield and other characters.

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References

Adu-Dapaah, H.K., B. Asafo-Adjei, M. Owusu-Akyaw, and S. Amoah, 2004. Sustainable Soybean Production in Ghana. Paper presented at a Radio program on soybean in Ghana.

Chowdhury, M.M.U., M.J.U. Sarker, A.K. Choudhury, I.S.M. Farhad, S.K. Bhowal and K.M. F. Hossain. 2013. Soybean cultivation in coastal area of Noakhali. On-Farm Research Division, Bangladesh Agri. Research Institute, Gazipur, Bangladesh. p.1.

Fehr, W.R. 1989. Soybean, importance and distribution.pp.283-300. In: Robblen, G.R.K. Downy and Ashri (ed). Oilcrops of the World.Mc-Graw-Hill.Pub.Com. New York.

Hasio, T.C., E. Acevedo, E. Fereres and W.D. Henderson. 1976. Phil. R. Soc. Bot. 273: 275-500.

Karte, L.L., J.E. Spetch, J.H. Williams and R.C. Sorensen. 1983. Fertilizer of soybean genotypes during reproduction ontogeny I. Agronomic responses. Crop Sci. 23(3): 521-527.

Paikera, A. and S.N. Mishra. 1989. A note on effect of varying levels of nitrogen and phosphorus on yield attributes and yield of soybean. Department of Agronomy, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, India. Orissa J. Agril. Res. 2(1): 68-69.

Singh, D. and V. Singh. 1995. Effect of potassium, zinc and sulphur on growth characters, yield attributes and yield of soybean (*Glycine max).* Indian J. Agron. 40(2): 223-227.

Tomar, G.S., S.N. Khajanji. 2009. Effect of organic manuring and mineral fertilizer on the growth, yield and economics of soybean (*Glycine max* (L.) Merrill). Intl. J. Agri. Sci. 5(2): 590-594.